Mr. Independent Service Dealer: are you helping to support your “competitors”?

Not if you buy and use Raytheon Television and Radio Tubes. Raytheon does not have a factory TV-Radio service organization — does not compete with you in any way for service business. Raytheon believes that TV-Radio service is your business and serving you is Raytheon’s.

Every time you buy a Raytheon Tube you buy from the first tube manufacturer to help independent service dealers. For more than thirteen years Raytheon, through their Distributors, has offered independent service dealers the many benefits of the Raytheon Bonded Dealer Program. Support through national advertising, Western Union Operator 25 service and Group Life Insurance are among other business building dealer helps that Raytheon has pioneered for “independents”.

But most important of all, Raytheon makes TV and Radio Tubes that are ideal for all replacement work, because they are designed to provide quality performance in all makes and models of TV and Radio sets. Use them with complete confidence that they are best for you ... and for your customers, too.
An Invitation...

To men who want to "go places" in TV SERVICING

Find out about this NEW, ALL-PRACTICE WAY of becoming a Professional TV SERVICEMAN

If you have some Television or Radio experience, or if you know basic Television-Radio principles but lack experience—N.R.I.'s Professional Television Servicing course can train you to go places in TV servicing. This advertisement is your personal invitation to get a free copy of our booklet describing this training in detail.

Get COLOR-TV Textbooks Early

The day you enroll, N.R.I. sends you special Color-TV textbooks to speed your knowledge and understanding of this vast, growing phase of Television. Many full color pictures and diagrams help you recognize defects and learn how to correct them quickly and properly. To cash in on the coming Color-TV boom you'll need the kind of knowledge and experience this N.R.I. training gives.

Learn-by-Doing "All the Way"

This is 100% learn-by-doing, practical training. We supply all the components, all tubes, including a 17" picture tube to build a TV receiver, and comprehensive manuals covering a thoroughly planned program of practice. You learn how experts diagnose TV receiver defects quickly. You see how various defects affect the performance of a TV receiver—picture, sound and color; learn to know the causes of defects, accurately, easily, and how to fix them.

You do more than just build circuits. You get experience aligning TV receivers, eliminating interference, using germanium crystals to rectify the TV picture signal, obtaining maximum brightness and definition by properly adjusting the ion trap and centering magnets, etc. There isn't time to list all the servicing experience you get.

Mail Coupon—Get Details Free

Once again—if you want to go places in TV servicing, we invite you to find out what you get, what you practice, what you learn from N.R.I.'s course in Professional Television Servicing. See pictures of equipment supplied, read what you practice. Judge for yourself whether this training will further your ambition to reach the top in TV servicing. We believe it will. We believe many of tomorrow's top TV servicemen...for black and white, UHF and Color TV...will be graduates of this N.R.I. training. Mail the coupon now. There is no obligation.

NATIONAL RADIO INSTITUTE
Dept. 8BET, Washington 16, D. C.

Use your spare time to train at home for TV's top servicing jobs. N.R.I. Professional Television Servicing Course includes 17" picture tube, all other tubes and components to build TV receiver, 5-inch professional type Scope, highly accurate Signal Generator. Training low in cost. Monthly Terms.

Here's What Graduates Say

"I have serviced about 95% of common TV complaints and quite a few that are not common. A year ago I wouldn't have known where to start. Now I can fix a TV receiver defect in minutes when it used to take hours." JAMES D. McGIVALE, LAKE CORMORANT, MISS.

"Your course is so thorough that anyone interested in the challenge of servicing shouldn't miss the opportunity. I can find my way around a TV chassis as easy as I can my own home as a result of your Professional TV Servicing Course." C. DORITY, Silver Springs, Md.

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

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

Name.
Age.
Address.
City. Zone State.

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

RADIO & TV NEWS is published monthly by Ziff-Davis Publishing Company, William R. Ziff, Chairman of the Board (1946-1955), at 64 E. Lake Street, Chicago 1, III. Entered as second-class matter at the post office at Chicago, Ill., under the Act of March 3, 1879. Authorized as second-class matter. Subscription rates: in U. S. and possessions, and Canada $4.00; all others $5.00.

February, 1958
CONTENTS

FEBRUARY, 1958

INDUSTRY NEWS

Spot Radio News .................................................. Washington Correspondent 14
New Television Station Grants ................................ 14
Radio Astronomy and the Jodrell Bank Radio Telescope .... A. C. B. Lovell 35
Report on the Soviet Earth Satellite ....................... 124
New Device Reads Written Numerals ........................ 127
Subliminal Ads Tried on TV .................................... 143
Radio Communication Terminal Carried by Air ............ 144
Video Color Converter "Previewed" by Long Distance Phone 148
Calendar of Events ............................................. 151
New Converter Changes Heat to Electricity ............... 157
Radio-TV Parts Puzzle ........................................ 167

HIGH FIDELITY AND AUDIO

Which Way to High Fidelity? (Buy Now or Later?) ......... Norman H. Crowhurst 44
All About Audio and Hi-Fi—Speaker Power and Efficiency (Part B) ...... Robert M. Voss 51
Playback Standardization for Tape Amplifiers .......... G. A. Briggs 56
Hi-Fi—Audio Product Review ................................. 69
What Do You Know About Recording Tape? ............... Herbert G. Hard 111
Certified Record Revue ........................................ 128
Sound on Tape .................................................... 152

SERVICING

Television-Radio
Role of the Service Association (Editorial) ................. W. A. Stocklin 8
New Silicon and Germanium TV Rectifiers .......... Walther H. Buchsbaum 39
An "Automatic Rheostat" Protects TV Sets ................. Luther A. Gotwald, Jr. 42
Service Technicians' All-American Award Winners ....... 52
Service Dealers and Set Sales ................................ William Leonard 58
The Two-Way Mobile Service Business ..................... Frank De Bra 62
Rhombic Antennas for TV ..................................... 64
Troubles in Retrace Blanking Circuits ..................... James A. McRoberts 66
Mac's Service Shop ............................................ 68
Recharging and Storing Dry Batteries ....................... 116
Service Notes .................................................... 120
Service Industry News .................................... 162
Antenna News .................................................... 170

Test Equipment
A Transistor Galvanometer Amplifier ....................... W. B. Bernard 43
Video-Frequency Response Testing .......................... 59
New Tube Tester Data ........................................... 158

AMATEUR

"Muscle Mouse"—A Compact 50-Watt Transmitter ......... Jay Stanley 54
Multipurpose Ham Accessory .................................. Ralph W. Meynholtz, Jr. 98
Modern Ham Shack ............................................... 100
Far East Ham Convention on Guam ......................... 110

ELECTRONIC CONSTRUCTION

An Electronic Photoflash ....................................... Richard Graham 47

DEPARTMENTS

Within the Industry ............................................ 28
What's New in Radio ........................................... 112
Manufacturers' Literature .................................. 136
Sales Aids ....................................................... 146
Technical Books ............................................... 172

FIRST IN RADIO-TELEVISION-AUDIO-ELECTRONICS

Average Net Paid Circulation 255,815

RADIO & TELEVISION NEWS • RADIO NEWS • TELEVISION NEWS

Copyright 1958 by Ziff-Davis Publishing Company. All rights reserved.

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

CONTRIBUTIONS: Contributions are solicited to retain a copy of such manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. No responsibility can be assumed for manuscripts or illustrations not accompanied by return postage, unless specifically requested. Manuscripts and illustrations not accepted are subject to whatever reasonable treatment the Editor deems necessary. \(\text{\textcopyright } 1958\) by Ziff-Davis Publishing Company. All rights reserved.
NO ADVANCED EDUCATION NEEDED!

MEN 17-55

Prepare now to enter one of the many profitable branches of

ELECTRONICS

SEND FOR FREE FACTS!

The day SPUTNIK spiraled into outer space will be known to thousands of men throughout the United States and Canada as "Opportunity Day"—because it brought to light the tremendous possibilities that the field of Electronics holds for the man who seeks a better job or a business of his own.

One of the great things about the giant field of Electronics is the fact that even a man who does not have an advanced education or previous technical experience can prepare for many profitable opportunities in his spare time at home...or, if he desires, he may attend our well-equipped Chicago or Toronto laboratories.

If you seek a better job or a business of your own, why don't you fill in the coupon below for FREE facts?

Make "SPUTNIK Day" your "Opportunity Day," too!

Draft Age?

We have valuable information for every man of draft age; so if you are subject to military service be sure to check the coupon.

Live-Wire Employment Service

Through long-established contacts with well-known employers, DeVry Tech's Placement Department has helped many men toward better jobs in Communications, Guided Missile Control, Radar, Avionics, Television, Instrumentation, etc. The service is free to graduates.

SEND for FREE BOOKLET

We'll give you a free copy of an interesting booklet, "Electronics and YOU." See for yourself how you may take advantage of the opportunities in this fast-growing field.

DeVRY Technical INSTITUTE

Chicago 41, Illinois

Formerly DeForest's Training, Inc.
Accredited Member of National Home Study Council

"One of North America's Foremost Electronics Training Centers"

MAIL COUPON TODAY!

DeVry Technical Institute
4141 Belmont Ave., Chicago 41, Ill., Dept. RH-2-0
Please give me your FREE booklet, "Electronics and YOU," and tell me how I may prepare to enter one or more branches of Electronics.

Name ________________________ Age ________________

(Please Print)

Street _________________________ Apt. _______________

City __________________________ Zone ________ State ____________

☐ Check here if subject to Military Training

DeVry Tech's Canadian Training Center is located at

2038 625 Roselawn Avenue, Toronto 12, Ontario.

February, 1958
ROHN TOWERS cover 3 fields
Bigger Profits for You!

Rohn Manufacturing Company is the largest exclusive manufacturer of home television towers! Thousands of distributors, dealers, and servicemen have handled, sold, and installed Rohn Towers for years! They've proved to themselves that there's more money in Rohn Towers and accessories than in any other line! Rohn Towers now dominate the field and profits for those handling this line are better than ever. Why? Because Rohn offers profits in all 3 major tower fields:

1. HOME TV
   By far the biggest usage of Rohn products has been and still is for home TV installations. In addition to finest of self-supporting towers, the Rohn line includes telescoping masts, tubing, roof towers, and other types of accessories for installations of all kinds. Wise dealers and servicemen rely entirely on the Rohn line for all installation requirements. This means BIGGER PROFITS.

2. COMMUNICATIONS
   Many distributors, dealers, and servicemen are making EXTRA PROFITS by stocking or handling the heavier type Rohn Towers that are suitable for communications purposes. There is a demand in every area for radio communications towers, micro-wave towers, radio telephone towers, and industrial towers. You can supply this need in your area. Special new literature is available for your use.

3. AMATEUR USE
   Another major field of usage for Rohn Towers is in the field of amateurs and experimenters. The especially designed "fold-over" tower is the best in the field for the amateur because it allows working on the antenna on the ground. Thousands of amateurs use Rohn Towers with a tremendous demand still to be sold. You can supply this demand in your area and capture BIG PROFITS for yourself.

Send the coupon or write or phone today for the field that you are neglecting or those that interest you the most.

ROHN Manufacturing Company
116 Limestone, Bellevue
Peoria, Illinois

ROHN MANUFACTURING COMPANY
116 Limestone, Bellevue
Peoria, Illinois

GENTLEMEN: Please send me the catalog and information on the following:
☐ TV Towers
☐ Communications Towers
☐ Full line of Rohn products

NAME __________________________
FIRM __________________________
ADDRESS _________________________
CITY ____________________________
STATE __________________________

RADIO & TV NEWS
Do you WISH you were EMPLOYED in ELECTRONICS?

F.C.C. License — the Key to Better Jobs
An FCC commercial (not amateur) license is your ticket to higher pay and more interesting employment. This license is Federal Government evidence of your qualifications in electronics. Employers are eager to hire licensed technicians.

Which License for Which Jobs
The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain, and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radiotelephone license qualifies you to install, maintain, and operate every type of radiotelephone equipment (except amateur, of course) including all radio and television stations in the United States, its Territories and Possessions. This is the highest class of radiotelephone license available.

The Grantham Communications Electronics Course prepares you for a FIRST CLASS FCC license, and it does this by TEACHING you electronics. Each point is covered simply and in detail, with emphasis on making the subject easy to understand.

OUR GUARANTEE
If you should fail the FCC exam after finishing our course, we guarantee to give you additional training at NO ADDITIONAL COST. Read details in our free booklet.

FCC-TYPE EXAMS
FCC-type tests are used throughout the Grantham course. Constant practice with these FCC-type tests helps you prepare for the actual FCC examination.

Grantham School of Electronics maintains two complete schools — one in Hollywood, California and one in Washington, D.C. Both schools offer the same rapid courses in FCC license preparation, either home study or resident classes.

Get
Your First Class Commercial
F.C.C. LICENSE
in
12 Weeks!

Learn by Correspondence or in Resident Classes
Grantham School of Electronics specializes in preparing students to pass FCC examinations. Correspondence training is conducted from Washington and Hollywood, resident DAY and EVENING classes are held in both cities. Either way, we train you quickly and well — NO previous training required.

This booklet FREE!
This free booklet gives details of our training and explains what an F.C.C. license can do for you. Future. Send for your copy today.

Here's Proof...
that Grantham Students prepare for FCC examinations in a minimum of time. Here is a list of a few of our recent graduates, the class of license they got, and how long it took them:

<table>
<thead>
<tr>
<th>Name</th>
<th>License</th>
<th>Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>James M. Farish</td>
<td>1st</td>
<td>12</td>
</tr>
<tr>
<td>Francis Krug</td>
<td>1st</td>
<td>14</td>
</tr>
<tr>
<td>Steve Galvan</td>
<td>1st</td>
<td>13</td>
</tr>
<tr>
<td>Douglas Moore</td>
<td>1st</td>
<td>11</td>
</tr>
<tr>
<td>Bernard Kirschner</td>
<td>1st</td>
<td>12</td>
</tr>
<tr>
<td>Richard Meenan</td>
<td>1st</td>
<td>10</td>
</tr>
<tr>
<td>Charles Page</td>
<td>1st</td>
<td>16</td>
</tr>
<tr>
<td>Edwin Harman</td>
<td>1st</td>
<td>12</td>
</tr>
<tr>
<td>Albert D. Meleib</td>
<td>1st</td>
<td>12</td>
</tr>
<tr>
<td>Guido Elias</td>
<td>1st</td>
<td>12</td>
</tr>
</tbody>
</table>

Grantham School of ELECTRONICS

MAIL COUPON TO SCHOOL NEAREST YOU

Hollywood Division
1505 N. Western Ave.
Hollywood 27, Calif.
Phone: HO 2-1411

Washington D.C. Division
821-19th Street, N.W.
Washington 6, D.C.
Phone: ST 3-3614

for FREE Booklet CLIP COUPON and
mail in envelope or paste on postal card.

February, 1958
For the RECORD

ROLE OF THE SERVICE ASSOCIATION

What is a service association? Ask all the associations in this country that question and you will wind up with an amazing diversity of answers. With differing views as to function, it is not so surprising that the service industry has not been able to come up with a universally acceptable national organization—urgent as the need may be for such an entity on those occasions when the industry must speak with a single voice—despite the unremitting efforts of many determined people.

If you survey the by-laws, the activities, and the nature of the membership of this country's service associations, you end by scratching your head. Some are scarcely more than social clubs, in which the boys get together to talk shop with others of like interest. Some are mainly concerned with the technical end of their business, admitting to membership all who service sets, regardless of their position, interested in improving their know-how with lectures on color TV or clinics on troubleshooting horizontal-output circuits. Others may be businessmen's organizations, restricting membership to shop owners, rather than to technicians, and devoting their time to investigating overhead, stocking of parts, group insurance benefits, and the like.

Many associations have functioned in some or all of the directions already noted, and have also launched into others not even mentioned here. Yet, of all the ways in which a service association may operate, we have not yet encountered a single one that we would call foolish or useless. Nevertheless, this great diversification, though necessary, has been an appreciable factor in holding back unity for the entire service industry.

We know of no quick and easy solution to the problem, but we have long felt that there has never been sufficient basis for a really good perspective on the matter. Who can point out with any certainty which of the many interesting trends already cited are the predominant ones—the ones that involve more service associations than others and on which there is basically little conflict in viewpoint? It has been understandably difficult for service associations to make the reliable, comparative appraisals of each other that would be needed in order to obtain such a perspective.

With your assistance, if you are the member of an association, we can satisfy our own curiosity. At the same time, we believe the project we hope to undertake will also help you. Would you like to tell the story of your association in Radio & TV News, where others may read about it? Would you like to learn what others are doing?
EASY-PAY TERMS:
Only 10% down.
Available on orders over $45.
Fast handling—no red tape.

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

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

send for the leading
electronic supply guide FREE!

ALLIED RADIO CORP., Dept.1-88
100 N. Western Ave., Chicago 80, Ill.

Send FREE 404-Page 1958 ALLIED Catalog

Name
Address
City_________________________Zone____State____
These tools can make your work easier

Are you using all eighteen of these tools? Designed by and for the electronic service-dealer, each can save you energy, money . . . and time.

And as you well know, a service-dealer has two major things to sell: his time and know-how. Because CBS tools save precious time, it is not surprising that over 2.5 million have been sold. Service-dealers, engineers and technicians use them habitually. The Soldering Aid, for example, has become a standard.

Many of the tools grew out of a CBS contest. All are time-tested, painstakingly developed and manufactured to give you helpful, foolproof tools. Their quality is tops, yet they are priced most economically.

Order the tools you still need from your CBS Tube distributor — particularly the new Printed-Circuit Soldering Aids. Ask to see the bigger yet handier new Tube-and-Tool Caddy. Or write today for CBS Tool Catalog, PA-6.

Let all the CBS tools help make your work easier, faster; more profitable.
Learn PRACTICAL RADIO-TV with 25 BIG KITS

Clip and Mail the Coupon Below—Now!
Train in Spare Hours at Home
for the Best Jobs and Big Pay in
Radio-Television
—my new, faster way!

Want Proof? Send for my big FREE CATALOG and Sample Lesson. Let the facts speak for themselves!

Why wait—get into Radio-Television fast! I will train you in as little as 10 months to step into the top paying Radio-Television field as a much-needed Service Technician! You will train entirely at home in your spare time...which means you can train as fast or as slowly as you like. You have a choice of THREE Sprayberry Training Plans...one exactly suited to your needs. My easier-than-ever payment terms make it possible for you to get set for the good jobs in Radio-Television without the slightest strain on your budget! Get the true facts...just mail the coupon for my big new 56 page fact-filled catalog plus actual sample lesson—both FREE.

REALLY PRACTICAL TRAINING—NO PREVIOUS EXPERIENCE NEEDED
My students do better because I train both the mind and the hands. Sprayberry Training is offered in 25 individual training units, each includes a practice giving kit of parts and equipment...all yours to keep. You will gain priceless practical experience building the specially engineered Sprayberry Television Training Receiver, Two-Band Radio Set, Signal Generator, Audio Tester and the new Sprayberry 18 range Multi-Tester, plus other test units. You will have a complete set of Radio-TV test equipment to start your own shop. My lessons are regularly revised and every important new development is covered. My graduates are completely trained Radio-Television Service Technicians.

MAIL THE COUPON—See what's ahead in Radio-TV...No Salesman Will Call On You!
The coupon below brings you my big new catalog plus an actual sample Sprayberry Lesson. I invite you to read the facts...to see that I actually illustrate every item in my training. With the facts in your hands, you will be able to decide. No salesman will call on you. The coupon places you under no obligation. Mail it now, today, and get ready for your place in Radio-Television.

SPRAYBERRY ACADEMY OF RADIO-TELEVISION
1512 Jarvis Avenue, Dept. 25-D, Chicago 26, Illinois
Mail This Coupon For Free Facts and Sample Lesson

Average cost per lesson
ONLY $3.42
Including Kits and Equipment

February, 1958
RCA talks picture tubes
to your customers

...presells 'em for you!

Some Important "Dos" and "Don'ts"
For Every TV Set Owner

Don't wait until the all-important Picture Tube "goes" completely, before replacing it.
The Picture Tube is the heart of your set. A poor or outworn tube can spoil your TV pleasure. A reputable brand tube, with a trademark you know, can often make an older TV even better than new.
Don't accept "just as good".
Don't buy on "price" alone.
Don't forget to ask the TV service technician for your warranty card - 12 months is virtually standard among name manufacturers today. And don't forget—a warranty is only as good as the company behind it.

Do specify an RCA Silverama Picture Tube for replacement.
RCA makes an RCA Silverama Replacement Picture Tube for virtually every make of set. It's the very same tube used in many of the new 1958 sets. It incorporates every great advance in tube making. It costs no more than other top-quality tubes. And, RCA backs up every Silverama with a full year's warranty.

Super Aluminized RCA Daylight Clear

RCA Silverama
PICTURE TUBES
RCA Electron Tube Division, Harrison, N. J.

Frequent, straight-from-the-shoulder ads like this will appear in TV Guide...reaching 5,300,000 TV families coast to coast during 1958. The ads are designed to acquaint the public with facts about picture tubes and will prove helpful in impressing your customers with the importance of asking for top-quality, brand name tubes.

These ads will also continue to build acceptance for Silverama Picture Tubes—tubes that are noted for trouble-free performance and customer satisfaction. See your RCA Tube Distributor for your copy of the newly revised RCA Silverama Picture Tube Replacement Chart.
FREE...ANY 3
of these superb High-Fidelity
12" COLUMBIA RECORDS

Two delightful and romantic ballet scores by Offenbach and Chopin

Definitive performances of three best-loved Beethoven sonatas

Johnny Mathis sings 12 favorites — Day in Day Out, Old Black Magic, etc.

Erroll Garner plays Carson, No Greater Love, Memories of You, etc.

Tenderly, Deep Purple, Soon, Laura, September In The Rain, 7 others

Complete score! I Could Have Danced All Night, The Rain In Spain, etc.

7 exciting new jazz improvisations - ideal for listening or dancing

Duchin plays The Man I Love, April Showers, Am I Blue?, Brasil — 11 more

Suave arrangements of Embraceable You, Somebody Loves Me — 12 more

The Moon of Manacora, Lotus Land, Poinciana, Jamaican Rumba, etc.

Armstrong and his All-Stars, 10 numbers from triumphant tour abroad

But Not for Me, Vienna, Mad About You, Love Me, Nevertheless, etc.

A romantic musical tour — Ormandy and The Philadelphia Orchestra

Oklahoma! Nelson Eddy Complete Score

Rodgers & Hammerstein's fabulous hit, with Nelson Eddy as Curly

3 Gershwin works — Concerto in F, Rhapsody in Blue, American in Paris

12 inimitable Elgar arrangements — ideal for listening or dancing

Emperor Waltz, Blue Danube, Vienna Life, Gypsy Baron Overture — 2 more

Eight of the best-loved melodies of all time — magnificently performed

Arias by Mozart, Verdi, Puccini, Donizetti and many other composers

America's favorite quartet, the Boswell Sisters, Walked In and 31 others

The King of Swing Benny Goodman and His Original Orchestra, Trio and Quartet. 11 numbers

6 works: Symphony No. 3, Academic Festival Overture, 4 Hungarian Dances

The complete score of Lehár's operetta — Armanda, Maxima, Women, etc.

COLUMBIA RECORD CLUB
TERRE HAUTE, INDIANA

February, 1958
A NEW SPACEFLIGHT project, the Pied Piper, calling for a massive and elaborately equipped satellite to orbit between 800 and 1100 miles from earth, using television scanners and facilities for transmission to ground stations, is now underway.

Designated as project WS-117L and assigned to Lockheed which has tagged the program as ARS for Advanced Reconnaissance Satellite, the first satellite will be an unmanned object, but subsequent models with manning in mind have been blueprinted.

The original idea for the satellite was initiated by the USAF three years ago. The initial budget for the program, set in 1956, was $4-million; it has been increased to $12-million. The target date for the unmanned satellite is during 1958 and 1960 has been set as the date the Air Force hopes it can get a manned object launched.

SUBLIMINAL PERCEPTION via TV, a new advertising technique under investigation by scores of advertising and engineering experts, which has been described as . . . "the faculty of absorbing fleeting visual information without being consciously aware of it" . . . is now up for an official study in Washington by the Commission.

For further information see "Subliminal Ads Tried on TV" on page 143.

THE EIGHTEEN MONITORING stations of the FCC, the first Federal agency to track the original Spatnik to any extent, took over 3000 direction-finder bearings and over 250 fixes on the first satellite. The spot checks were supplied to Project Vanguard of the Naval Research Laboratory and to the Bureau of Standards, as well as Stanford Research Institute.

The 18 stations which participated in the tracking operation are located in Allegan, Michigan; Grand Island, Nebraska; Kingsville, Texas; Millis, Massachusetts; Santa Ana and Livermore, California; Laurel, Maryland; Portland, Oregon; Powder Springs, Georgia; Lainikai, Hawaii; Searsmont, Maine; Spokane, Washington; Douglas, Arizona; Fort Lauderdale, Florida; Ambrose, Texas; Chillicothe, Ohio, and Anchorage and Fairbanks, Alaska.

The positioning operation is a complicated affair involving direction-finding (getting bearings on the direction from whence the satellite radio signals come) and then fixing—by the same means used in navigation—the exact spot on the western hemisphere over which the small object is passing.

Because of the terrific velocity at which the satellites move (one travels at five miles a second), speed and exacting coordination are essential. The FCC monitors have to take these bearings during the brief time the satellite...
I chose COYNE TELEVISION
RADIO-COLOR TV
home training because
Coyne has been training
men for good jobs OR
their OWN BUSINESS for
NEARLY 60 YEARS

Giant opportunity field! Join the thousands
Coyne Home Training is preparing for a suc-
cessful future in TV—open the door to better
pay jobs, or your own business! COYNE—a
leading residential, practical school—oldest
of its kind—established 1899—is the institu-
tion behind this training.

Here is MODERN—QUALITY TELEVISION
Home Training designed to meet the rigid
standards that have made Coyne famous. You
get personal supervision of Coyne Staff who
know TV and know how to teach. Learn
quickly and easily in spare time. No previous
experience or advanced education necessary.

SEND COUPON FOR FREE BOOK
Send coupon below for all-new fully-illustrated
book and full details including EASY PAYMENT
PLAN. NO COST OR OBLIGATION—NO SALESMAN
WILL CALL

Modern, up-to-the-minute. Easy to follow, step-by-
step instructions—fully illustrated with 2150 photos
and diagrams. UHF and COLOR-TV included. So prac-
tical you can quickly earn extra money in TV-Radio
Sales and Service. Not only Coyne Quality training,
but costs half what you’d expect to pay because you
pay only for training—no costly extras. Free life-time
employment service.

B. W. Cooke, Jr.
President
COYNE ELECTRICAL SCHOOL
A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT
500 S. Paulina Dept. 28-H6 Chicago 12, Illinois

February, 1958
is crossing this section of the globe.

The monitoring network of the Commission is now tracking the second satellite, in the same way it followed the first. Frequencies involved are 20,005 and 40,002 kc.

**BARTLESVILLE**, the guinea-pig town in Oklahoma where toll-TV is being tested, is against the plan, according to Senator William Langer.

In a survey conducted among the 8000 families in the test town by the Senator—who is a member of the Senate Judiciary anti-trust subcommittee—over 1800 said that they were not in favor of pay-TV, while only 157 said they were for the idea and 150 noted that they were against toll-television, but did it like the *Telemovie* program.

Commenting on the results, the Senator said that the views confirmed his feeling that..."pay-as-you-see television...will ultimately result in poor people getting poorer programs, while those who can afford to pay will get better programs..."

**FOR THE FIRST TIME** since 1927, the International Scientific Radio Union (URSI—named from the initials of its French title, Union Radio Scientifique Internationale) held its 12th general assembly in this country in Boulder, Colorado, to exchange technical information, coordinate international research efforts, and recommend future projects.

Local hosts were the Boulder Laboratories of the Bureau of Standards, the University of Colorado, the High-Altitude Observatory, and the City of Boulder.

Much of the discussion on radio measurements and standards dealt with standards of time and frequency. Dr. L. Essen (National Physical Lab., Teddington, England) surveyed recent improvements in quartz-crystal oscillators and the development of atomic frequency standards such as the ammonia Maser and the cesium-beam standard.

Dr. J. A. Saxton (Radio Research Station, Slough, England) reported on numerous developments in radio-frequency measurements during the last three years.

In a paper, prepared by the Swedish Research Institute of National Defense, propagation of 20 to 80 mc. waves over a mixed earth-water path was described. The report showed that, in general, a maximum height gain of roughly 7 decibels above that expected over a smooth earth is obtained just before reaching the top of a hill, going from land to water; and that, for fresh water, recovery of over-water field strength occurs at 25 to 30 wavelengths from the shoreline. Dr. Saxton (England) noted that, on the average, within-the-horizon field strengths fall below the smooth earth field at higher and higher frequencies, possibly because antennas intervisible over a smooth earth are not inter-
(Commercial)

FCC License Exams

your Guarantee of Success in Electronics

in a Minimum of Time

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 N. 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 &
Telegaph 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"

February, 1953

Accredited by National Home Study Council

Cleveland Institute of Radio Electronics
Desk RN-14, 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
Address
City
Zone
State

Special Tuition Rates to Members of Armed Forces
Desk RN-14
New Transcription-Type Tone Arm Makes Collaro World's First True High Fidelity Changer

The Turntable That Changes Records

From Collaro Ltd., world's largest manufacturer of record playing equipment—comes the most significant development in years—the exclusive new transcription-type tone arm, which transforms the conventional record changer into a TRANSCRIPTION CHANGER, with features of the finest professional equipment.

The arm is a one-piece, spring-damped, counter-balanced unit which will take any standard high-fidelity cartridge. It is free of any audio spectrum resonances.

Stylus pressure between the first and last record in a stack remains virtually constant at less than a gram of difference, compared to 4 to 8 grams on conventional changers. Vertical and horizontal friction are reduced to the lowest possible level, insuring longer life for records and styli.

In its superb performance, the new Collaro Continental, Model TC-540, meets the rigid requirements for high fidelity equipment, offering professional quality at a record changer price. The Continental is $46.50. Other Collaro changers are priced from $37.50 up. (Prices slightly higher west of Mississippi.)

FREE: Colorful new catalog, containing guide on building record library plus complete Collaro line. Write to Dept. R-014

ROCKBAR CORPORATION
MAMARONECK, N. Y.

Rockbar is the American sales representative for Collaro Ltd. and other fine companies.
Learn TELEVISION-RADIO
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 broad-
casting circuits. All equipment
yours to keep.

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, satis-
fying 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 Tech-
nicians. 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 sim-
plified practical training
methods. You train at
home. Get practical expe-
rience, learn-by-doing. Ad-
dress: NATIONAL RADIO IN-
STITUTE, Washington 16, D.C.
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 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 Signal Generator
You build this Signal Generator. Learn how to calibrate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver circuits. Make tests, conduct experiments.

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

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.

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.

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

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

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States
POSTAGE WILL BE PAID BY
NATIONAL RADIO INSTITUTE
Washington 16, D. C.

SAMPLE LESSON
64-page CATALOG both FREE

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

"Super Showman"

A More Powerful version of the world's most beautiful indoor antenna

- New Disappearing Dipoles for improved reception on Channels 2–6.
- Metro-Dyne Electronic Tuning reduces "ghosts"... rejects unwanted signals... filters out electrical interference on ALL CHANNELS.

Available in stunning Mahogany and Gold or Blond and Gold $18.95

CHANNEL MASTER

Brings you new PRODUCTS... bigger PROFITS... quality PREMIUMS

You get valuable coupons redeemable for distinctive and useful gifts with every order for the new Super Showman or T-W kit.

Pick from more than 135 FREE premiums... featuring America's best known name brands.

Your Channel Master Distributor has your FREE 16-page catalog.

Call him now.

"INSTALL-IT-YOURSELF"

T-W ANTENNA KIT

An entirely new type of City and Suburban antenna

- Powerful 2-element T-W antenna outperforms a stacked conical.
- Fully Super-Semblited — elements pop out in seconds.

Promotionally Priced at $29.95

CHANNEL MASTER CORP.

FLEMINGTON, N. J.

Including 2-element T-W combination aluminum mast, tripod mount, wire, and hardware.
An ingenious new kind of magnetic memory has been developed by Bell Laboratories scientists for the storage of digital information. Known as the “Twistor,” it consists basically of copper wires interwoven with magnetic wires to form a grid.

“Twistor” gets its name from a characteristic of wire made of magnetic material. Torsion applied to such a wire shifts the preferred direction of magnetization from a longitudinal to a helical path. This helical magnetization has been applied to produce a magnetic storage device of unprecedented capacity for its size.

In a magnetic memory, information is stored by magnetizing a storage element. In conventional memories the storage elements consist of rings of ferrite. In the “Twistor,” they consist of tiny segments of hair-thin magnetic wire. At each intersection of the grid, one such segment is capable of storing a binary digit.

The “Twistor” is simple and economical to fabricate, and its minute energy requirements are easily supplied by transistor circuits. Bell Laboratories engineers see important uses for it in future telephone systems which demand the compact storage of much information, as well as in digital computers for civilian and military applications.
M. W. LeClear examines the structure of a 6U8 through a magnifier. Characteristics of the tube have been plotted by the two-axis recorder in background. Outstanding quality of G-E oscillator-mixer tubes—consequently, their popularity as replacements—comes from a balanced application of advanced design principles, precision manufacture, and careful testing.

Superior quality of G-E oscillator-mixer tubes proved by their high gain and uniform electrical characteristics!

Time is your most valuable commodity. Any replacement that conserves your working time and makes it more productive, puts extra dollars in your pocket.

The case for General Electric oscillator-mixer tubes rests on that benefit. These quality types—such as the 6U8, 6X8, 6CL8, 6CG8—have uniform tube-to-tube electrical properties. Install them as head-end replacements, and no adjustment of the coarse oscillator frequency control normally is needed.

Add the saving in call-back time that comes from first-class performance of customers’ receivers! For high-gain General Electric oscillator-mixer tubes reduce noise. Their low microphonics mean minimum streaking and similar picture disturbances.

Complete redesign of the pentode section was necessary to obtain the high tube gain you require for top performance. Rigid tube structure and precision control of grid-rod and mica-aperture diameters keep down microphonics. Uniform electrical characteristics of G-E oscillator-mixer types are a product of (1) the industry’s most advanced methods of manufacture to high-quality standards, (2) testing and retesting.

Install General Electric tubes for superior performance you can count on . . . every time, from every tube! Your G-E tube distributor makes fast deliveries. Phone him! Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.

Progress Is Our Most Important Product

February, 1958
Use Delco Radio Service Parts!

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

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

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

Delco Radio
Division of General Motors, Kokomo, Indiana
EARN MORE MONEY...GET INTO
TELEVISION
ELECTRONICS-RADIO

Learn ALL 8 PHASES in ONE MODERN HOME-STUDY COURSE
At Home — In Spare Time

YOU GET ALL THIS NEWEST
PRACTICAL EQUIPMENT

- Parts to build a modern TV set, including all tubes plus a large screen Picture Tube
- Parts to build a powerful Superhet Receiver, standard broadcast and shortwave
- Parts to conduct many experiments and build Continuity Checker, RF Oscillator, TV Circuits, Audio Oscillator, TRF Receiver, Signal Generator
- A Valuable Professional Multimeter

YOUR NATIONAL SCHOOLS TELERAMA COURSE COVERS ALL 8 PHASES
1. TELEVISION, INCLUDING COLOR TV
2. RADIO, FM AND AM
3. INDUSTRIAL ELECTRONICS
4. SOUND RECORDING AND HI FIDELITY
5. PREPARATION FOR FCC LICENSE
6. AUTOMATION
7. RADAR AND MICRO WAVES
8. COMMUNICATIONS

YOU ARE NEEDED IN THE TELEVISION-ELECTRONICS-RADIO INDUSTRY!
You can build a secure future for yourself if you get into Electronics NOW! Today's shortage of trained technicians creates tremendous opportunities. National Schools Shop-Method trained technicians are in constant and growing demand for high-pay jobs in Broadcasting and Communications, Electronic Research, Servicing and Repair, and many other branches.

Let National Schools, a Resident Technical School for over 50 years train you for today's unlimited opportunities in electronics! Our Shop Method trains you to be a MASTER-TECHNICIAN. Completely up to date, developed by experienced instructors and engineers, your Telerama Course will teach you all phases of the industry quickly, clearly and correctly. You can master the most modern projects, such as Color TV, printed circuits — even prepare for FCC License without taking a special course. You can handle sales, servicing, manufacturing, or make good money in your own business. SEND FOR FACTS TODAY!

EARN AS YOU LEARN. Many of your students earn their entire tuition and more in Spare Time jobs we show them how to do while learning.

YOU GET EVERYTHING YOU NEED —
Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects — all the valuable equipment shown above — many other materials and services — consultation privilege with our qualified staff, and Graduate Employment Service. EVERYTHING YOU NEED for outstanding success in Electronics.

RESIDENT TRAINING AT LOS ANGELES

If you wish to take your training in our Resident Schools at Los Angeles, the world's TV capital, start NOW in our big, modern Shops, Labs and Studio-TVs. Here you work with latest Electronic equipment — professionally — finest, most completely equipped facilities offered by any school. Our own Personal Expert, friendly instructor. Personal attention. Graduate Employment Service. Help in finding home near school — and part time job while you learn. Check box in coupon for full information.

NATIONAL SCHOOLS
TECHNICAL TRADE TRAINING SINCE 1905
LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE — MAIL NOW TO
NATIONAL SCHOOLS, DEPT. RH-28
4000 S. FIGUEROA ST.
LOS ANGELES 37, CALIF.

Clip coupon now... Mail it today!

NAME: ____________________ AGE: _____
ADDRESS: __________________
CITY: _____________________ STATE: _____

Check if interested ONLY in Resident School training in Los Angeles.

VETERANS: Give date of discharge: ____________

APPROVED FOR G.I. TRAINING
NATIONAL SCHOOLS
4000 S. FIGUEROA ST., LOS ANGELES 37, CALIF.

February, 1958
Guard customers’ sets from hum and sync buzz!

Install G-E high-quality TV audio tubes!

Once you have adjusted the buzz control on a customer’s TV set for noise-free audio, it is annoying ... and costly in working time ... to be summoned back later because the buzz has recurred.

Change in the AM-rejection characteristics of an audio tube may produce this result. In order to keep down service callbacks needed to remove buzz and hum, General Electric tests 6BN6’s, 3AL5’s, 5T8’s, and other audio detector types under conditions which closely parallel actual operation—and over periods of time that give ample opportunity for any change in characteristics to develop.

This testing for stability of characteristics throughout tube life, supplements G-E manufacture that employs fully every modern method for building superior performance into the finished product.

A pace-setter in designing and applying audio types, General Electric brings you tubes for replacement that add real listening pleasure to customers’ visual enjoyment. Install audio-tube quality you can back up ... and which will back up your service reputation! Phone your G-E tube distributor! Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.

Progress Is Our Most Important Product

GENERAL ELECTRIC
FREE! from HOWARD W. SAMS...
these valuable all-steel file cabinets with your purchase of
PHOTOFACT the world's finest TV-Radio Service Data

NOW—FOR PHOTOFAC
SUBSCRIBERS! You can get these File
Cabinets ABSOLUTELY FREE from
Howard W. Sams if you are a regular
subscriber to PHOTOFACT and buy each
Set as issued monthly...

NOW—FOR PHOTOFACT LIBRARY
PURCHASERS! You can get FREE
File Cabinets as you complete your
PHOTOFACT Library. What’s more,
you can own the PHOTOFACT Library
the NEW EASY-BUY WAY:
There's no interest. There's no
carrying charge. And Howard W. Sams
will give you ABSOLUTELY FREE
all the steel file cabinets you'll need
for your Library.

Take advantage of this money-saving
opportunity. See your Sams Distributor
today, or write to Howard W. Sams
for full details...

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

☐ Send me full details on your FREE File cabinet offer and
EASY-BUY Plan.
☐ I'm a Service Technician: ☐ full time; ☐ part time
My Distributor is:

Shop Name:
Attn.:
Address:
City. Zone. State.
**Within the Industry**

ROY A. LONG, research engineer in Stanford Research Institute's engineering research division, has been elected a Fellow in the Audio Engineering Society.

Mr. Long has been with the Institute since 1949. The Fellowship was awarded to him in recognition of his active participation and many contributions to audio engineering.

Formerly chairman of the San Francisco Chapter of the Society, Mr. Long is also a member of the Institute of Radio Engineers, the Acoustical Society of America, and the Research Society of America.

**JOSEPH S. RAMER** has taken over the duties as engineering advisor for the Heath Company and will work closely with the company's engineers in developing new do-it-yourself kits for the firm's already extensive line. He will report directly to E. E. Fiebich, director of engineering of the company.

Prior to joining the firm, Mr. Ramer was engaged in electronic development work for the National Bureau of Standards and later headed the Fuze Department, U. S. Naval Ordnance Laboratory, Corona, Calif. where he supervised classified electronic work for the government. He has been in the electronics field for over 20 years, 15 of them with the U. S. government.

**reeves soundcraft corp.** is building an ultra-modern robot tape plant in Danbury, Conn., which is scheduled for completion by mid-year. The plant and its facilities will represent an investment of over 1 million dollars.

**cannon electric company**'s Santa Ana California Division is building a new 106,000 square foot plant which is scheduled to be in production soon. Located on a 30 acre site, the plant will eventually employ 1500 persons.

**general transistor corporation** has leased an additional 16,000 square foot building at 87-11 130th St., Richmond Hill, N. Y. for the manufacture of semiconductor products.

**sola electric co.** of Chicago has opened a sales office at 173 Orange St. in New Haven, Conn. Richard Hesse is in charge.

**hartley products co.** has tripled the area of its New York plant to deal with the accelerated demand for its 217 full-range speaker. The company is also using plant facilities in Michigan for cone treatment and research. The combined offices of **wescot**, the Los Angeles Section of the IRE, and the WCMA have been moved to new and larger quarters at 1435 S. La Cienega Blvd. in Los Angeles.

**heliot division of beckman instruments inc.** has dedicated its new 3 million dollar facility in Newport Beach, Calif. The 156,000 square foot ultra-modern building houses manufacturing and administrative facilities.

**industro transformer corp.** has acquired additional new plant facilities at 35-10 36th Ave., Long Island City, N. Y. Production lines for the manufacture of germanium-junction alloy transistors will be established at the new site.

**sprague electric company** is expanding its Pacific Coast manufacturing facilities with the construction of a new plant of more than 21,000 square foot capacity at Visalia, Calif. The new factory will house all manufacturing facilities presently located at the Venice, Calif. headquarters.

**motorola communications & electronics inc.** has built a new Dallas, Tex. administrative headquarters which will administer the ten-state southern sales area. The building, complete with parking area for 42 cars, has been constructed on a 42,000 square foot tract of land in the Brook Hollow Industrial District about five miles from downtown Dallas.

Ground has been broken at the site of the new **CBS laboratories** in Stanford, Conn. When completed, the million-dollar building will provide research and development facilities for a scientific and administrative staff of 150 persons. The laboratory is on High Ridge Road near the Merritt Parkway.

**J. BURTON HENRY** has been appointed sales manager of the new products division of **International Resistance Company of Philadelphia. He will also continue to serve in his present capacity as sales administrator.**

He joined the company in 1944 and since then has held a variety of positions. During World War II he was with the Army-Navy Electronics Production Agency. Previously he had been associated with Brunswick Radio Company, Kolster Radio Company, and Atwater Kent.

Mr. Henry attended the Towne Sci-
NEW! CRYSTAL! CARDIOID! COMPETENT!

**Electro-Voice** VARIABLE-D MICROPHONE

MODEL 951

$49.50 LIST, LESS STAND

NEW Model 951 Crystal Cardioid. This latest addition to the E-V line uses the same Variable-D principle as E-V's broadcast cardioids. It assures uniform directivity and high discrimination. Response is 50 to 11,000 cps. Has chrome-finished, pressure-cast case, on-off switch. Just $49.50 list, less stand.

**MODEL 664**

**DYNAMIC CARDIOID**

is the finest of its kind!

Guaranteed to outperform all others. Unidirectional high-fidelity Model 664 produces highly directional sound selectivity; reduces pick-up due to ambient noise up to 50%; has smooth, peak-free response at all frequencies from 40 to 15,000 cps. Convenient on-off switch, chrome finish....... $85.00 List, less stand.

**ELECTRO-VOICE OFFERS THESE HIGHLY INFORMATIVE BOOKLETS FOR THE PROPER SELECTION OF MICROPHONES...**

The ABC's of Microphones. Explains in detail the various applications of all types of microphones. Tells how to get the best results in each application. Write for Bulletin N82.


**NO FINER CHOICE THAN—**

Electro-Voice®

February, 1958
Convince yourself at no risk that CENTURY instruments are indispensable in your every day work.

SHIPPED ON APPROVAL
SEND NO MONEY—NO C.O.D.
Examine instruments for 10 days before you buy... Only then, when satisfied pay in "easy to buy" monthly installments.

Just 2 settings on the NEW
FAST-CHECK TUBE TESTER

Model FC-1
Tests all tubes completely, accurately
and in seconds—RIGHT ON THE SPOT.
The FC-1 is the only tube tester in its price range to give a complete tube test of over 600 tube types in seconds without multiple switching or annoying checking of roll charts. You make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you sell each day will pay for the FAST-CHECK in a very short time.

WIDE RANGE OF OPERATION
Checks quality of over 600 tube types, which covers more than 99% of all TV and radio tubes in use today, including the newest series TV tubes, entire battery-type DC plate-tube, 0240, magic eye tubes and gas rectifiers. Checks cathode emission, cathode-cathode grid shots and detects inter-element leakage up to 1.5 megohms. Checks for life expectancy.

Model AD-1 PICTURE TUBE ADAPTER—Also available for the FC-1. Checks 10 picture tubes (including the new short-neck 110 degree RCA-type picture tubes) for cathode emission, shots and life expectancy. Also rejuvenates and restores cathode emission of weak picture tubes. Model AD-1 (factory wired only) . . . $4.50

OUTSTANDING VALUE FEATURES
Each section of multi-purpose tubes simultaneously. If one section is defective the tube will read "Bad" on the meter scale. 41 tube sockets accommodate all the tube types. Less than 10 seconds required to test tubes. Only tube type 12 volt and cathode-cathode grid shots and detects inter-element leakage up to 1.5 megohms. Checks for life expectancy.

Model AD-1 FACTORY WIRED . . . $4.50
Model AD-1 SEMI-KIT FORM . . . $4.50

Save valuable servicing time and earn extra money with the FC-1.

CENTURY ELECTRONICS CO., INC.
711 Roosevelt Ave.
Dept. 202, Mineola, N.Y.

Please rush the instruments checked for a 10 day examination period. If satisfied agree to pay the down payment within 10 days and the monthly installments as shown. If not completely satisfied I will return the instrument within 10 days and there is no further obligation. It is understood there will be NO CARRYING CHARGES. Should I fail to make payment due, the full unpaid balance shall become due and payable at once.

Name
Address
City State
Prices Net F.O.B. Mineola, N.Y.

CENTURY OF PENNSYLVANIA

DONALD G. FINK, director of research of Philco Corporation, has been elected president of the Institute of Radio Engineers for 1958. He succeeds John T. Henderson, principal research officer of the National Research Council, Ottawa, Canada, as head of this international society of 62,000 radio engineers and scientists.

Serving with Mr. Fink is Carl-Eric Granqvist, director of Svenska Aktiebolaget Gruenwald, Stockholm-Lidingo, Sweden who succeeds Dr. Jiro Niwa of Tokyo as vice-president.

Elected as directors for the 1958-1960 term are G. S. Brown, professor and head of the Department of Electrical Engineering at MIT and W. H. Doeherty, assistant in electronic devices at Bell Telephone Laboratories, Inc.

ROBERT D. BROWNING, former recording engineer for RCA Victor Records, has joined the research and engineering staff of Century Instrument Corporation.

His most recent connection was with RCA in Chicago where he was chief engineer and manager of recording. He joined the company in New York City as a technician after three years service in the Army Signal Corps during World War II. He was later promoted to recording engineer.

A native of Selma, Alabama, Mr. Browning is a graduate of Alabama Polytechnic Institute at Auburn where he received his B.S. in electrical engineering. He is a member of the Audio Engineering Society.

DANIEL P. KNOWLAND, JR., has been appointed to the post of assistant general manager of Heath Company. He was formerly comptroller and assistant secretary, having joined the firm in 1955 after serving as assistant comptroller of Du Pont, Inc., parent firm to Heath.

JAMES HERVEY is the new marketing manager in charge of consumer products for American Electronics, Inc. He will be responsible for the sale of the firm's "Concertone" and "AmERICAN" lines of tape recorders.

The Hoffman Radio Division has announced the appointment of TOM E. MUMFORD to the new post of sales manager for hi-fi and radio. He has been with the firm since 1952....

RADIO & TV NEWS

ROBERT D. BROWNING, former recording engineer for RCA Victor Records, has joined the research and engineering staff of Century Instrument Corporation.
RCA INSTITUTES offers you the finest of home study training. The equipment illustrated and text material you get with each course is yours to keep. Practical work with very first lesson. Courses for the beginner and the advanced student. Pay-as-you-learn. You need pay for only one study group at a time.

Send for this FREE Book Now

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

RCA INSTITUTES, Inc. Home Study Dept. N-28
350 West Fourth Street, New York 14, N. Y.

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

Name
Address
City
Zone
State
Korean Vet? Enter discharge date

In Canada — RCA Victor Co., Ltd.
3001 Cote de Liesse Rd., Montreal 9, Que.

To save time, paste coupon on postcard. February, 1958
Jerrold FM Range Extender!

Simply connect a Jerrold FM Range Extender between the antenna and your FM tuner or receiver...and enjoy all the FM stations you've wanted to hear! Jerrold's FM Range Extender pre-amplifiers boost the strength of signals at the antenna 18 times...bring in distant stations you never heard before...increase the enjoyment of stations you now receive.

Features:
- 20 dB S/N ratio with 0.6 µV input
- High RF gain and output
- Full FM band width

Available in two models for either indoor or outdoor operation.

Indoor Model 406A-FM

USE YOUR TV ANTENNA TO IMPROVE FM RECEPTION

Use Jerrold's popular low-cost MULTI SET COUPLER to connect your FM receiver to your TV antenna...for greater FM pleasure.

See The Jerrold FM RANGE EXTENDER and MULTI SET COUPLER at leading distributors or write:

JERROLD ELECTRONICS CORPORATION
Dept. PD 27, Philadelphia 3, Pa.
the experts say . . . in High Fidelity the best buys are "EICO"

**EICO**

**KITS and WIRED**

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

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

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

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

BEFORE YOU BUY, COMPARE. At any of 1200 neighborhood EICO distributors coast to coast, you may examine and listen to any EICO component. Compare critically with equipment several times the EICO cost — then you judge.

You'll see why the experts recommend EICO, kit or wired, as best buy.

Thousands of unsolicited testimonials on file.

HF52 Standard Speaker System — revolutionary new generic type of system — incorporates the slot-loaded conical horn** and omni-directional cone tweeter.** More sonic detail, more naturally throughout the audio spectrum. No other commercially available system approaches it in over-all musical quality & technical excellence. 40-20,000 cps essentially flat, clean useful range 30-40,000 cps. Impedance 16 ohms. HW 21" x 11 1/4" x 17 1/2". In Walnut or Mahogany. $139.95. In Blonde, $144.95.

HF70 FM Tuner equals or surpasses wired tuners up to 3X its cost. New, pre-wired, pre-aligned, temperature-compensated "front end" — drift-free. Sensitivity, 1 5 us for 20 db quieting, is 6X that of other kit tuners. DM-79 traveling Tuning eye. Response 20,000,000 cps.±3 db. Cathode follower & multi-pole outputs. Kit $29.95. Wired $46.95. *Less cover, excise tax incl.

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

HF60 60-Watt Ultra Linear Power Amplifier, with Accutrack Output Transformer, Ultra-linear power amplifier essentially identical to HF50. The least expensive means to the highest audio quality resulting from distortion-free high power, virtually absolute stability, flawless transient response: "... is one of the best-performing amplifiers extant; it is obviously an excellent buy." — AUDIOCRAFT Kit report. Kit $72.95. Wired $99.95. Matching Cover E-2 $4.50.

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

HF30 30-Watt Power Amplifier employs 4-EL84 high power sensitivity output tubes in push-pull, parallel, permits Williamson circuit with large feedback & high stability, 0.28% full-wave rectifiers for highly reliable power supply. Unmatched value in medium-power professional applications. Kit $29.95. Wired $62.95. Matching Cover E-3 $3.95.


HF20 20-Watt Integrated Amplifier, complete with finest preamp-control facilities, excellent output transformer that handles 36 watts peak power, plus a full Ultra-Linear Williamson power amplifier circuit. Highly praised by purchasers, it is established as the out-and-out value in amplifiers of this class. Kit $48.93. Wired $79.95. Matching Cover E-1 $4.50.

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

HF11 Two-Way Speaker System, complete with factory-built cabinet. Jensen 8" woofers, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass; crisp extended highs. 70-12,000 cps.±6 db. Capacity 25 w. Impedance 8 ohms. HW: 11" x 23" x 9". Wiring time 15 min. Price $39.95.

"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF-420 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis."

William A. Stocklin, Editor, RADIO TV NEWS

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

THE HI-FI EXPERTS SAY . . .

"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF-420 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis."

William A. Stocklin, Editor, RADIO TV NEWS

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

TURN PAGE FOR OTHER EICO AD.

**Patents pending by Hegeman Laboratories**
the specs prove it... your BEST BUY is

NEW! TV-FM SWEEP GENERATOR & MARKER #368
Kit $69.95 Wired $119.95

COMPLETE with steel cover and handle.

NEW! DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666
Kit $69.95 Wired $109.95

COMPLETE with steel cover and handle.

NEW! COLOR
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.- sensitivity 100 microv. input 2.5 mc; direct-coupled & push-pull outputs; R-follower & push-pull outputs; K-follower output; 4-stage 20 step, low-pass filter compensation, attenuator up to 1000:1. Sweep perfect linear 10 cps-100 kc (ext. cap. for range 1-100): preset TV & radio synthesizer; sync. amp. & large internal & external voltage probe. Direct coupled, balanced bridge circuit. High intensity trace CRT. 0.06 usec rise time. Push-pull output, flat to 100 kc, sensit. 0.06 mV/mil. Built-in voltmeter, Z-axis mod. Sawtooth & 60 cps outputs; Astig. control. Retract blanking. Pushpull control.

NEW! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)
Kit $29.95 Wired $49.95

Compile of probe tip selects DC or AC-OHM. Uni-Probe- exclusive with EICO only 1 probe performs all functions!

Turn page for more EICO values.

Prices 5% higher on West Coast.
RADIO ASTRONOMY and the Jodrell Bank Radio Telescope

By A. C. B. LOVELL
Director, Jodrell Bank Experimental Station

The great steerable radio telescope which has been built at Jodrell Bank in Cheshire, England, for the University of Manchester has recently been put in operation. It is to be used with two distinct types of radio equipment for the exploration of the universe: first, as a receiver to pick up the radio waves which are generated in the remote parts of the universe, and second as a combined transmitter and receiver for investigations within the solar system using the radio echo or radar technique. It was this latter that was recently made such good use of in the tracking of the Soviet earth satellites that were launched a few months ago.

First of all, however, it may be useful to say a few words about the fundamental reasons which led to the idea of such a huge and expensive instrument.

The exciting discoveries in astronomy have depended mainly on the development of optical telescopes of ever-increasing size. These large telescopes require unusual climatic conditions if their potentialities are to be realized; the great telescopes of the twentieth century have been built in America at Mt. Wilson and Palomar.

The 60-inch telescope on Mt. Wilson came into operation just after the First World War and, in the hands of the American astronomers, it revealed a universe of unforeseen immensity. Hitherto, the assemblage of stars was believed to be contained in a relatively small volume some few thousand light years in extent, with the sun and planets near the center. The many nebulae to be seen in the telescopes were thought to be diffuse objects lying within this system. But this new telescope revealed that the Milky Way system, or local galaxy, was disc-like in structure, extending for 100,000 light years across its plane and containing about 10,000 million stars. Moreover, Hubble's investigations with the telescope soon convinced his colleagues that many of the nebulae were external to this system, and that the nearest one in Andromeda must be separated from the local star system by over a million light years, and must also contain a vast number of stars. Other nebulae were shown to be similar star systems at even greater distances. Nowadays, it is known that the 200-inch telescope on Mt. Palomar can see nebulae out to distances of hundreds of millions of light years, and within the field of view there must lie an enormous number of galaxies—perhaps of the order of a thousand or ten-thousand million.

Origin of Radio Astronomy

In the face of this penetration to the remote depths of space it seemed hardly possible a few years ago that the remaining tasks of observational astronomy could be other than the detailed study of the individual stars and nebulae as seen in the conventional telescopes. But by a strange twist of fate the Second World War was to place a new and enormously powerful tool in the hands of astronomers for the exploration of space, and the recent discoveries have rivaled in excitement those made in the last twenty years with the ordinary telescopes.

Almost all astronomical research has been carried out with telescopes and other instruments receiving light waves emitted by the stars in the visual part of the electromagnetic spectrum. Various auxiliary instruments such as photoelectric cells have been used to extend the studies a little beyond the visual limits into the infrared and ultraviolet regions, but appreciable extension is prohibited by the absorption caused by water
vapor and fine dust in the earth's atmosphere. Thus, our knowledge of the universe has arisen almost entirely from the study of stellar emissions in this narrow visual and near-visual region of the spectrum.

It was, therefore, surprising when an American engineer, Jansky, discovered at the end of 1931 that radio waves, apparently emanating from regions beyond the solar system, were reaching the earth. Jansky's work caused little immediate interest and the only important additions to his results before the Second World War were made by Grote Reber, an amateur investigator who constructed the first radio telescope of the type with which we are familiar today. It was 30 feet in diameter and received radio waves on a wavelength of about two meters. The instrument could readily be pointed to different parts of the sky and with it Reber confirmed Jansky's discovery that radio waves were reaching the earth from outer space.

He found that the radio signals were strongest from directions near the center of the local galaxy and along the plane of the Milky Way, in fact, that the radio signals were roughly proportional in strength to the concentration of stars in the direction in which the radio telescope was pointing. On the other hand Reber failed completely to detect any signals from the bright stars or from other prominent features visible in telescopes.

Even today, after many years of rapid technical development, only a very few objects identifiable in the large telescopes are known to be the source of some of these radio emissions. Apart from the sun, no one has yet found radio emission from any common type of star. On the other hand, the rare supernovae, or the gaseous remains of exploded stars in the Milky Way, are known to be radio emitters. Probably most of the radio waves in the Milky Way come from such types of object together with that generated in the interstellar gas which fills the space between the stars. The reason why most of the radio sources, or radio stars, have not been identified is now believed to arise from their very great distances which put them beyond the range of even the largest optical telescopes. For example, the second most powerful radio source in the sky lies in the constellation of Cygnus, and this has been identified as the collision of two entire galaxies of stars at a distance of 200 million light years. This is about the useful limit of penetration of the 200-inch optical telescope on Mt. Palomar, and it seems possible that many of the weaker radio sources may be similar cases of galaxies in collision at even greater distances. We shall return to this when discussing the uses of the new radio telescope.

New Radio Telescope

The study of the radio emissions from space is carried out on a wavelength a million times longer than the wavelength of the light waves which are focussed by the conventional optical telescopes. The radio waves are unaffected by cloud, fog, or daylight and, in this respect, the radio astronomer has a marked advantage over the traditional methods of astronomical investigation. On the other hand, because of the long wavelength, it is extremely difficult to achieve any appreciable resolution. The beam width, or the angle of the cone in which the radiation is received, depends on the ratio of the wavelength to the diameter of the telescope. Thus to achieve the same resolution as a very small optical telescope, the ariels of a radio telescope would have to extend for thousands of miles. The need for the maximum possible resolution in the radio work has been a dominant feature of the technical developments. A great deal has been achieved by special devices in which two similar aerial systems, spaced by several hundred yards, are connected to common recording equipment. This type of radio telescope, known as an interferometer, has been developed in Cambridge (England) and Sydney.

In an alternative approach, the physical size of the aerial system is increased. There are now several steerable radio telescopes of small size in existence. Many years ago a large radio telescope with an aperture of 220 feet was constructed at Jodrell Bank, but this was fixed to the earth and could be used only to explore a small part of the heavens. Experience with this instrument soon demonstrated the vital role which could be
played by a completely steerable telescope of this order of size. The engineering and constructional difficulties of such an undertaking are formidable. Nevertheless, the results to be anticipated were such as to enlist the sympathetic interest of many prominent scientists when the idea was first put forward in 1949.

Telescope: Crucial Instrument: In connection with astronomical investigations, the telescope has been the crucial instrument for the exploration of space. Successive increases in size have led to more light-gathering power and greater resolution, and although the improvements in auxiliary instruments, such as photographic plates and spectroscopes, have been very important, nevertheless the great advances in observational astronomy have come primarily from larger and larger telescopes. The situation in radio observations is very similar: whereas large optical telescopes are required to improve the light-gathering power and the resolution, large radio telescopes are required in order to be able to pick up faint signals at greater distances from the earth as well as for greater resolution.

The new telescope is essentially a paraboloidal steel bowl 250 feet in diameter, with the focus in the aperture plane, built so that it can be directed towards any part of the sky. In principle the motion of the telescope is altazimuth. The bowl, which weighs about 700 tons, is driven in elevation in a Ward-Leonard system through two 27-foot racks from the dismantled battleship "Royal Sovereign." These are mounted 170 feet above ground on two towers which themselves rotate on a 350-foot railway track to give the motion in azimuth. The drive is via two six-ton trucks under each tower, again through a Ward-Leonard system. Four additional trucks, which are undriven, serve as wind carriages on each side of the structure. The towers are connected near ground-level through a heavy diametral girder system supported on the central pivot, which is the fundamental locating point of the telescope. The power and instrumental cables come through this central pivot into a motor room situated within the diametral girder immediately above the central pivot. This room contains the motor generator sets and controls for the Ward-Leonard system that is employed.

17-Foot Gauge Double Track: The 17-foot gauge double railway track on which the telescope rotates is mounted on deep-piled foundations which extend, in some places, 90 feet underground. The various power, control, and instrumental cables are taken into an annular laboratory underneath the central pivot and then through an underground tunnel to the control room. This control room houses the main control racks and console. The computer system consists of mapsopm resolving devices working in servo loops to solve the necessary equations in order that the telescope can be given a sidereal movement. A wide range of movements can be selected at the control desk; for example, automatic sidereal motion at a given right ascension and declination, motion in galactic latitude and longitude, straightforward motion in azimuth and elevation, and various automatic scanning movements with a choice of rasters. Parallax corrections can also be introduced when it is desired to track a body in the solar system. There are no slip rings so that the danger of creating electrical interference is avoided, and the limit of motion is 420 degrees, after which an automatic reversal takes place.

The specification calls for a tracking accuracy of at least 12 minutes of arc at speeds up to 4 degrees per minute. The maximum slewing speed is about 22 degrees per minute in azimuth and elevation. The position of the telescope in azimuth and elevation is repeated back to the control room through magslips driven by accurately machined chain racks independently of the driving system. The specification requires these positions to be repeated to an accuracy of ±1 minute of arc.

Reflecting Membrane 1/2" Thick Steel: The reflecting membrane is of 1/2-inch thick steel sheet welded from 7000 individual sections of about 3 ft. x 3 ft. onto the purlins of the steel framework. It has been essential to ensure good conductivity across these welded sections, otherwise the membrane would become very "loppy" at certain wavelengths. The primary aerial feed is carried at the focus on a steel tower built up 62½ feet from the apex of the paraboloid. This tower diminishes in cross-section rapidly with height in order to avoid obscuration and scattering from the primary feed. It was, however, essential to design it with sufficient stiffness so that no displacement occurred as the bowl turns over. An important scientific requirement is that easy access can be obtained to the primary feed so that the operational wavelength can be changed readily. Originally it was intended to have an access tower which could move out on tracks on top of the diametral girder to put the operator in the reach of the aerial when the bowl was inverted. This was later abandoned in favor of a system whereby the aerial is mounted on a 50-foot steel tube which slides into the top of the aerial tower. With the bowl inverted this can be winched down to ground-level and replaced by another 50-foot tube complete with aerial system. The radio-frequency cables from the aerial run inside this tube and can be reached from a small platform near the base of the tower when the bowl is facing towards the zenith.

In much of the work it will be necessary to mount the radio-frequency preamplifiers and other parts of the receiving equipment as close as possible to the aerial. These essential units will be contained in a small laboratory which swings underneath the bowl. Further laboratory space is available at the tops of the two towers, but even from those the minimum length of cable run to the primary aerial is about 200 feet. Other scientific apparatus will be installed on the base girders; but the main recording apparatus will be in labora-

Here is a view of the Jodrell Bank radio telescope which has been taken from the operating console, at which the controller sits. During the night the great telescope is illuminated by floodlights in order that the controller may be able to keep everything in view and monitor the position of the immense bowl.
tories that are situated adjacent to the control room.

Calculated theoretical curves showing the beam width and power gain as a function of wavelength are given in Fig. 1. Calculations have been made of the effect of irregularities in the membrane on the power gain, from which it is clear that, except at very short wavelengths for which the telescope is not primarily designed, large distortions are permissible without any appreciable effect on the performance of the telescope. During the next few months it is hoped to begin the scientific establishment of the curves on an experimental basis by observing certain radio sources at different azimuths and elevations over a range of wavelengths.

**Immediate Tasks**

A common feature of the surveys of radio stars in both northern and southern hemispheres is the failure to associate all but a few with celestial objects visible in the large telescopes. For example, the Cambridge survey located 1936 radio stars, 1906 of which were of small angular diameter and distributed isotropically. Only a few per-cent of these have been successfully associated with known objects. Even the surveys in the southern hemisphere by the Sydney group give similar results.

The spatial distribution of these unidentified radio stars has been investigated by plotting log N against log l where N is the number of sources per unit solid angle with an intensity greater than I. If the sources are distributed uniformly throughout space it is easy to show that the plot should give a straight line of slope −1.5, so that any departure from this relationship will give information about the variation of spatial density with distance. The results of the log N/log l Cambridge plots are very surprising. There is a marked departure from the expected slope, the experimental curve becoming steeper for low intensities until a flattening due to instrumental limitations occurs. The implication is that the spatial density of radio stars is constant in the neighborhood of the solar system but progressively increases with distance. It is impossible to account for this result and for the isotropy of the sources other than by assuming that the increased looking place capacities which are comparable with the limits of observation of the 200-inch telescope. If, in fact, this spatial distribution is due to processes on a cosmical scale, then the universe is assuming a significant bearing on cosmological theories. In the steady-state or continuous-creation theories the density of nebulae should be everywhere the same and independent of time and space. But our nebulae are continuously being formed to take the place of those which moved out of the field of view as a result of the expansion of the universe. On the other hand, in the evolutionary theories the spatial density decreases progressively with time. In this case we should expect to find a great concentration of star formation near the limits of the observable universe which corresponds to a period of time some 2000 million years ago.

**Lead to Further Conclusions:** This is precisely the result which appears in the radio star distribution, but since the radio emission from individual nebulae is too weak to be detected at such distances we are led to further conclusions about the nature of these radio sources. Galactic collisions of the Cygnus type can be shown to produce radio emission of the order of magnitude required, and the suggestion is that these sources are colliding galaxies probably lying beyond the limit of penetration of the 200-inch telescope. This is consistent with the interpretation of the log N/log l curve, since at the time of several thousand million years ago both the spatial density and the number of colliding galaxies must have been much greater than at present.

This interpretation of the log N/log l curve for the observed radio sources is therefore in favor of the evolutionary cosmological theories. This conclusion is, at present, in very great dispute particularly as the preliminary results of the Sydney survey do not entirely agree with those obtained in Cambridge. The issue is of the utmost importance, carrying with it the possibility of a significant contribution to this local problem of the origin of the universe.

Before the available data can be used, the validity of the data must be greatly increased, and this program can be expected to form a very prominent aspect of the work of the new telescope in the program as planned now, the telescope will be used on a frequency of 168 mc. as an element in an interferometer to measure the actual angular extent of the sources so that the effective temperatures of the individual sources can readily be determined.

**Additional Uses:** The foregoing is an example of the use of the new telescope in programs where it will be used as a receiving aerial. In addition to this cosmological study on 168 mc. the telescope is equipped with receiving systems on 90, 408, and 1420 mc. for surveys of the distribution of radio emission from the local galactic system and for the investigation of the strength of the radio waves emitted by various types of normal extragalactic nebulae.

In addition to this type of work the telescope will be used as a combined transmitting and receiving aerial. In these radar or radio-echo aspects of the work, the moon, artificial satellites, and the planets will certainly figure prominently.

The moon echo experiments show that the radio echoes are subject to deep and rapid fading—an effect which is now believed to be due to a peculiarity of the moon's motion with respect to the earth-ionosphere system. The lunar echo apparatus at Jodrell Bank works on a frequency of 120 mc. and uses a transmitter giving 10 kw. in 30 millisecond pulses at a recurrence rate of 0.6 per second. The receiver bandwidth is 30 cps, and appropriate arrangements have to be made to allow for the Doppler shift in the frequency of the returned signal. The most important results obtained with this apparatus concern the long-period fading (the minimums), which by cross-polarization experiments has been shown to be due to the rotation of the plane of polarization of the radio wave as it traverses the ionosphere (the Faraday effect).

The most immediately evident aspect of a moon echo system by which the total electron content of the ionosphere could be determined.

The magneto-ionic theory shows that the polarization shift depends on the total electron content of the ionosphere per square centimeter along the line of sight. Experiments on a single frequency can give only the rate of change of the electron content, and it is necessary to carry out the measurements on two closely spaced radio frequencies. Measurements of the total electron content by this means indicate that the electron content is considerably greater than that estimated on the basis of a simple parabolic region.

**Telescope Removes Handicaps:** The technical difficulties in this work are considerable, and with the present aerial system, measurements can be made only with the moon in transit for about 10 periods in each lunation. The new telescope will immediately remove these handicaps and will enable systematic data to be collected about the total ionospheric electron content. This is of considerable importance to our understanding of the ionosphere and of solar terrestrial relationships.

The problem of radio echoes from the planets is vastly more difficult, and, as far as is known at present, no serious attempts have yet been made to solve it. Success in detecting radio echoes from Venus would demand an over-all power sensitivity between a million and ten million times greater than that required in the case of the moon. This assumes, of course, that the reflection coefficient of the planet would not be inferior to that of the

![Fig. 1. Calculated power gain and beam width of the 250-foot aperture radio dish.](image-url)
New Silicon and Germanium TV Rectifiers

Already widely specified for military and commercial applications, germanium and silicon rectifiers are now available at reasonable prices for use in TV receivers. As a matter of fact, some recent receivers are using these diodes as original equipment in their power supplies.

While these devices are too new for their ultimate value to be assessed, they show some interesting promise with respect to stability, temperature, and efficiency as compared to more conventional rectifiers used in the power supplies of TV receivers.

On the basis of size alone, the obvious and dramatic improvement in rectification efficiency which is possible today can be seen in Fig. 1. The heart of the TV power supply originally was the power transformer and the vacuum-tube rectifier, such as the SU4 which is shown. It is now possible to supplant these elements with two silicon diodes similar to the one shown in Fig. 1.

Aside from size, silicon diodes are particularly advantageous in installations generating high ambient temperatures. Such diodes operate, without derating, up to 125°C with currents up to several amperes. Germanium rectifiers have lower operating temperatures, but also exhibit the rectification efficiency and "non-aging" characteristics which make both types of rectifiers attractive for TV application.

Semiconductor Rectification

Operation of a vacuum-tube diode is a familiar phenomenon. Semiconductors rectify because they are devices or materials through which current can flow in only one direction, essentially. In the case of a selenium rectifier, rectification occurs at the junction between the selenium and its base. The selenium coating over the steel plates is usually quite thin, and the amount of current a rectifier can safely carry depends upon the area of the plates. Inherently, selenium rectifiers are suitable only for low-voltage applications; in order to use them for 117-volt circuits, several plates, usually five or six, are connected in series. Selenium rectifiers have low resistance in one direction and a relatively high resistance in the other direction.

In most TV circuits, their polarity is so arranged that they pass the positive portion of a sine wave and stop the negative. Silicon and germanium rectifiers get their rectification properties from the junction of the base metal with some impurity. In silicon diodes, this impurity is usually a small drop of indium or gold antimony. For germanium diodes, indium or some aluminum derivative is used to produce the desired impurity. Rectification takes place only at the junction point because electrons there can move only in one direction.

The amount of current and the maximum allowable peak inverse voltage in a germanium or silicon rectifier depends on the internal construction and on the amount of heat that can be conducted away from the junction itself. Compared to the selenium rectifier and to a vacuum tube, the "forward" resistance of these new diodes is much less and the backward or "reverse" resistance is much greater. For this reason, there is much less power lost in the rectifier during the period when current passes. There is also much less leakage current during the non-conductive cycle and, therefore, much less heat generated at the junction. These are the basic characteristics that produce the increase in rectification efficiency.

The construction of silicon and germanium diodes is practically identical. Both types of rectifiers consist of small pieces of the semiconductor material mounted in a hermetically sealed metal capsule. A typical construction technique is shown in Fig. 4. The silicon wafer is welded to a copper piece which connects to the case, while the "plate" connection from the antimony dot goes.
through a glass seal to an external lead.

Note the fact that the case corresponds to the cathode of a vacuum tube. The hermetic seal and welded construction are necessary to prevent contamination of the semiconductor material. The large metal area corresponding to the cathode side of the rectifier is the portion that dissipates most of the heat. In the replacement units shown in Figs. 2 and 3, the metal shell mounts directly on a larger metal plate intended to dissipate the heat.

Actually, the amount of heat generated in a typical silicon diode used for TV power supplies is not great enough to require special mounting or radiating fins. In the replacement units shown, the mounting was adopted mostly to facilitate replacement of standard-mount rectifiers. Many of the new receivers now appearing on the market use silicon diodes as an integral part of the power supply, and these units appear as in the photograph of Fig. 5, without any special heat-radiating fins. A typical example is the unit which, in the mounting shown in Fig. 3, can pass up to 500 ma. and, in the much smaller case shown in Fig. 5, can operate at 250 ma.

**Typical Germanium Units**

*General Electric* has recently published a replacement guide which enables the service technician to substitute a new germanium rectifier for almost all rectifier stacks found in receiver models dating back to 1953. This unit has been designed with heat-dissipating plates and terminal lugs to fit into the same place and mounting as most of the selenium units it replaces. A total of seven different types are actually available, but only three types will be suitable for replacement. Four of the new germanium types are intended for new-equipment design and have special mounting features for printed circuitry. The type 1N573, shown in Fig. 2, is a half-wave rectifier intended to operate from the 117-volt line and designed for 250 ma. output. The 1N575 can carry 350 ma. The third model, 1N581, is a 250-ma. doubler and takes the place of two selenium rectifiers, or a full-wave stack.

Like their selenium counterparts, these diodes have a very low forward resistance and must, therefore, have a series resistor of 4 or 5 ohms, to limit current. In a typical voltage-doubler circuit, such as shown in Fig. 7, the average voltage drop across each diode is only .12 volt with an output current of 250 ma. These rectifiers can operate up to 120°F and, their manufacturer believes, will not show any sign of aging for the life of the TV receiver. Exact life expectancies of germanium rectifiers are not yet available, but, from tests conducted so far, it would appear that more than ten years of undiminished power output may be expected from the average unit.

**Typical Silicon Rectifiers**

Fig. 3 shows some typical silicon rectifiers, made by *International Rectifier Corporation*, specifically designed to be used as a direct replacement for existing selenium rectifiers. Each of these units is represented as being equivalent to a selenium rectifier capable of carrying 500 ma. and, like the selenium units they replace, the silicon diodes are used with a series resistor, usually 5 ohms. The advantages of the silicon unit are reported to be somewhat higher "B+" voltage, cooler operation, and long life without any aging.

While the "Unistac" 500 was designed specifically as replacement for existing selenium rectifiers, other silicon diodes are available without the heat-radiating fins, to replace rectifier tubes in equipment using power transformers. Of particular interest to the service technician are those silicon units which are mounted on tube sockets for direct plug-in replacement of many popular vacuum-tube rectifiers. A typical example is the 6X4, shown in Fig. 6, which can be plugged in to replace the 6X4 vacuum-tube rectifier shown with it. Another similar plug-in replacement for the 6X4 is the T1/680, made by Texas Instruments. The new "B+" circuit is illustrated in Fig. 8. In addition to the obvious saving of filament power and subsequent heat, the 6X4 also has only a six-volt drop at 70 ma. as compared to 22 volts for its tube equivalent with this current. Note that the impedance of the transformer itself serves as the limiting resistor in Fig. 8.

*International Rectifier Corporation* is preparing to release other plug-in units, such as the 6W5 and 5SR4G. *Barke's Tarzian Incorporated* offers a series of full-wave silicon replacement rectifiers which can be used as substitutes for practically any tube rectifier. A typical comparison of rectifier efficiency between the popular 5U4 and the 5S018 silicon replacement shows that, while the vacuum tube itself dissipates 42.6 watts in a typical circuit, its silicon replacement dissipates less than 1.5 watts. The reduction in dissipation means that the silicon unit itself will be much cooler and contribute substantially less heat to the entire chassis. Cooler operation will prolong the life of other components as well. In addition, the silicon replacement is not subject to the problems of vibration, emission, and filament-voltage variation.

**Replacing Tube Rectifiers**

From what has been said so far, one might jump to the conclusion that, certainly as far as vacuum-tube rectifiers are concerned, one should go right ahead with a semiconductor replacement on any set that comes in for repair. There are, nevertheless, some very real limitations. On the matter of price alone it may be impractical to make a replacement for a tube. On the one hand, such units as the "Unistac" 500 retail at about $1.50 and germanium rectifiers, like
the G-B types shown in Fig. 2, also compare in price to selenium equivalents. On the other hand, rectifiers specifically designed to replace vacuum tubes run considerably higher. The S6X4, to illustrate, is quoted as costing about $20.

Why so great a difference? Units like the "Unistac" 500 are rated at 117-volt r.m.s. input and are thus entirely suitable for use where there is no transformer step-up of the line voltage before it is applied to the rectifier. Each of the two silicon diodes built into the S6X4 assembly, however, is rated at 400 volts r.m.s. input and a maximum peak inverse voltage of 1250 volts.

Another consideration when silicon diodes are contemplated for use in place of vacuum tubes is the smaller voltage drop across the silicon diodes themselves, with the resultant increase of available "B+" voltage. While this may seem highly desirable in some cases, it can also create problems. In the case where a 5U4 rectifier is replaced, for example, an additional 45 volts of "B+" may be available. If "B+" was originally 325 volts, it will thus rise to 370 volts. However, in many power supplies, the filter capacitors are rated fairly close to the actual operating voltage intended. Conditions of high line voltage and frequent surges may result in "B+" voltages which approach or exceed the working-voltage rating of the filter capacitors, if "B+" is increased. In our example, the filter capacitors may have been rated at 400 working volts d.c. At the instant the receiver is turned on, the diodes will provide "B-" even though the various tubes in the set have not yet warmed up and, therefore, do not draw any power. This means that the voltage at the filter capacitors will be higher than under full-load conditions. Even though this warm-up surge may last only a few seconds, repeated excess voltage will ruin the capacitors within a relatively short time. Sustained operation at 370 volts and surges up to 400 volts or more would require capacitors rated for, at least, 450 working volts d.c. It is usually not worthwhile to replace a 5U4 rectifier and, in addition, replace the filter capacitors. For this reason it may not always be practical to install a substitute in a particular TV receiver.

A good rule appears to be that, if the filter capacitors are rated more than 85 volts above the original "B+" working voltage, a semiconductor substitute would work out. While it is feasible to use a bleeder resistor to reduce the surge voltage, the resulting power loss in the resistor and the heat thus generated do not make this advisable.

The series resistor used with these rectifiers limits the amount of current that can be drawn through the rectifier and tends to keep sudden surges to a minimum. If a short circuit occurs in the "B+" system of a TV receiver using silicon or germanium rectifiers, it is possible to burn out the rectifier in the same manner as a selenium unit or vacuum tube may be burned out. A fuse or fusible resistor will protect the rectifier in such instances. Whenever a silicon or germanium rectifier is installed, the technician should check the circuit to see whether a fuse of some kind is used. It is not very difficult or expensive to add a fuse to almost any existing TV receiver and, if the customer is advised of its advantages, the small extra charge will not be resented.

Test Procedures

The simplest check for a defect in a "B+" circuit using a silicon or germanium rectifier would seem to be an ohmmeter test. While such a test will indicate polarity and show up most burned-out rectifiers, it is not a valid way to measure forward and reverse resistance. The reason for this is that the voltage applied through the ohmmeter will affect the apparent resistance because of the nonlinear diode characteristic. A much better test uses a battery, a potentiometer, and a milliammeter. With the positive battery terminal connected to the "plate" side of the diode, connect the body or "cathode" to the potentiometer and milliammeter as shown in Fig. 9. Adjust the potentiometer to read about 10 ma. If the battery is reversed, no current should be measured.

Silicon and germanium rectifiers will make their appearance in AM and FM radios as well as in the control circuits of some new household appliances. Their application as high-voltage rectifiers in TV receivers has been predicted, but, at the time of writing, no inexpensive, reliable rectifier of this type has been announced. In military equipment, high-voltage rectifiers using silicon elements are just now coming into use where reliability, ruggedness, and rectification efficiency are important. The relatively high cost of this type of rectifier makes its application to consumer products doubtful at this time.
An
"Automatic
Rheostat"
Protects
TV Sets

Adding a 3-step, thermal-delay device protects the TV receiver by providing gradual warm-up.

By ATTACHING an "automatic rheostat" to the power input of a TV receiver or other electronic equipment, the entire circuit can be protected from surge currents and voltages when the equipment is turned on. Containing only six electronic components—three thermal-delay relays and three resistors—the simple circuit described here indeed acts as an automatic rheostat, protecting tubes, electrolytic capacitors, and rectifiers from damaging surges.

Two years ago the author repaired an eight-year-old TV set. After replacing nearly all the filter capacitors, it was decided to protect them with a time-delay relay. A 30-second delay relay was applied to the power transformer while a separate filament transformer pre-heated the cathodes of the tubes. When the power supply cut in 30 seconds later, the tubes were ready to draw their current and no surge voltage was applied to the filter capacitors. Not one capacitor failure occurred during the next two years. However, a service record shows that there was one defect. The surge of current going through the power supply burned out a rectifier tube at the rate of one every four months.

More recently, another, similar protective device was added to a new receiver to correct the failing of the former circuit. The series connection of filaments and the use of selenium rectifiers in the power supply suggested, as a solution, a stepped variable input of voltages from about 30 volts to 117. Four voltage steps were achieved by using three time-delay relays which close switches at 10-second intervals, each in its turn shorting out one of the three resistors in series with the TV set. When the set is turned on, the resistance in series with the a.c. input goes through an automatic cycle of 325, 175, 25, and 0 ohms.

There is no special requirement for the chassis pan on which the automatic warm-up control is built. The author used an ordinary aluminum cake pan, 8" by 8" by 2", with excess being cut away just before the finished unit was mounted in the receiver, as shown in Fig. 1. Mounting of the octal sockets and the resistors on that portion of the cake pan which was used is shown in Fig. 2. The circuit is shown in Fig. 3. The three Ampereite thermal-delay relays, types 115N010, 115N020, and 115N030, are designed to close respectively after 10, 20, and 30 seconds from the time power is applied to them. All are made in conventional vacuum-tube envelopes with octal bases and all use 115-volt heaters so that they may be placed directly across the line. Each draws only 2 watts and is designed so that heater power may be continuously applied. As a result, the extra power all three relays consume while the receiver is in operation is not significant.

The delay relays are connected directly to one side of the power line; but through the receiver's "on-off" switch. One wire on the a.c. input of the receiver—the one connected to the "on-off" switch—is lifted from its existing connection and connected instead to the 115N030, last of the relays to close, as shown in Fig. 3. One side of each of the three relay switches is then connected to the wire going to the set's "on-off" switch.

Now the three resistors, each a wire-wound unit rated at 20 watts, are connected in series, beginning with the 25-ohm unit. The unconnected end of the 25-ohm resistor is then connected to the unswitched pole on the 115N030.

Connection is then made between the junction of this resistor with the first 150-ohm resistor and the free pole on the 115N020. The junction between the two 150-ohm resistors is connected to the free pole on the 115N010. The free end of the final 150-ohm resistor is returned to the switch. The three resistors act in conjunction with the internal resistance of the receiver, when the switch is turned on, as a voltage divider, reducing the input voltage to the set.

(Continued on page 161)
A Transistor Galvanometer Amplifier

By W. B. BERNARD
Capt. USN

Ultra-sensitive unit gives full-scale meter deflection with an input signal of 2.5 to 3 µa.

Since the transistor bases draw current it is necessary to have two balance controls to maintain balance under all conditions of the input circuit. The 10,000-ohm potentiometer in the collector circuit is adjusted to give a zero meter reading with the bases shorted together; and the 250,000-ohm potentiometer is adjusted to give a zero reading with the short circuit removed. The first time these zero adjustments are made it may be necessary to go through this sequence twice.

These adjustments insure that when there is no external applied signal all base current is being supplied by the biasing circuit. Under these conditions the zero setting is unaffected by variations in the impedance of the signal source and the transistor amplifier will furnish no current to the external circuit.

The photographs above show the physical construction of the amplifier. It is built on a 3" by 4" card of insulating material which mounts directly on the terminals of the 100-0-100 µa. meter that is driven by the amplifier. No attempt was made to compress the circuit to a minimum size. Except for the space occupied by the two zero-setting potentiometers the size of the unit could be reduced by a factor of two or three.

Power for the collector supply may be taken from dry cells. If maximum sensitivity and linearity are not required a single cell will be sufficient. With a 1.5 volt supply it requires an input of 3 µa. to cause full-scale deflection of the meter. If the supply voltage is increased to 6 volts, full-scale deflection is achieved by an input current of less than 2.5 µa. Even with a 6 volt supply the total current drain from the supply is less than 1 milliampere so that the life of the battery should be about equal to the shelf life.

The present amplifier was not designed with an object of providing absolute accuracy, however, tests so far indicate that its characteristics are sufficiently stable to permit its use as a basis for a volt meter with a sensitivity of 400,000 ohms-per-volt. Such a unit would give most of the advantages of a v.t.v.m. without requiring an a.c. power connection or an expensive load of batteries.

February, 1958
THE prospective buyer of a high-fidelity system is invariably concerned with the question, "Will they be better next year—or the year after? Should I buy now or wait?" This really hinges on a more basic question, as to how much better high-fidelity reproduction can get—is there an ultimate in high-fidelity and have we almost reached it?

Starting to investigate, related questions arise, such as: Which is the best arrangement, a packaged system, bought all in one unit, or a component system, where we go and buy separate pickup, turntable, tuner, preamplifier, amplifier, and loudspeaker system? Then, whichever of these systems we buy, what should we look for in each section? Where can we expect to find further improvement in performance and to what extent? A straightforward answer to these questions will be of assistance to the prospective high-fidelity buyer in answering the first one, as to how much improvement he is likely to see in "next year's model."

Pickup-Tone Arm

Taking phonograph reproducers first, we will start with the pickup-tone arm combination. The earliest of these, many years ago, came as an integrated unit. The pickup was inseparably part of the tone arm. Then, in the interest of versatility and to provide for ready replacement of the expendable part, the plug-in cartridge was adopted. Not only could a new cartridge of the same type be installed into the original arm, but the user could go out and buy another type of cartridge.

The great advantage of this system is that it enables the user to change to a better type of cartridge when it appears. Also arms and pickups can be chosen separately. These advantages have been largely responsible for maintaining the popularity of the interchangeable plug-in arrangement for these many years. Now some manufacturers are reverting to an integrated pickup and tone arm.

The expendable part, the stylus and its assembly, is usually replaceable or interchangeable. This makes the unit readily adaptable to both 3 mil and 1 mil grooves and also makes the expendable part replaceable. But the mounting is unique for the particular pickup and tone arm assembly so it is not possible to put one manufacturer's pickup on another's tone arm. They each come with their own complementary parts.

This development has come about, because, as pickups near perfection, it becomes evident that the two do complement one another. One cannot design a pickup with perfect performance without considering the arm it operates in—or vice versa. But, of course, this loses the advantage of versatility.

Phono Preamplifier

Electrically, the pickup has to feed correctly into the preamplifier so as to give sufficient output, without overloading and causing distortion. Preamplifier manufacturers encountered the problem of how to adjust the gain of their units so as to readily accept pickups having different output levels.

If the preamplifier is made sufficiently sensitive to accommodate the pickups with very low output, such as some of the earlier moving coils, then it is liable to produce some distortion in the earlier stages when connected to a pickup with considerably larger output.

Of course, if the pickup is a ceramic or crystal, instead of magnetic or moving coil, a completely different input is used anyway so this is not so much of a problem. The equalization is also different for a crystal or ceramic cartridge than it is for magnetic or moving coil.

The problem of levels between pickup and preamplifier is a two-way one. Some preamplifier manufacturers have successfully solved the problem so their units will operate from pickups of varying sensitivity—but some have not, and this throws the problem back to the pickup manufacturers.

The pickup may be of a design that provides a wide choice of output voltage. It could be made to give quite a good output and thus give better possibilities of avoiding hum and noise pickup. This would yield an effectively greater dynamic range from the unit.

The deterrent to using the best possible output voltage is that the sensitivity is higher and, consequently, with some preamplifiers overload may be produced in the earlier stages. It is true this overload is not strictly due to the pickup. The same pickup connected to a preamplifier with proper provision for different levels from the pickup would sound perfect. But, connected to a preamplifier designed primarily for the low sensitivity pickups, overload occurs. Then a comparison, for example, between the older moving coil types with low sensitivity and the new high-sensitivity magnetic, can give the false impression that the newer cartridge produces distortion, when it is really produced in the preamplifier due to the higher level.

With this kind of situation the manufacturer not only has to make sure his unit performs according to specification, but he has to guard against possible wrong conclusions that may be drawn by the user from distortion elsewhere in the system. This kind of problem recurs frequently at different points throughout the high-fidelity system and is a particular headache to component manufacturers. It could be regarded as a disadvantage of the component approach. But anyone who is seeking to better his system, by getting improved components as they become available, considers that the advantages of the component approach...
in this respect outweigh this particular disadvantage.

Turntable or Record Changer?

This, too, is an old question and has been discussed several times before. The present trend seems to be toward the use of a simple turntable for playing LP’s (and probably 78’s as well in some instances, for those having an extensive library of 78 discs). The 45’s were created for a basically different purpose. Their intent is to provide a continuous program, for background in music, dancing, or such occasions. The sensible approach seems to be to use a good turntable for 33 LP’s and a separate low-cost changer for 45’s. Some of the modern multi-speed turntables do a very good job of reproducing uniform performance on all speeds but, in general, it is usually possible to get better performances using the simplicity of drive that can be employed for a single-speed turntable.

The latest announcement in this direction is of an electronically driven turntable. The 60-cycle line will drive this turntable at 30 as a single-speed turntable. Then an additional unit with a four-way switched oscillator provides the necessary frequencies to drive the same turntable at 16, 33, 45, and 78, with a range of adjustment on each speed. This approach seems to show promise of combining the advantage of mechanical simplicity in a single-speed drive with multi-speed operation.

However, if you are budget minded, you will probably find a single-speed drive at lower cost that will give performance indistinguishable from this new development for most purposes. There are several good products on the turntable market that will give really good performance for some time.

Radio

The important thing to look for in a radio receiver, whether it comes as a high-fidelity receiver complete with power amplifier and loudspeaker system, or whether you are buying a separate tuner, is that the receiver section should be suitable for the locality in which it will be used. This is true for both AM and FM reception.

At one time, in answer to the question whether one should buy two separate tuners for AM and FM, or a combined changer type, the preference would definitely have gone to the two separate units, provided you could afford it. The only excuse for taking a combined unit would have been on the score of cost. But modern engineering technique has certainly produced some very good combined units, so it is not possible to generalize any more. The choice must be made on the performance of the individual components.

In these days when more and more man-made equipment is producing interference all over the band, an important feature is the standard of interference rejection achieved by the receiving units. Interference can come in through the antenna or through the power line. Rejection of interference coming in through the power line can be achieved by an appropriate type of interference rejector connected between the supply outlet and the line cord. This keeps the interference well away from the receiver itself.

The kind of interference that comes in through the antenna is usually of the short-duration, high-energy-level type, the duration of the impulse being only a matter of microseconds and the energy level many times that of the received signal. In most cases interference suppression such an impulse will close the set down, possibly for a period of almost a second after each impulse. If the impulses are fairly close together—two or three to the second or more—it can completely interrupt reception.

The first stage of interference rejection consists of bypassing these impulses early in the r-f section of the receiver, so as to prevent them being passed on through the rest of the amplifier and causing overload-blocking. This step certainly reduces the blocking effect of the impulses, but they can still be quite audible because the little bit of impulse before the bypass effect comes into operation still gets amplified. The audio amplifier “preads” it so as to be audible as a plop or scratch from the loudspeaker.

Interference of this type can still ruin the reproduction considerably by a rapid succession of plops and scratches.

More modern types of interference suppressors employ extra tubes and delay networks to block off amplification for the duration of the impulses and at the same time “hold” the audio waveform while this blocking off takes place. This may be regarded as a three-stage suppressor and this kind of suppressor is now available on a good many AM tuners. It may be regarded as a “must” for high-fidelity.

Of course, it is important to select a tuner with a suitable bandwidth for the degree of sensitivity and selectivity necessary in your locality. You are fairly close to a few powerful transmitters and these are the only ones you wish to receive, a wide-band tuner without too much selectivity or sensitivity will give you higher fidelity reception than the more sensitive, selective ones made for distant reception.

In the latter case a greater sensitivity and possible restriction of the bandwidth is necessary to avoid interference between channels. If you are in a “bug” who wants distance as well as local reception, you need a receiver with a local/distant switch, which must be well-engineered.

In FM a similar principle is true. The sensitivity of the receiver should suit your locality. If you are very close to the transmitters you intend to listen to, there is no point in having a high sensitivity receiver that may only succeed in picking up more noise or interference. If the tuner comes with a two-way arrangement for adjusting for local or distant reception, this may well serve the same purpose.
In FM reception, as with other realms of high-fidelity, trends are evident. In the pickup field, at one time magnetic was the only type of pickup used. Then came the moving coil and crystal. Finally, with improved design we got back to the magnetic as seeming to give the best consistent degree of performance (although many still prefer the moving coil). But the possibility that a new design of ceramic will one day out-perform either should not be overlooked.

Similarly in FM reception, at one time the ratio detector achieved a degree of popularity, while for some time now the limiter/discriminator arrangement has been preferred as the better type. However, recent developments in the ratio detector, with an improved approach to the design, achieve results at least as good and possibly a little better. So the trend will probably swing back toward an improved ratio detector in the near future.

Always be on guard against the sweeping claim that a certain type of circuit is inherently better than any other type of circuit. This kind of statement should always be accepted with some reserve. Even if it is true at the time it is made, it would always be safer to add “at the present stage of development.” Further development may always reverse the order.

Unfortunately, in the high-fidelity business, a large number of “engineers” become “wedded” to a particular circuit in a quite unscientific way. They are convinced that a certain circuit is best and there is no point in trying another circuit because they just know it isn’t as good. This attitude is certainly a hindrance to progress.

The Power End

Under this heading we consider the amplifier and loudspeaker, which bring another set of problems. Amplifiers are primarily designed to meet a specification—to give a certain maximum power output with an adequately low amount of distortion and to achieve a certain linearity of frequency response. As there is no such thing as a “standard” loudspeaker impedance, because individual loudspeakers deviate in impedance in the widest possible way, the only way to specify performance of an amplifier is when it is loaded with a standard resistance value equal to the nominal impedance of the loudspeaker.

Some, from this fact, have accused the amplifier manufacturer of designing his amplifier to feed a resistance load and adopting the attitude that it is not his responsibility what happens when it is connected to a loudspeaker. In very few instances—if any—is this true.

Most, if not all, amplifier manufacturers have made a conscientious effort to see that their amplifiers perform at least reasonably well into the average loudspeaker. Due to the wide variation of possible loudspeaker impedances, it becomes almost impossible to guarantee that the amplifier will perform uniformly well into any loudspeaker. Added to this, the prevalent stress on performances to a very high specification into a dummy load (to which unfortunately we never listen!) has rather forced the amplifier manufacturer’s hand, into producing an amplifier to meet a fantastic specification first and to perform reasonably well into most loudspeakers that may be connected to it second.

The loudspeaker manufacturer has been faced with similar problems. If one particular amplifier does not perform properly when his particular loudspeaker is connected to it, sometimes his loudspeaker undeservedly gets the blame.

An example of this situation is illustrated by one electrostatic tweeter manufacturer who has incorporated networks into his tweeter for the purpose of avoiding the distortion produced in some amplifiers when the combined impedance of the woofer and tweeter, producing resonance, causes a widely diverse loading on the amplifier.

Strictly, of course, this is none of the electrostatic tweeter manufacturer’s business. But his tweeter is liable to get blamed for this misbehavior anyway, so for his own “protection” he incorporates a network into his unit that will guard against this kind of misbehavior.

In an endeavor to accommodate different types of loudspeakers, so performance will be more uniform, several amplifier manufacturers have incorporated variable damping circuits.

Unfortunately this is not the whole story, however. Most high-fidelity damping circuits, as well as varying the damping in the region of loudspeaker resonance, also vary the stability margin or feedback criterion of the amplifier in other regions. The performance of the amplifier may be uniform into a resistance load throughout the range of the damping control, but it may not be uniform when connected to a loudspeaker.

On the acoustic side of the loudspeaker, it has to be integrated with its enclosure and in which it will be used, as well as being correctly matched to the amplifier. A loudspeaker unit designed to operate in a small enclosure for acoustic suspension operation will not serve well in a large enclosure of the bass-reflex type, although it may have the right cone diameter. The fact that one 15-inch woofer works well in a bass-reflex enclosure of certain dimensions is not evidence that another 15-inch woofer can be interchanged in the same enclosure with identical results.

Then, as Mr. Briggs’s article in the August issue shows, there is the matter of standing waves. These can be quite exaggerated by the type of loudspeaker, its enclosure, and its position. To get the best performance we have to make a choice that virtually “integrates” the loudspeaker with the listening room. The other question here concerns (a) the development of the wider range electrostatic loudspeakers, (b) the “servo” type loudspeaker, and (c) other possible developments with the component system. A difficulty with the wide-range electrostatic loudspeaker, even when this range only encompasses from somewhere in the region of 500 cycles up, is the poor possibility of achieving any degree of acoustic damping by electrical coupling to the amplifier. This is quite possible with dynamic type loudspeakers, as evidenced by recent developments that have been introduced along these lines.

However, it is not impossible that the electrostatic type unit can also be developed in this direction. A suggestion for this would be to develop a relatively simple negative-capacitance electronic circuit integrated with the electrostatic loudspeaker. This will reduce the electrical capacitance of the unit, enabling the basic power amplifier to be more directly coupled to the acoustic load on the electrostatic loudspeaker diaphragm.

(Continued on page 156)
An Electronic Photoflash

By RICHARD GRAHAM

Construction of compact unit producing a good flash with only 450 volts is either battery- or a.c. line-operated.

UP TO ABOUT five years ago, flash photography was an expensive proposition, particularly for the amateur with limited funds. Irrespective of whether the common flash bulb or the older type of high-voltage electronic flash was used, the cost was high. Both had inherent disadvantages which often outweighed the advantages, resulting in what might best be described as a subconsciously reluctance on the part of the amateur enthusiast to accept either wholeheartedly.

Flash bulbs, of course, showed up the picture taking by requiring changing after each exposure. In action photography this is a distinct disadvantage. It also required maintaining a stock of flash bulbs which had to be available for any photographic occasion which might arise.

With the advent of the electronic photoflash, speed light, or strobe light, call it what you will, these disadvantages were remedied. In fact, other advantages were soon apparent. The high speed of the flash could photographically stop or "freeze" any natural motion. The duration of the flash was about \( \frac{1}{2000} \) of a second (the exact time depended on the power input and tube). This made the electronic flash a natural for high-speed action photography and wiggly things such as babies, animals, etc. Furthermore, the unit was good for over 10,000 flashes—which meant it probably would outlast the shutter with which it was used.

However, the high-voltage type of electronic photoflash had some serious drawbacks. The voltage required was in the neighborhood of 2000 to 4000 volts. Generally the power supplies used to supply this voltage were bulky because of the extra insulation required. Since most of the components used were special, the cost was high. It was not uncommon for one of these units to weigh 25 pounds.

Fortunately, subsequent developments have reduced the operating voltage to 450 volts, making the electronic photoflash a safe and practical reality. This relatively low voltage means that ordinary radio and TV components can be used with a consequent saving in size, weight, and cost. While this article will discuss the theory and design considerations of electronic photoflashes in general, a description of an economically constructed flash unit is also included which, because of its low cost, will appeal to all photo-electronic enthusiasts.

The basic concept of the electronic photoflash is simple. A d.c. power supply of some form is used to charge a large capacitor. This capacitor is then discharged through a special xenon-filled flash tube by means of a trigger circuit which is actuated by the camera shutter contacts.

The power supplies for charging the large capacitors used in the electronic photoflash have consisted of dry and wet batteries, vibrator supplies, a.c. transformer-type supplies, voltage doublers and triplers, or any combination of these. While all of these types of supplies have been used with success, the exact choice represents a compromise among three conflicting factors; namely, size, capacitor charging rate and cost. The faster the capacitor charging rate, the heavier the current-carrying capacity of the supply, which usually means a large size. If a smaller supply is desired at the same capacity, then the cost will rise quite sharply.

It is felt a happy compromise has been reached in the unit described by using a voltage tripler with three 65 ma. selenium rectifiers to produce approximately 450 volts. The cost for this type supply is very low, its compactness can be verified from the photographs of the unit, and the capacitors can be brought up to charge within four or five seconds.

Electronic photoflash units are usually rated in watt-seconds. This refers to the energy storing capacity of the capacitors which is later discharged through the flash tube. The watt-seconds input can be calculated for any photoflash from the following formula:

\[
W-S = \frac{1}{2} CE^2
\]

where: \( C \) = capacity in microfarads
\( E \) = applied voltage in kilovolts.

Thus we can see that for a given watt-second input, the capacitor value will increase as the square of the voltage change. The higher the operating voltage, the less the capacity needed. However because of the danger involved with the high-voltage photoflash units a compromise can be found between the amount of capacity and voltage needed by operating in the 450-volt range.

Since high capacitance units in this voltage range are commonly used in TV and radio work, the cost of these capacitors is very low when compared to those in the higher voltage range. Furthermore, even though greater capacity is necessary with lower voltage to obtain an equivalent watt-second rating, the size is considerably reduced through the use of electrolytics. At voltages much higher than 450 or so,
electrolytic capacitors aren’t too practical. Actually the cost for these capacitors can be reduced to 1¢ per microfarad or less by merely “shopping around” a bit.

There are a number of ways of triggering or causing the flash tube to conduct. The method used depends upon whether a high-pressure or low-pressure type of flash tube is used. The low-pressure, or self-ionizing, tube will flash when the high voltage is applied to its terminals. The usual and simplest way of accomplishing this is by means of a relay, as shown in Fig. 1.

Since the resistance of the flash tube is approximately 3 ohms when conducting, the instantaneous current through the tube and its associated circuit is on the order of 150 amperes (assuming an applied potential of 450 volts). Thus, because of the low resistances involved, any possible contact resistance should be avoided. Unless a special relay is used, that is, one designed specifically for this type of service, it is best to avoid firing by this method. However this method does have the advantage in that no high voltage exists in any external cable except for the very brief instant that the flash tube is fired.

The high-pressure type of flash tube is always connected across the high-voltage terminals and requires a high-voltage pulse (10,000–15,000 volts) to a grid wire on the flash tube to ionize the gas and start the conduction. This method eliminates the possibility of contact resistance in the discharge circuit. Many systems using the high-pressure type of flash tube utilize the discharge of a small capacitor in the 1–5 µfd. range into a model airplane ignition coil to produce the high-voltage pulse. This capacitor is charged by means of a high-resistance voltage divider across the high voltage.

The discharge of the trigger circuit capacitor can be accomplished directly with the camera shutter contacts. However, to reduce the shutter contact current a more satisfactory method is to discharge the trigger capacitor by a relay or thyatron which, in turn, would be actuated by the shutter contacts. Either of these two methods provides a simple means of synchronizing the shutter opening with the flash. Many camera shutters are designed strictly for use with the usual magnesium flash bulb. These flash bulbs have a 3 to 20 millisecond delay between the time the voltage is applied to the lamp, i.e., the shutter contacts have closed, and the time of maximum flash intensity. Since the delay of an electronic flash is practically zero, some provision must be made to delay the time between the shutter contact closing and the flash. This is done very easily in the thyatron or relay method by introducing an electrical delay with resistance and reactance.

A typical circuit for firing the flash tube by means of a thyatron is shown in Fig. 2. This method has the lowest camera contact current, about 1 ma., a very good advantage, however it also adds to the circuit complications.

The relay method represents a compromise between the use of a thyatron and the use of the camera shutter contacts to fire the flash tube. The relay current is small and the flash can be easily synchronized. Furthermore, there is nothing special about the relay. For these reasons, it was used in the model shown in the photographs. A typical circuit of the relay firing method is shown in Fig. 3.

The electronic flash outfit described consists of a basic power unit (Fig. 4A), and a flash unit (Fig. 4B) to which can be added, if desired, a booster unit (Fig. 4C) and a battery unit (Fig. 4D).

The basic power unit is built into a box 4"x6"x2" and, when used with the flash unit, makes up a complete flash outfit. This unit consists of a voltage tripler, 200 µfd. worth of capacitor, a capacitance charge indicator, and various parts of the trigger circuit. The voltage tripler produces approximately 450 volts which, in conjunction with the 200 µfd. capacitance, will give a 20 watt-second input to the flash tube. The capacitance charge indicator consists of the neon lamp PL and resistors R1 and R2. The neon will light when
the voltage across the capacitors rises to approximately 400 volts. This indicates that the capacitors are practically up to charge and that the unit is ready to be fired. A second voltage divider consisting of resistors \( R_9 \) and \( R_8 \), together with capacitor \( C_1 \), and relay \( RL \), form part of the trigger circuit, the operation of which was described previously. The potentiometer \( R_c \), which is in series with the relay coil, is provided to give an adjustable delay for synchronizing the shutter and flash. The adjustment of this potentiometer \( R_c \) will be described in detail later.

Since FP-type electrolytic capacitors were used in which the can was the negative pole, it was necessary to insulate the cans from the case. This was done to avoid any danger of shock since one side of the power line is connected directly to these capacitors. A heavy kraft or fish paper wrapping provides sufficient insulation.

The "on-off" switch is a single-pole, double-throw switch which electrically serves a dual purpose. In the "on" position a.c. is applied to the voltage doubler input. In the "off" position a 5000-ohm bleeder resistor is automatically switched in to discharge the capacitors.

The flash unit which attaches to the

Battery unit which converts the photoflash to portable use.

Inside view of the basic power unit used for the photoflash.
camera consists of the battery case formerly used with the old type flash gun; a flash tube; a new reflector specifically designed for efficient operation with this particular flash tube; and a housing enclosing the model airplane ignition coil.

The housing was formed from a piece of aluminum bent over a short piece of pipe the same diameter as the shank of the reflector. A long bolt through the bottom edge of the U-shaped housing serves to clamp the housing to the reflector. The model airplane ignition coil is held inside the housing by means of two fuse clips over the ends of the coil. The exact arrangement for the clamp holding the housing on to the battery case is left to the ingenuity of the constructor since it will undoubtedly vary with the type of flash gun and camera that are used.

The flash tube is held in the reflector with a few drops of cement. No socket was used on the flash tube—rather the wires were soldered directly to the pins. After all, with 10,000 or more flashes between tube changes, no changes are contemplated for quite some time!

To increase the light output, a booster unit can be constructed. This increases the input from 20 watt-seconds to 60 watt-seconds by increasing the capacitance from 200 µfd. to 600 µfd. This increase in light output is particularly desirable for the slower speed films, for color work, and for working over greater distances. In the unit illustrated, four 100 µfd. capacitors are wired in parallel, insulated (for the same reason as before), and mounted in 4" x 6" x 2" box. This is the same size as the power unit. Connectors are provided on the side of each unit. The two units are then held tightly together by means of trunk fasteners of the draw type which are available in most hardware stores.

If cost is no object and the ultimate in compactness is desired, Sprague makes a 526 µfd., 450-volt capacitor (Type FF-1) only 2 1/4 inches in diameter and 4 3/4 inches long. Each capacitor of this type is good for 53 watt-seconds. Using two of these capacitors will give over 100 watt-seconds input, which should provide adequate light for almost any situation.

Since a 117-volt a.c. source is needed to operate the power unit, it is necessary to construct a battery-rectifier unit described if any outdoor flash photography is contemplated. This unit is actually a small 6-volt d.c. to 450-volt d.c. power supply which modifies the flash outfit for portable operation—free from any and all power lines. The battery unit is constructed in a 4" x 6" x 3" aluminum box and is fastened by means of trunk fasteners as before. This allows a quick changeover from a.c. to battery operation as the demand for either arises.

The circuit is quite conventional and uses standard auto radio parts (except, of course, for the miniature 6-volt storage battery). The transformer is made by small auto radio transformer used in a half-wave circuit. The center tap is taped up. Four selenium rectifiers are used in series to reduce the voltage per rectifier to within its ratings. The output is fed directly into the output capacitors that are found in the power unit.

When the flash outfit is battery powered, the switch on the battery unit is used to turn the equipment on and off. This switch should be left on only long enough to charge the capacitors. If any appreciable time exists between the moment the capacitors were charged and the picture taken, it would be advisable to give the capacitors an occasional "log." This is done by turning the battery unit on for a few seconds to bring the capacitors up to full charge again. This conserves battery power and will lengthen the number of flashes per battery charge.

With reasonable care taken to conserve battery power, at least 40 flashes per charge can be obtained. This is considerably more than is ordinarily taken on one occasion. Since the storage battery is good for at least 150 charge-discharge cycles, the total number of flashes per battery is over 10,000. This assumes very careful battery care, i.e., not leaving it in an uncharged condition too long, keeping the water up to the recommended level, etc. . .

A suitable battery charger can be constructed with a bridge-type selenium rectifier; a 10-volt filament transformer; and a 50-ohm rheostat. A suggested circuit is shown in Fig. 4E. The rheostat is adjusted to produce a maximum charging current of 250 ma. in accordance with the manufacturer's instructions. An ordinary auto battery type charger will also provide some series resistance is included to limit the maximum charging current to 250 ma.

After the flash outfit has been completed, it is necessary to synchronize the flash with the shutter opening before it can be used with the flash gun. This is done by adjusting the time constant of the resistance-inductance circuit formed by the relay coil and the series potentiometer R. As stated previously, magnesium flash lamp rather than the flash tube. A 100-ohm resistor is then placed in series with the flash tube, and the flash occurs. It would be advisable to check the synchronization occasionally, for example, between rows of film. This is because the battery voltage also determines the delay. For this reason, it usually isn't advisable to synchronize the shutter and flash at shutter speeds greater than 1/50th of a second.

While the relay suggested in the parts list is commercially available, the best bet is an experiment and reducing the cost by rewinding a small 6-volt relay. This is what was done in the unit shown. Merely remove what appears to be half the turns. It isn't too critical. Thus the amperes turns is approximately the same as before, since the resistance of the coil is halved, along with the number of turns.

An exposure chart is given in Fig. 5. However the guide numbers, as found by this chart, may vary but it serves as a good starting point. A few test shots will soon give the correction factors that must be applied to future exposures.

The completed flash outfit, all set for portable operation is shown on page 47. A complete wiring diagram is shown. The total weight is only 8 pounds. The over-all dimensions are five inches high, four inches wide, and six inches long. When the flash is used on a.c., the weight is only 3 1/2 pounds and the height is reduced 3 inches. The construction can be simplified somewhat from the unit described by eliminating some or all of the units. The outfit, of course, loses some of its "universal" features.

However, it is the writer's considered opinion that the unit described is an economical and worthwhile undertaking for the serious photo-electronic enthusiast.
During a recent recording session of a piano quintet, difficulties were encountered when it was found that the correct balance between piano and strings could not be achieved using one microphone. A hasty glance at catalogues revealed a profusion of professional mixers bristling with meters, gadgets, etc. at prices too high for the author's wallet. It was decided, therefore, to construct a mixer to meet less rigid requirements. It must be emphasized that the "less rigid requirements" do not refer to the fidelity of reproduction, but rather to the number of extra features included. The mixer had to be capable of continuously varying the relative gain of two high-impedance microphone inputs. (Later, a variable input for a high-level source was added.)

Fig. 1 shows two of the most common types of transformer-less mixing circuits. Fig. 1A is probably the more common because of its simplicity. Each input has its own gain control and the output from the tap of each control is fed, through a series resistor, to a common grid. These isolating resistors have a very important function; if they were not present, turning either control completely counter-clockwise would ground the grid, cutting off the second channel as well.

It is obvious, however, that considerable signal will be lost in the series resistors—the main disadvantage of this circuit. This brings us to Fig. 1B. In this circuit, two triodes are used for two inputs, with the plates and cathodes tied together and the inputs connected directly to the grids in the normal fashion. Perhaps analysis of this circuit is simplified by drawing the equivalent circuit, shown in Fig. 1C. The schematic shows a triode, with two parallel control grids. Since we have effectively two triodes in parallel, the plate resistance of the combination is equivalent to one-half of that of the single section operated under the same conditions. (Each change in plate voltage will cause twice as much of a change in plate current.) Getting back to the grids, it is found that a change in grid potential will cause a certain change in the current drawn by its respective plate, with no affect on the current drawn by the other plate. Hence the transconductance remains the same. Substituting in the formula for amplification factor:

\[ \mu_i = G_m \times R_x \]
\[ \mu_i = G_m \times R_x/2 \]
\[ \mu_i = \mu_i/2 \]

where \( \mu_i \) equals the amplification factor of the single triode and \( \mu_i \) equals that of the two sections in parallel. It is now clear that the \( R_x \) and \( \mu_i \) of a triode operated in this manner are divided by the number of sections in parallel. For one and a half 12AU7, the arrangement used in the author's circuit, under standard conditions, typical values are: \( \mu = 6, R_x = 2500 \text{ ohms, and } G_m \) (from one grid) = 2400 micromhos.

In addition to mixing facilities, the use of two high quality mikes necessitates the use of two preamplifiers, as noise considerations prevent mixing at a very low level. See Fig. 2. A 12AY7 is used as the input amplifier because of its desirable characteristics as a low-level amplifier. (Continued on page 164)

Fig. 1. (A) One type of simple triode mixing circuit is shown here. (B) Another mixer circuit employing two triodes. (C) Partial equivalent circuit of part (B).
Richard G. Wells, Jr. of Pikeville, Ky., was one of thirteen "All-American Award" winners. He was cited for installing free TV cables in public schools, aiding in last January's flood emergencies, and for encouraging youths to study electronics.

Philip DiPace of Allary, N. Y., is active in Boy Scout work and church activities, and was cited for his work toward higher business ethics and for performing free radio and TV services for older people unable to afford even nominal service fees.

Bert Ryrastra of Charlotte, Mich., won his award for his outstanding service to Scouting, for rendering free radio and TV services to the needy, and for assisting in civil defense communications over his ham call, W3WJ6.

Mortimer Libowitz of Brooklyn, N. Y., assisted youths interested in electronics and used his ham radio station, K2BDQ, in civil defense communications to become eligible for an award.

John Stefanski of Pontiac, Mich., encouraged and helped youths to follow an electronic career, promoted better business ethics, and provided free TV service to patients at Oakland County TB Hospital, to be named a winner.
Remo De Nicola of Quincy, Mass., devoted many hours of his spare time to volunteer community service work with youth groups and church organizations and servicing sets for the needy without making a service charge.

John R. O'Brien of Evanston, Wyo., was honored for instructing first aid classes, setting up p.a. systems at community functions, and for saving several children and adults from death by drowning.

Frank J. Hafer, W2EUI, won recognition for his outstanding work in handling emergency communications in his home town, Roselle, N.J. His award was bestowed in part for his rescue work in three plane crashes.

Scott A. Witchner, Jr., Lampasas, Tex., used his amateur radio station, W5YIS, to save lives during the disastrous floods last May 12 and to direct local civil defense communications.

Harry E. Ward of Long Beach, Calif., has advanced the cause of electronics by assisting and encouraging education, maintaining placement files, and training groups in public safety, all without compensation.

Marcus E. Denham of Pryor, Okla., was honored for his voluntary contributions to the youth training programs in his city and his wide community service through a number of organizations to which he gave his services.

Philip G. Rektopf, Jr., of Louisville, Ky., was cited for installing a system of sound speakers to enable blind children to roller skate without accidents, putting textbooks on tape for the blind, and repairing electronic equipment free for wards at Boys' Haven in Louisville, Ky.

Billy Joe Jenkins, Paducah, Tex., was honored for installing tree television cable and for servicing TV sets free at Richards Memorial Hospital, assisting with Boy Scouts and Little League, and supplying p.a. systems at community functions.
HERE is a transmitter so small that with the tubes and plug-in coil removed it is very little larger than The Radio Amateur's Handbook. Yet it is no flea power affair: it handles a full 50 watts' input on 80 meter c.w.—and very nearly as much on 40 meters and 20 meters. It is ideal for use on either of the two most popular Novice bands and makes an excellent portable or auxiliary rig for the old timer.

The compactness of the transmitter is accounted for by the wonderful new silicon rectifiers—tiny, cool-running units which have virtually no voltage drop and handle up to 500 milliamperes of current with ease. These rectifiers and a simple a.c.-d.c. heater hookup (old stuff to the old timer—but may be very new to many of the current crop of hams) make possible a power supply which tucks neatly under a 2" x 7" x 7" chassis—along with all other parts.

Yes, the circuit is a.c.-d.c.—but don't go away! This particular circuit was chosen because neither side of the "B" voltage goes to the power line. The chassis of the transmitter can be grounded (and for that matter, should be) to an outside ground which means that this rig is just as safe as any standard a.c. transmitter. Actually, it is probably safer than most other 50-watt rigs, because even tangling with the high voltage (which runs about 275 volts under full load) would be a bit better than mixing it up with the 500 volts common in many 50-watt rigs. This circuit is one which depends upon fairly high current and fairly low voltage.

Looking at the circuit diagram, the crystal oscillator uses one 12BY7A in a Pierce circuit. This circuit was chosen because it requires no tuning—the transmitter has only one tuning coil and that is in the output stage. The latter stage uses two 2SBQ6GT's in parallel. These tubes were chosen because they are low in cost (less than half as much as comparable transmitting type tubes) yet are rugged and draw plenty of plate current. On 80 and 40 meters, the tubes work "straight through" on the crystal frequency. For 20-meter operation, the transmitter "doubles" in the final output stage.

The heater voltage for the unit comes from a resistor line cord which drops the line voltage sufficiently to operate the three tube heaters—which are connected in series and "add up" to 62.6 volts. The line cord was used in preference to a resistor because it "spreads out" the heat dissipation. (The line cord normally runs somewhat warm—in case you have never seen one before). Not all jobbers stock these cords today, but the larger ones do, so there should be no difficulty in finding one.

The "B" voltage circuit uses a voltage doubling hook-up, which, thanks to the fact that 117 volts a.c. is higher than that on the peaks of the cycle, provides approximately 300 volts without load. Even heavily loaded, the power supply output is excellent, a characteristic of the low-resistance silicon rectifiers.

The parts layout is apparent from the photographs and nothing is particularly critical. It may be a good idea to mount the variable capacitor first, to see how much space it requires, because there is no space to spare under the chassis. If your capacitor is different in shape from the one shown, some minor layout changes may be necessary.

In wiring, note that all of the "B-minus" wiring is kept off the chassis. The variable capacitor mounts on the chassis and the rotor is connected to the "B-minus" lead by means of a fixed capacitor. This allows grounding the chassis to an outside ground, keeping the chassis "cold" and safe. Actually, as explained earlier, the "B-minus" lead also is isolated by the rectifiers from the a.c. line, which gives further protection.

Be particularly careful in hooking up the line-dropping cord to make certain that the resistor lead goes to the tube heaters. A mistake at this point could blow the tubes, since it could easily put full line voltage on the tube heaters. If you have an ohmmeter, identifying the resistor lead is easy. If not, you can do it by elimination: connect a flashlight battery to a flashlight bulb using the line cord to complete the circuit. Two of the leads will allow current to pass to light the bulb—but one will not, and this one, of course, is the resistor lead. The final step is to substitute a pair of headphones for the bulb to find which of the two non-resistor leads is "paired" with the resistor lead.

You will notice in wiring that plenty of ceramic bypass capacitors are used, the idea being to kill off as many sources
of TVI as possible. On 80 and 40 meters, chances are that your rig—like
the one shown—will not interfere at all with a TV set in the same house—and
probably won’t bother TV reception
even when tuned up on 20 meters. The
heavy bypassing, plus the shielding pro-
vided by a bottom plate, do a surprisingly
good job. Of course, in weak signal
TV areas, it may be necessary to
shield the tube and the coil by means of
a rectangular enclosure built of
Reynolds perforated metal.

The plate circuit of the final ampli-
der is parallel fed, which keeps d.c.
voltage off the coil, another safety pre-
caution. The coils, plug-in for ease of
changing bands, have antenna windings
which are slid up and down the form to
provide for proper antenna coupling and
then are cemented in place.

In a low cost and simple transmitter
like this one it was felt that a meter
was unnecessary and, instead, two bulbs
were substituted. The first is a No. 44
dial light bulb, connected in series with
the “B-plus” lead. It becomes brighter,
or dimmer, depending upon the current
being drawn by the transmitter and is
quite satisfactory as a meter for indi-
cating resonance dip. A neon bulb,
which is connected to the chassis and
simply presses against the glass of one
of the tubes, gives a good indication of
actual r.f. output—a further aid in
tune up.

The transmitter is crystal-controlled,
of course. For your crystals, select the
“pressure mounted” type—not the
“plated” crystals, which will handle
only very low crystal current. The lat-
ter are excellent for many types of cir-
cuits, but not for this one.

Wind the coils with care; current
runs fairly high, and a bad solder joint
might cause a lot of trouble. Be care-
ful, too, in wiring to the plate caps,

(Continued on page 160)

Bottom view of “Muscle Mouse” shows placement of components.

Top view shows tubes and coil and the use of indicator lamps.
All About Audio and Hi-Fi

Part 8. Factors that determine the power handling ability and the efficiency of high-fidelity speakers.

We have seen that a diffuser can be used to subdue peaks in the upper register and reduce beaming effects. The problem can also be tackled electronically in the speaker circuit by using a filter.

A dividing network in a multi-speaker system is designed to limit the activities of each unit to its most satisfactory audio range and has become almost standard practice in wide-response installations. It is obvious that similar controls can be used on a single speaker or on two or more units working in parallel, although the full effect of a dividing network will not be obtained. There is, however, the benefit of smoothness from units working in parallel due to cancellation of resonances which rarely occur at identical frequencies in different speakers. The filter now described was made up by Mr. R. E. Cooke, and could easily be assembled at home by the average experimenter. It gives continuously variable attenuation up to 15 db centered around a choice of five frequencies, 2, 3, 4, 5, or 6 kc., selected by a switch. The “off” position of the switch enables rapid A-B comparisons with unmodified response of the speaker (s) to be made without altering the resistor setting.

The filter consists of a parallel-tuned LC resonant circuit shunted by a variable resistor R. The tapped air-cored inductor L is wound by hand; the 1 µfd. capacitor C may be any good paper type obtainable from jobbers. R is a wire-wound, linear taper variable, and S is an ordinary 6-position switch. The full circuit is given in Fig. 36.

The filter is placed in series with the loudspeaker, and the switch gives maximum rejection at various frequencies as follows:

<table>
<thead>
<tr>
<th>POSITION</th>
<th>INDUCTANCE</th>
<th>CENTER OF TROUGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.2 mhy.</td>
<td>2 kc.</td>
</tr>
<tr>
<td>2</td>
<td>3.9 mhy.</td>
<td>3 kc.</td>
</tr>
<tr>
<td>3</td>
<td>1.8 mhy.</td>
<td>4 kc.</td>
</tr>
<tr>
<td>4</td>
<td>1.0 mhy.</td>
<td>5 kc.</td>
</tr>
<tr>
<td>5</td>
<td>0.7 mhy.</td>
<td>6 kc.</td>
</tr>
</tbody>
</table>

With R set at its full value of 50 ohms, the maximum dip in response of about 15 db for each switch position is produced. A general picture of results is given in Figs. 39 and 40.

The air-cored inductor L consists of 303 turns of No. 18 SWG (No. 16 AWG) double cotton-covered copper wire. Tappings are brought out as shown in Fig. 36. The total resistance is only 12 ohms so the insertion loss is negligible outside the region of resonance.

I have been using one of these filters with an experimental speaker system which has some annoyance value in the upper middle register. It works very well, but it is difficult to decide which is the “correct” setting and I would always prefer a speaker which did not require the treatment.

The general effect is similar to that due to a so-called “presence” control on amplifiers, which I find much more baffling than simply relying on the normal bass and treble controls, which usually prove to be adequate.

But there is one possible application of the filter which can be fully recommended, and that is where a wide range speaker is being used on a commercial set not equipped with adequate tone controls and with an over-all response shaped like a salmon, with all the best cuts in the middle and a large speaker system often sounds woolly on music and resonant on speech with this type of input, and a touch of tone control.
in the speaker circuit often works wonders.

**Power Handling and Efficiency**

These qualities in a loudspeaker are so interdependent that we might as well deal with them together. I always think that for domestic use the power handling capacity of a speaker is a very much over-rated virtue; we are concerned with how much comes out of a speaker, not with how much we can put into it.

The main difficulty is the absence of any recognized system of rating, plus the fact that the method of mounting affects results. Probably the best assessed is to listen to the speaker on full orchestra— including cymbals—and also on organ and rate it at peaks which are free from roughness, harshness, and undue boominess. Full orchestra is mentioned here deliberately because, with modern recording techniques, there is far more power in the upper register than there used to be. In fact, the hi-fi craze has often produced too much top, but there are welcome signs of a return to sanity. Distortion at high frequencies is always much more distressing to the ear than at low frequencies.

The oscillogram of Fig. 35 shows that the peak produced by cymbals is almost equal to the drums. The output from a pickup was photographed on the scope. At the left we have full orchestra for comparison with drums and cymbals that follow. It is interesting to note the steep wavefront produced by these percussion instruments; any overloading of amplifier or speaker at these peaks would obviously mar results.

Rating a loudspeaker at a single frequency is quite useless, because too much depends on the choice of frequency, and the speaker does not have to work at a single frequency—it always receives powerful harmonics. But this is not to say that testing a loudspeaker at a single frequency is useless. This, of course, vital to any assessment of performance. We have already stated that method of mounting affects results. If reflex or horn loading improves the waveform at low frequencies for a given output of sound, then frequency doubling and trebling are reduced and so is intermodulation; but the important point is the output. No system can be judged merely by the amount of input it will take.

This is one reason why the open baffle is still better at the bass end than most people imagine, in spite of cut-off due to limitation of size. The cone is free to move as it likes and the sound waves from back and front enter the room without restriction. The speaker will handle fewer watts than reflex and enclosed cabinet types, but it needs fewer watts for equivalent acoustic output over most of the audio range.

It is a pity that it is almost impossible to measure total speaker output, but it is very easy to measure and calculate input. (Mr. Cooke uses a sliderule, but I can still do it on my fingers.) This is why the habit of rating speakers on input and ignoring output has been so generally adopted.

It cannot be too strongly emphasized that true efficiency in a moving-coil speaker depends on flux density and this is the quality in a magnet that costs the money. And in this connection we refer to total flux, which is the product of gauss and gap dimensions (diameter, width, and depth.) It is impossible to assess the value of a magnet by a statement of gauss alone, as 13,000 lines per square centimeter with a typical center pole would give 54,000 total flux, where 13,000 lines with a 1½" center pole would produce 145,000 lines, an improvement of about 100%.

Magnet weight gives a rough idea of value, but as the prices of magnetic alloys vary, the weight is not a complete guide. Actually, it makes no difference to the user which type of magnet is employed; whether it is alnico, alcob, ticonal, ceramic, or hygienic does not matter. The only thing that counts in value is the total flux. All modern magnets merit the description permanent.

**Efficiency and Watts**

It is always difficult to grasp the relationship between the power we put into a speaker and the amount of sound which comes out, because a twofold increase in power produces only 3 db increase in sound pressure, which is just easily perceptible. (To the ear, the increase sounds more like 33% than 100%.) Fig. 38 shows the relationship, taking 1 watt as a reference.

Acoustically, the increase in level caused by an increase in power from 30 to 60 watts is the same as from 1 to 2 watts, but electrically it is quite a different story. As Fig. 38 shows, it pays to use a high-efficiency (i.e., high flux density) loudspeaker and work on the steep portion of the curve below 15 watts, because the next 3 db are at a

*(Continued on page 146)*
The service technician is the man on the scene when the owner gives up on the old TV receiver.

The trend in sales and service of television sets is following the pattern of the automobile industry of two decades ago. If no drastic and dramatic change takes place in color TV sets or circuitry during the next few years, the entire consumer TV industry may shift to a sales-service pattern closely resembling that of the present auto industry.

In the early days of the automobile industry, dealer thinking was geared almost wholly to the sales of new cars. Used cars presented no serious problem because there was a ready market for any second-hand car that could make a road demonstration. Minor service and adjustments could be made by the car owners. Most dealers felt that if they could break even in their service departments they were lucky.

When family ownership of cars approached the point of saturation and trade-ins became a major problem, auto dealers were forced to take a new look at their service departments. The end result was that dealers' service departments were put on a profit-producing basis. Service charges were established at a level that would produce a profit.

The television industry has reached the position where the trade-in of an old set is involved in a high percentage of the sales of new sets. TV sets are purchased for their utility in entertainment and most sales are generated by a complete breakdown of the old set.

The average home owner uses a TV set until the frequency of the need for service impels him to consider the purchase of a new set.

Service dealers sensed this trend in consumer buying long before set retailers became conscious of it. Service dealers found that, when the frequency of the need for service on a TV set became burdensome, the owner usually asked the service technician to recommend a good brand for him to buy. This led many service dealers into the business of selling sets.

The attitude of service dealers toward selling sets was aptly crystallized in a statement in one of the service association house organs which said, "Strictly service shops are becoming a thing of the past. If you don't trade that customer into a new piece of goods when he's ready, some smart service dealer will—and walk off with your customer. Remember, when the old set blows up, you're the first man on the scene."

Service dealers whose basic income is tied to selling service at a profit have a decided edge on set retailers who permit their service departments to become step-children of their sales departments. When a service department is operated at a loss, the dealer will always have a negative attitude toward the work done by the employees. Every effort will be made to avoid service work rather than to exploit it for its income and new sales potential.

In one midwestern city, the recent action of a prominent TV-appliance retailer is typical of the "new look" TV dealers are taking toward service. In the early days of TV, this dealer was afraid of service so he farmed out his service work. This did not prove satisfactory, so he set up his own service department. Since he felt that his service should have the sole function of backing up his sales, he restricted its activities to work on products which he sold.

Operating on the assumption that low-cost service would help him make sales, this dealer held his service charges at three dollars and fifty cents for a home call when specializing service dealers found it necessary to get from five to six dollars per call to make a profit on their operations. His substandard charges failed to produce the results he thought they would. When he was faced with the loss of two of his best men who felt they were underpaid because he was using service as a sales football, he reorganized his service department to put it on a profit-producing basis.

In commenting on this change in his thinking about service, this dealer said, "The majority of independent service shops in this town charge five dollars for home service calls. Practically all of them now sell sets. While they were making money on their service work by promoting it, they also picked up lots of customers for new TV sets. Actually, they've been selling most of the better class of customers who are more interested in performance and service than they are in making a sharp trade on their old sets. We are now going to..."
VIDEO-FREQUENCY sweep tests, important in monochrome work, are basic to color-TV receiver servicing. The video amplifier is located between the picture detector and the picture tube, as shown in Fig. 1. Note also that in the case of the color set, the video amplifier is called a Y amplifier.

The differences between video amplifiers and Y amplifiers are minor. We use the same methods to sweep both types of circuits. The chief difference lies in the two extra components used in a Y amplifier. These are a 3.58-mc. subcarrier trap and a 1-microsecond delay line.

Of course, a color-TV receiver has several more video-frequency circuits, apart from the Y amplifier. However, you will find that these added circuits are swept in practically the same manner as the Y amplifier.

We make sweep tests of video and Y amplifiers because good picture quality cannot be obtained unless the video-frequency circuits have sufficient bandwidth. For highest quality picture reproduction, a video amplifier should have a bandwidth of 4.2 mc.

In most black-and-white receivers, the sound signal is passed through the video amplifier, and the video amplifier therefore has appreciable gain at 4.3 mc. The sound signal is never passed through a Y amplifier—it is trapped off earlier.

A typical response curve for a video amplifier is depicted in Fig. 2. Although it looks something like an i.f. response curve, note the entirely different frequency band in the video amplifier. Note also that part of the low-frequency response between zero frequency (d.c.) and about 100 kc. is missing—this is due to test-equipment limitations, and is explained later.

The picture detector is an essential part of the video-frequency circuit. Note, from Fig. 3, that the video amplifier is driven through the internal impedance of the preceding detector. This value varies widely. It is different for a 1N60 crystal than it is for a 6AL5 vacuum tube, for example. It greatly affects the high-frequency response of the video-input circuit. Hence, an accurate sweep test of the video amplifier must take the picture detector into account: we must sweep through the picture detector. Any high-frequency loss through the detector must be compensated by adjustment of load values in the video-amplifier circuits, if the detector-amplifier combination is to do its job.

If we were simply introducing a sweep signal directly into the video amplifier, past the detector, this signal

---

**Fig. 1.** The video amplifier in (A) is located between the picture detector and the picture tube in a monochrome receiver. The Y amplifier of a color set (B) occurs in a similar location.

**Fig. 2.** Typical swept response curve of a monochrome video-amplifier stage.

**Fig. 3.** The internal impedance of a video detector is shown as Z. This is an important constant in determining response of the video system.

---

By ROBERT G. MIDDLETON
Radio Electronic Television Schools
would be in the video-frequency range; that is, it would vary roughly between zero and 4 or 5 mc. At the input of the detector, however, we introduce instead an r.f. signal. In this case, it is a swept band of frequencies in the i.f. or r.f. range, varying over a suitable bandwidth of, say, 5 mc. Also introduced at this same point (see Fig. 4) is a single-frequency signal from a conventional generator. This latter instrument is tuned to a frequency at one end of the band being swept by the FM generator. Thus, the picture detector—and, in fact, the entire video-frequency channel—is being driven by test signals in the manner that is normal for it under ordinary reception conditions. Our next concern is the nature of the signal that now appears in the video amplifier and the manner in which it can be used.

Since the detector is a nonlinear device, it is an excellent means for beating together two signals that are fed to it to produce a heterodyned output. In fact, it is in just this way that the 4.5 mc. audio i.f. is developed: this signal is the result of heterodyning the FM audio carrier against the video carrier in the detector. In the same way, the sweep (FM) generator output beats against the signal from the standard generator to produce a sweep signal that has been heterodyned down to the video-frequency range. To detect the response curve produced by this method, we will need another detector before application to the scope, just as we need another detector to recover modulation from the audio signal after it has already been heterodyned down to 4.5 mc. More will be said concerning the function of this demodulator later, just as more will be said, in detail, concerning the entire procedure outlined here in general.

Of course, we will want to mark the video-frequency response curve. This is done by applying the output from a marker generator, through an isolating resistor, to the output circuit of the picture detector. A marker pip or "bug" then appears on the curve, at the frequency to which the marker generator is set. An isolating resistor of 20,000 ohms is usually satisfactory. However, if the marker overloads the amplifier, use a higher value; or, if your generator has weak output, use a smaller value, such as 10,000 ohms. Do not use extremely small values of isolating resistors, or you will load the circuit and distort the shape of the response curve.

When we come down to actual practice, the general method already outlined is not quite as easy as noted, although specific difficulties are not formidable. Our first concern is to make certain that, to obtain a true picture of amplifier response, sweep input to the detector is flat. Many factors may defeat this condition.

In the first place, we must make certain that the band we are sweeping with the generator is reasonably flat. Also, we must remember that the cables from the two generators used are necessarily in parallel and that there is therefore a possibility of cable resonance or other interactions that could impair flatness of sweep. In addition, traps or other less obvious frequency sensitive components at the input of the picture detector may produce "suck-outs" in response even when the sweep signal is initially flat. Finally, harmonics of the fundamental signals we desire from the two generators could set up cross-beats to produce spurious signals that would result in distortion and consequent confusion.

There are several methods of checking sweep uniformity (flatness), but the method to be described has proven quick and effective. We proceed by hooking up the equipment as shown in Fig. 4. No disconnection of the picture detector from its circuit is necessary, in most cases. However, if a d.c. bias is present at the point of signal application (as is sometimes the case) be sure to use blocking capacitors with the output cables. A value of .01 ufd is ample in this application. Blocking capacitors prevent drain-off of the d.c. bias back through the generators.

Some sweep generators have unterminated output cables, while many have a terminating resistor. When the following test method is used, it is unimportant whether the sweep-generator cable is terminated or not.

It should be understood that almost any pair of corresponding test frequencies may be used from the two generators. The only consideration is to use frequencies which will provide a flat sweep signal through the video amplifier. To determine test frequencies, observe the scope screen while the dials of the generators are being tuned from low frequencies, such as 15 mc., to high frequencies, such as 150 mc.

(Editor's Note: While choice of frequencies is rather wide, it is not unlimited. At frequencies below the receiver i.f., the time constants in the detector circuit will tend to introduce attenuation, giving a false picture of response. Other effects are possible if the sweep generator is set to too high a frequency. In general, it is advisable to feed to the video detector a signal as near as is conveniently possible to the band of frequencies it was designed to handle—the receiver i.f. band. Going below this frequency should certainly be avoided.)

As the generators are being tuned, watch the response curve on the scope for changes in shape. Aside from non-linearity of the sweep generator itself, in some spots, you will find that generator harmonics and cross-beats may interfere with the curve shape at certain unsuitable frequencies. Fig. 5 shows a detected and displayed video-frequency response curve, obtained with the method used here. Fig. 6 shows this same curve distorted by spurious signals when a certain range of frequencies was used on the sweep generator. However, you will normally find that there is more than one frequency range over which the curve meets two tests: it will be free of interference of the kind just noted and it will remain constant in shape. Needless to say, this adjustment will be facilitated if the additional complication of adding the marker generator is not introduced until this part of the procedure is completed.

You will encounter a few situations in which uncertainty is present—the response curve may not remain constant over a very wide frequency range, so that you do not feel quite confident.
that the sweep signal is really flat. In such a case, it is advisable to disconnect the picture detector input from its tuned circuit.

It should always be possible to find suitable ranges of operation with the picture detector "open" on the input side, however, disconnection requires time and is not necessary in the great majority of cases.

The reader may ask why a demodulator probe is shown at the input to the scope. A demodulator probe is not used in i.f. alignment. However, it is used in video-frequency tests because there is no detector at the output of the video amplifier. We must supply a detector. This detector is the demodulator probe. When we sweep i.f. response only, the picture detector performs this function.

A suitable demodulator probe rectifies the video-frequency sweep signal, but passes the envelope (response curve) to the scope. A rectifier tube for a v.t.v.m. will not do, since it produces an extremely weak and distorted output. A special demodulator probe, such as the one shown in Fig. 8, must be used. It has suitable time constants for good detector action.

Since the demodulator probe has a certain amount of input capacitance it is possible, in some cases, to load the output of the video-amplifier circuit and thus attenuate the normal high-frequency response of the amplifier. Some video amplifiers are relatively load-sensitive while others are not.

In any case, it is advisable to remove the socket from the picture tube when making a video-frequency test. The input capacitance of a demodulator probe is about the same as the input capacitance to the picture tube. With the socket removed from the tube, the capacitance which the probe shunts across the video amplifier input will cause negligible distortion of the response curve.

It is also necessary to be aware of the possibility of overloading the video amplifier. Reduce the output from the generator while watching the top of the response curve for any change in shape. Be sure to attenuate the generator outputs to a point below which no further change in shape of curve occurs.

You will usually find that the shape of the curve changes as the setting of the receiver's contrast control is varied. This is a normal condition and is based upon accepted ideas of picture reproduction at low-signal and high-signal levels.

Receiver manufacturers often adopt the viewpoint that reception under weak-signal conditions is improved when the high-frequency response is cut down—this characteristic does tend to minimize the visibility of snow in the picture although detail also suffers in consequence. Hence, you will often find that when the contrast control is advanced, the low-frequency end of the response curve rises faster than the high-frequency end. At a normal setting of the contrast control, the response curve should be reasonably flat.

Here are the circuit factors which govern the shape of the video-amplifier response curve:

1. The low-frequency gain is controlled by the values of the plate-load resistors—off-values will cause the low-frequency gain to be abnormal or subnormal.
2. The mid-band gain is controlled principally by the value of the larger peaking coils (these may be either series or shunt connected in various receivers). A shortened turn or two, e.g., will produce a serious "dip" in the response.
3. The high-frequency gain is controlled principally by the values of the smaller peaking coils. Off-values or shortened turns cause the high-frequency response to slump off rapidly.
4. Flatness of response and control of "peaks" at the high-frequency end is controlled by the damping resistors across the peaking coils. Series peaking coils will often cause sharp high peaks in the response, unless suitably damped. Too low values of damping resistors cut down the high-frequency response below normal.

Some receivers have relatively narrow-band i.f. response which causes attenuation of the higher video frequencies. To compensate for this attenuation, the high-frequency response of the video amplifier may be peaked up considerably. This method provides a flat over-all frequency response, but tends to distort the transient response.

When one amplifier is overcompensated, and a following amplifier is overcompensated, sharp edges in the picture are "softened" and appear less distinct than is the case when both amplifiers have a flat response. On the other hand, when one amplifier is flat and the following amplifier is peaked at high frequencies, overshoot and ringing occur at sharp edges in the picture. This is a condition of "trailing reversal" accompanied by "circuit ghosts." These conditions, as they show up in square-wave tests, are pictured in Fig. 7.

To make square-wave tests of transient response of the entire video signal system, a test set-up is utilized as shown in Fig. 9. It will be observed that this is a modulated-carrier arrangement, in which square-wave modulation is impressed upon the picture carrier. Note that a low-capacitance probe is used here.

To make useful tests of transient response, it is essential to employ a square-wave generator which has fast rise time. The rise time should be about the same as the transmitted video signal or a little faster. Not all service square-wave generators meet this requirement. The generator should have a rise time not slower than 0.7 microsecond.

However, the generator should not have excessively fast rise time, as provided in specialized lab generators—many modulation circuits built into service generators will "ring" when impacted by excessively fast rise, and the service technician can be misled by this circumstance.

While it is obviously impossible to discuss all topics of interest under this heading, the highlights noted here serve to point out the way to serious-minded technicians who are interested in where they are going.
The Two-Way Mobile Service Business

By FRANK DE BRA

Background information on a fast-growing area in electronics, which provides good income for many.

MOBILE land radio communications is two-way radiotelephone communication between vehicles, or between a vehicle or vehicles and a fixed station. The vehicle is called a mobile station and the fixed station is called the base station. Mobile marine radio communications is two-way radiotelephone communications between boats or between boats and a fixed shore station.

All mobile radio stations are licensed by the Federal Communications Commission. The FCC classifies these stations as the "Safety and Special Radio Services." These services are used by law-enforcement agencies (police and sheriffs' departments), butane and propane gas companies, construction companies, power companies, REA utilities, forestry departments—actually, the list is practically endless.

In 1953 there were nearly 400,000 of these stations licensed by the FCC. There are now in use over 500,000 units with the increase averaging about 5000 units a month. Each one of these units is a source of revenue for a technician who is capable of handling this type of service.

In addition to the mobile land stations there are numerous marine and aircraft stations which also require the services of a competent technician. No matter where you live, you are probably close enough to some phase of this business so that you can profitably get in on it.

All mobile radio stations must operate in accordance with regulations set forth by the FCC; but no communications system can be better than the maintenance it receives. No matter how good the equipment was when it was originally installed, the operating performance and conformance with FCC standards will decrease without proper maintenance.

In general radio and TV repair service, the customer normally waits until his set has broken down before he calls for service. However, mobile communications equipment often must be kept in operating condition around the clock, 365 days a year. The standards of operation are a great deal higher and the equipment may be somewhat more complicated than the general radio and television technician is accustomed to.

Mobile radio communications service must be considerably above the standards of radio and TV service. The test equipment must be more accurate and more elaborate than that used by the average radio and television technician. Because of these special requirements the financial rewards for this type of service are higher.

Most of this service is done on a contract basis. The service shop gets a set monthly fee for maintaining equipment in operation. Therefore, the income from this type of work is more regular than is that of general radio and TV service.

In addition to the steadiness of income from mobile service, the shop will find other revenue coming in automatically. Users of industrial electronic equipment will need service that the shop doing only radio and TV work is not equipped to handle. For example, hospitals have paging systems which are required to operate dependably 24 hours a day. While the equipment is not too complicated for the experienced technician to handle, the average shop has neither the test equipment nor the manpower to give the required service.

While the greatest portion of this type of service is handled on a contract basis, there is plenty of it done on a per-call, or time-plus-parts, basis. There are two ways in which contracts are made: 1. The company which sells the equipment also sells a service contract. The company then sub-contracts to a local service shop. 2. The local service shop contracts directly with the operator of the equipment. In general, there are two types of contracts; labor only and labor-and-parts.

Generally speaking, the labor runs $5.00 per mobile unit and $10.00 to $15.00 per base station per month, depending on the size. And, there is other equipment, such as remote control units, which must be maintained. The average remote control unit runs around $2.50 per month for service. The parts are usually $2.50 extra. Thus a contract for labor alone on a ten-unit system will bring in a minimum of $55.00 each month.

A technician should be able to handle successfully and efficiently about 150 units or, say, 15 average systems each consisting of 9 mobile units and one fixed unit. Your slide rule will show you that at $55.00 per system this is a gross of $825 per month for labor.
These are just figures, of course, but they give some idea of the potential for a good technician.

In addition to the regular service, there will be installations, both mobile and fixed antenna work, and other services which do not come under the service contract. The usual charge for a mobile-unit installation is $20.00 and for the removal from one vehicle and re-installation in another is $32.50. These figures will naturally vary with location, just as other labor charges vary. However, the income from this type of service business is both regular and satisfying.

Service on a mobile transmitter can only be rendered by a qualified technician; in fact the FCC requires that he be licensed. The minimum requirement is a second-class commercial radiotelephone operator license. This restriction, in itself, greatly reduces the competition in this field. However, the license costs absolutely nothing. All that is required is to pass an FCC examination, which should not be difficult for a technician who really knows his theory. A good "Q & A" manual can be used for study or, if you really want to better yourself, excellent correspondence courses are advertised right here in this magazine.

Once you are properly licensed you are over the biggest obstacle. In addition, though, you should study the following FCC rules:

Part 8: Rules Governing Stations on Shipboard.
Part 16: Rules Governing Land Transportation Radio Services.

Part 18: Rules Governing Industrial, Scientific, and Medical Service.

These rules may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. They cost 10¢ each, except for Part 8, which costs 15¢. It is necessary to have this information available because, in addition to servicing the equipment, you will be called on to handle the licensing of the stations.

If you are already doing radio and TV service, you have some of the equipment you will need in mobile communications maintenance. In addition to your usual hand tools, you may need one or two additional items. If you don’t already have them, for instance, a pair of good wire strippers, a good vibrator puller, and a tube puller will come in handy. The tube puller consists of a pair of metal tweezers with rubber-covered tips. Any of these extra tools can be purchased from your parts distributor. In fact, it would be a good idea to consult with him.

In addition to test equipment which is used in radio and TV repair, you will need the following equipment:

A frequency meter. The FCC requires that transmitters be maintained to within 0.01% on frequencies below 50 mc, and to within 0.005% on frequencies above 50 mc, so your meter must be accurate. The FCC requires that it meet certain specified minimum standards. In these services you may be required to measure accurately any frequency between 250 kilocycles and 460 mc. And the frequencies are constantly going higher.

An FM modulation meter. The FCC requires that stations in these services do not deviate more than 15 kc. It also requires that modulation be checked periodically, as well as frequency. The modulation meter should actually respond to voice peaks rather than to sine-wave modulation.

A dummy r.f. load. This is necessary in order to tune and adjust transmitters without causing interference to other stations.

A source of power for operating the equipment on the bench. Some of the units on which you will work will draw in excess of 50 amperes. The average battery eliminator used in automobile radio repair just can’t handle this load. The best arrangement is a good storage battery with the eliminator always connected across it. Thus, the battery takes the brunt of the load, while the eliminator tends to keep the battery charged and helps on the peak loads. The power supply must be capable of handling both 6 and 12-volt units.

This equipment list is a minimum. There is other equipment that is so handy that it is almost essential, such as a good wattmeter. The equipment you get will be governed by what you need and what you can afford. Equipment for this type of service is more complicated, more accurate, more rugged, and therefore more expensive than that used in radio-TV repair.

Also manufacturers of radio communications equipment produce test equipment especially designed for servicing their own units. It is relatively inexpensive, considering what you get for your money, and also considering that service in any one shop is likely to center about one or two makes.

You will also need the technical manuals pertaining to the equipment, available from the manufacturer at nominal cost. Incidentally, in addition to the help furnished you in the technical manuals, the manufacturer will be glad to assist with any special problems you might run in to. Most companies maintain men in the field for this purpose. They will also help you (Continued on page 115).

Shop in the background has realized enough income from “going mobile” to depend almost exclusively on this field.

This truck’s whip antenna, sign of a mobile radio, alerts the enterprising service dealer to potential business.
Rhombic Antennas for TV

The photos show reception at the author's location in Fresno, California, from transmitters in Santa Barbara (175 miles away) and Los Angeles (210 miles away). Although signals traveled over mountainous terrain to a valley site, level of the receiver input ranged from 50 to 60 microvolts.

Charts for dimensions and practical construction details for a still outstanding fringe performer.

The antenna system described here is not restricted in use to any single phase of v.h.f. reception, but has found widespread acceptance in weak-signal television, FM, and amateur-band reception in the range of 50-250 megacycles. Its actual use is even then not limited to this range, but its size becomes so much out of practical proportions for the average enthusiast on the lower frequencies that we are seldom able to take advantage of its desirable characteristics below 50 mc.

For those not familiar with the general form and shape of the rhombic antenna, it is a diamond-shaped unit (Fig. 1) capable of building up large signal voltages at its terminals. The gain of the rhombic is directly proportional to the leg length of each of the four sides, with greater lengths providing greater gain. The rhombic has very sharply directive horizontal and vertical acceptance patterns, with each pattern sharpening up as the size of the antenna increases. In areas where TV and FM reception is hampered by the coincidence of two stations on the same channel, the high front-to-side and front-to-back ratios of the rhombic can often provide reception where others have failed. Several interesting variations can be found in its use. One of these is the "relay rhombic" system, which makes use of both the receiving and transmitting abilities of the antenna.

Speaking in general terms, a good example of the rhombic's pulling power is to be found in an installation built by Grant D. Ross of Marathon, Ontario, Canada. The array was approximately 6 wavelengths long per leg (at Channel 2), and mounted on poles 45 feet off the ground, on a hill 300 feet above surrounding terrain. The array was orientated for reception from WBAY, Channel 2, Green Bay, Wisconsin, some 305 miles to the south. Mr. Ross notes reception of good quality 50 per-cent of the time, fair to good 25 per-cent of the time, and fair to poor quality but 25 per-cent of the time. No other antenna system was able to develop a signal over this path.

Fortunately, the rhombic is not frequency sharp. Although it will provide the best reception on the channel for which it is cut, its gain will not vary greatly over a wide range. Any variation noticed will follow this pattern: less gain on frequencies lower than that for which the antenna was cut and greater gain on higher frequencies. For this reason, one need not worry about finding an area to fit the antenna but, rather, about finding the antenna size that will fit the area available.

It should be pointed out at this time that the rhombic does require a fair amount of room, ruling out such things as city lots under most circumstances. The antenna also requires a fairly clear, flat expanse, such as a cleared field.

Height above ground of the antenna may be discussed in terms of maximum and minimum. The minimum height will be dependent upon the frequency range of interest. Under no circumstances should the antenna be less than one and one-half wavelengths above ground for the lowest frequency in use. With the antenna too close to ground level, ground reflections can alter characteristics radically.

Before construction begins, care should be taken in selecting a site for the array. As the antenna system is highly directional, signal pick-up will be from one direction in a narrow lobe or beam. A clear, level field or a flat hilltop, (if one is available) are the best bets. Try to pick a location with as clear a shot in the direction of the station or stations, as possible. Keep the antenna back from busy roads, high-tension lines, and the like. Before going to the expense of erecting the antenna, make a few "dry-run" checks of the sites available.

Using a simple yagi antenna and field-strength meter, check each possible site for the amount of signal present. Once you get out of primary and secondary signal areas, the signal received may be very spotty and appear in layers. This tendency will increase as the frequency increases. It is often better to erect the antenna somewhat farther from the receiving location and to run a longer transmission line, if you can get into a better signal area.

When the work of laying the antenna out actually begins, precautions must be taken to insure that the main lobe of the antenna falls on the transmitter site of the station(s) to be received. In the case of FM and TV reception, this may not mean orientation squarely on the city from which the station transmits, as many stations have their transmitter sites in outlying...
areas. A good airline map of your area will provide an excellent method of ascertaining the correct headings to be used.

If more than one station from an area is to be used for reception, orientation should be on the weakest one, for maximum pickup.

The supports needed for mounting the antenna will probably depend upon what is available in your location. In some cases, major poles or aluminum towers will be the answer. Whatever they are, the supports must be capable of withstanding fairly heavy pressures in supporting the long runs of wire. They may also require guyng.

Once the support poles have been installed according to Figs. 1 and 3, the actual antenna work begins. Best results are obtained with copper-clad steel wire. The copper-clad feature will insure good electrical conductivity while the steel core will add to the over-all strength. This wire is, of course, solid, not stranded. The antenna must be mounted level. Number 12 or 14 wire is the best in this instance.

If you must solder lengths of wire together for the longer leg lengths, overlapping on the order of two feet between spliced pieces is recommended. These wires must be soldered with utmost care, as a great deal of strain will be placed on such connections during wind storms.

From Tables 1, 2, and 3, decide on the size of the rhombic you wish to use, basing measurements on the lowest channel to be received. Each chart gives measurements for three sizes of rhombics for each channel. The smallest figures are for rhombics three wavelengths per leg, the middle figures are for those six waves per leg, and the last and largest are for rhombics 12 waves per leg. Measurements are given for each TV channel up to six, the FM band, and for an average for Channels 7-13. From Table 1, select the leg length to be used. From Table 2, select the full rhombic length, which must correspond with the leg length chosen. And from Table 3, select the corresponding width. Thus, you have a choice of three sizes for each channel with both the rhombic length and width entirely dependent upon the leg length you select for your location. Line SD in Table 3 gives you the stacking distance for half-wave stacking, for each channel.

As can be seen in Fig. 1, two 390-ohm resistors are connected in series across the front end of the rhombic (between the two legs that join at the forward end of the antenna.) These resistors are of the ½-watt carbon variety. They must not be wirewounds. Their purpose is to make the antenna uni-directional or terminated.

The insulators used in the construction of the rhombic are quite important, from the aspect of mechanical stability. Heavy-duty Johnson 107 ceramic (hard-baked) type insulators will do the job very nicely and will stand up under strong wind and pressure loads.

For connection to the receiver, conventional 300-ohm twin-lead could be used, but the antenna-to-line mismatch will be reduced (and loss thus minimized) if a 450-ohm open-wire line is employed. For transmission-line runs of over 75 feet, open-wire line becomes even more important to avoid losses in the line itself.

Editor's Note: At the point where it feeds the antenna, a rhombic conventionally has an impedance of about 800 ohms. In this connection, note the author's use of 780 ohms of resistance to terminate the forward end of the antenna, which has the same impedance as that point. Even 600-ohm open-wire line would be preferred to 450-ohm line. It may well be that the author is anticipating the use of a stacked rhombic, described later. Having a lower parallel impedance, this arrangement should match a 450-ohm line.

Connection between the transmission line and the antenna is made by direct soldering at the points indicated in Fig. 3. Adequate support for the run of line from the antenna to the receiver should be provided to minimize wind sway. Matching the 450-ohm line to the receiver's antenna input is accomplished by the use of a tapped section of 300-ohm line, acting as a transformer. To make this up, simply split a length of flat 300-ohm twin-lead for 36 inches. The leads at the split end are connected to the corresponding leads at the end of the 450-ohm line and the unsplitted remainder of the 300-ohm line feeds to the input terminals of the receiver (or booster, if used) in the normal manner.

As seen in Fig. 2, a tackle block is mounted a few inches from the supporting pole and manila rope is run through it and on down the pole to a hook for securing the rigging. The end of the rope passing through the tackle-block pulley will pass through the hole in the insulator and fold back upon itself. At this point, it is wrapped with wire and taped for ruggedness. The distance between support pole and insulator should be about 4 ft.

There are two advantages to adding a second stack to a rhombic installation. The first is the additional gain thus obtained. The second, and more obvious under normal reception conditions
Troubles in Retrace Blanking Circuits

Although the blanking circuit is devised to remedy one problem, it can introduce others when defective.

The simplification of TV receiver design achieved by eliminating the d.c. restorer is a mixed blessing. Although viewers can see little subjective difference in the picture when the restorer is removed, the shifting d.c. level of video-signal input to the picture tube is one of the contributing factors in bringing out retrace lines. Special blanking circuits have become necessary and, as with any circuit, these are associated with troubles peculiar to their function.

The retrace lines, or white, diagonal lines across the raster shown in Fig. 1, are annoying blemishes on the scene being viewed. Knowing why they appear is important in dealing with them. Fig. 2A shows conditions under which retrace lines will appear; whereas Fig. 2B shows conditions under which they will not. In each case, the characteristic curve of the CRT is shown to the left. A couple of sequences of the information fed to the tube is shown to the right in each case. In Fig. 2B, the operating bias of the CRT has been set by manual adjustment of the brightness control (and d.c. restorer, if any) so that sync pulse tips (for simplicity, video information is not shown between pulses) keep the tube cut off during pulse time. Although horizontal pulses are shown, the sequence of vertical-sync pulses will occur at the same level.

With the picture tube biased more in the direction of white, either because manual adjustment of the brightness control has moved signal farther up on the curve or because, in the absence of a d.c. restorer, a brighter-than-average scene is being scanned, the condition of Fig. 2A prevails. The CRT is not cut off by sync pulses during the period when the electron beam retrace from the bottom of the raster back to the top, and the path of the beam on its return trip becomes visible, as shown in Fig. 1.

To keep the retrace lines from being visible irrespective of other conditions, a pulse, taken off from some point in the vertical circuit of the receiver, is coupled to the picture tube in such a way that it will maintain the cut-off condition without regard to brightness levels.

Simple Blanking Circuit

Retrace blanking in a simple circuit (DuMont RA-350) is shown in Fig. 3. The vertical-output transformer delivers a trapezoidal signal, waveform A, to the blanking circuit. The trapezoid is differentiated to produce peaked pulses by action of capacitor C10, and resistor R10. Waveform B results at the grid of the CRT.

The sharp spikes of waveform B must be long enough to be effective throughout the retrace time. Also, this pulse must have sufficient amplitude to drive the CRT into cut-off under all possible conditions of d.c. level normally encountered. About 60 volts peak-to-peak is satisfactory here, and for most picture tubes. The amplitude depends on operating voltages of the CRT.

Since the blanking pulse must be negative if applied to the CRT grid, the take-off for waveform A is at the "cold" side of the vertical-output transformer. A resistor in the "B+" feed prevents shorting of this pulse to ground by the filter (decoupling) capacitor.

In the circuit of Fig. 4, waveform A is developed across a capacitor, C12-12. From it, waveform B is shaped by the action of C12 and R12-D.

The cathode may be driven positive by the blanking pulse to achieve the same result that is obtained by driving the grid negative. Fig. 5 depicts such a circuit. The input wave is obtained from the "hot" side of the vertical-output transformer for this type of blanking drive of the CRT. Differentiation is not used here. On the contrary, some integration is provided by capacitor C15 to flatten out the pulse. Further stretching of the pulse occurs through the second feed capacitor, C20, with a phase difference as compared to the feed from capacitor C15 from the transformer.

Retrace Lines Present

Retrace lines present at normal settings of the brightness control indicate that the blanking pulse is absent at the CRT driven element or has insufficient
amplitude at that electrode. Check for a faulty blanking pulse at the CRT first.

The blanking pulse may be observed on a scope synced to half the vertical rate (30 cps). An alternative to the scope is the output function of a voltmeter. The meter may be calibrated roughly against some other set known to be working. We need not be concerned as to whether we are reading r.m.s. or peak volts: since the duty ratio of all blanking pulses are nearly the same, calibration against another set will hold for field service. A headset or an earphone in series with a capacitor (about 0.01 µF, 600 v) may also serve as a crude indicator away from the shop.

If waveform B at the CRT is low in amplitude or absent, test for waveform A at the vertical transformer. The same indicating devices or makeshifts may be used. A peak-to-peak voltmeter can be employed, if available, as another alternative measuring instrument.

If waveform A is absent, the impedance across which it is developed may be shorted out. This is the resistor in the "13+" line of Fig. 3 or capacitor C10-10 of Fig. 4. The vertical sweep may appear quite satisfactory with these impedances shorted, although no pulse will feed the blanking network. Test the impedance by measurement or by substitution.

The series-feed capacitor may be open. After waveform A is known to be present, check this capacitor by shunting with another. If no improvement is noted, this capacitor may be shorted. Test by checking voltage at the CRT, or by substitution.

Partial Retrace Lines

If waveform B is too sharply differentiated or spiked, it will only have sufficient amplitude to blank out retrace lines at its peak, which is timed to correspond to the center of the raster. If it is not sufficiently broad in this regard, amplitude at two points along either side of the slopes, away from the peak, will not be sufficient to cut off the CRT. In this condition, retrace lines will occur at the top or bottom of the raster, or at both top and bottom, although elimination at the center is achieved.

Changes in value of the series capacitor(s) or the shunt resistor(s) make for such trouble. Leakage from the CRT electrode receiving the pulse to chassis or to adjacent base pins is another cause. Test by substitution with components of known correct value, or by checking on an ohmmeter or capacity bridge. Check for leakage with a megohmmeter, or with the high scale of a v.t.v.m. Disconnect any shunt resistance while making the leakage test. (R<sub>shunt</sub> of Fig. 3, for example — the 39,000-ohm shunt may obscure a leakage path.)

Lines with Bright Pix

Although the blanking pulse may be satisfactory at the CRT for normal conditions, the CRT bias may be upset so that the beam current is excessive, causing retrace lines to appear. Voltage readings at the electrode pins will show a deviation from normal. The blanking circuit can be disconnected if it is suspected as causing this excessive brightness. The condition will persist if the retrace circuit is OK.

(Continued on page 135)

---

**Fig. 2.** The location of the operating point of the cathode-ray tube with respect to its characteristic curve determines whether the CRT will be cut off during sync-pulse time and thus during the vertical retrace interval.

**Fig. 3.** The blanking pulse that cuts off the CRT is taken from the vertical-output transformer in this arrangement.

**Fig. 4.** The impedance across which the blanking pulse is developed in this configuration is the 0.022-µF, capacitor.

**Fig. 5.** Here a positive pulse drives the CRT cathode.

**Fig. 6.** A blanking amplifier is needed to provide adequate pulse amplitude here.
SAW either a dirty robin or a rusty blackbird on my way to work this morning," Barney announced to Mac, his employer, as the two of them worked side by side at the service bench.

"You're always seeing robins about a month before anyone else does," Mac scoffed. "The poet had you in mind when he wrote, 'The wish is father to the thought.' However it is hard to be sure about color at times—which reminds me that something finally happened to my color set."

"Nothing trivial, I presume."

"Nothing really serious, but it was rather interesting. All at once during a color show the picture went out of focus. As you know from working with me, one thing I can't stand is a picture out of focus. It grates on my nerves the way a crooked picture on the wall annoys a housewife or a missing motor upsets an auto mechanic. And let me tell you right here and now that an out-of-focus picture looks lots worse in color than it does in black-and-white. Not only do outlines become blurred, but the colors themselves seem to suffer contamination.

"I quickly found I could bring the picture back into focus with the focus control, but it would not stay that way. Every few minutes I'd have to reset the control to restore sharpness to the picture and the control was extremely critical in operation. The color set, of course, uses a separate focus control rectifier to produce the required high voltage, around 4000 volts, needed on the focus anode; so I trotted out the high-voltage probe of the v.v.m. and checked both the high voltage and the focus voltage. The high voltage was just a trifle low and the focus voltage was erratic. With a technician's perennial hope of solving things easily, I changed the focus rectifier, high-voltage rectifier, damper, horizontal oscillator, and horizontal output tubes. None of these new tubes had any effect, but changing the high-voltage shunt regulator tube did bring up the anode voltage. However, the focus was still erratic; so I was convinced the trouble was what it looked like in the first place: a bad focus control.

"From force of habit I checked my service literature on the set to see if possibly there were any suggested changes in the focus circuit. Sure enough there were. A whole new arrangement had been worked out that was called the 'Focus Control Protection Circuit.' Obviously my set was not the only one that had lost a focus control. The replacement control was the same as the old one, but one resistor was cut out of the circuit, two new ones were added, and the high voltage for the focus rectifier was taken off a different transformer terminal. Later I had a talk with a service manager of the manufacturer and he told me that he thought the rather frequent breakdown of the focus control in the original circuit was due to momentary flashovers in the kinescope or other components, and the new circuit was designed to shunt some of the instantaneous heavy current produced by these flashovers around the control."

"I suppose you had to pull the chassis."

"Nope. The control is inside the high-voltage cage at the rear of the chassis, but when four self-tapping screws are removed and the high-voltage and yoke leads are unplugged, the whole high-voltage cage lifts right off, allowing easy access to the points you need to reach. The whole job took only a few minutes, and now the set is easily brought into focus and stays that way."

"It's a good thing you thought to check on any circuit changes."

"It's always a good idea to do that, especially when a part goes out for no apparent reason or when the same part fails repeatedly. You can save yourself a lot of callbacks and other grief by doing so."

"Hey, what were you doing here in the shop late last night? When Margie and I were going home from the show I saw a light on back here."

"You might say I was proving how stupid I was," Mac said with a sigh.

"There's a guy over at the relay factory who does part-time servicing. He took on a set a couple of weeks back that had him stumped; so he wished it off on my friend, Bob Sprain, who works in the lab there. Bob quit the service game when he went into engineering a couple of years back but he still has his equipment; and this other fellow had done Bob some favors so that he kind of had him across a barrel.

"Well, after Bob fooled around with the thing a week he decided he could use a little help, too; so last night he gave me a call and explained the deal. Bob has given me a hand time and again; so I was glad of a chance to pay him back a bit. I told him to bring the set down here and we'd see what we could find out. It was one of those situations all technicians get into now and then. You can preach 'unbusiness-like practices' and 'not helping competition' until you're black in the face; but sometimes you get into a spot where you have to be a real stinker to say, 'No.'"

"In the beginning the complaint was simply no raster. The original guy soon discovered there was no high voltage. Somehow, in fooling around, he fond out that when the yoke was disconnected the high voltage came right up; but when the yoke was connected, the high voltage and the boost voltage both disappeared.

"Well, this fellow is apparently the sort who jumps at conclusions; so he ups and installs a new yoke. This made no difference at all. Then he concluded the horizontal output transformer must be at fault; so he put in a new one of those. That didn't help either and that is when he gave it to Bob."

"As Bob said, replacing the yoke and transformer automatically cut the ground from a lot of beautiful theories about what might be wrong. On the other hand, I knew for sure no mistakes had been made in installing the new parts. Experience has made me suspicious about such matters. Worse yet, what Bob had told me conditioned my mind into thinking that connecting the yoke somehow imposed an unusually heavy load on the transformer that pulled down all the output voltages, including the rectifier filament voltage, so that nothing was left.

"Finally, though, after I had checked and found all connections on the new transformer and yoke correct, I called a halt to my aimless fumbling around and forced myself to think of the set as just another one that came in with the original symptoms. I started checking it as I would any such set and found that everything worked normally right up to the grid of the horizontal output tube, no matter if the yoke was connected or not. But then I discovered a substantial horizontal output voltage appeared between 'B-plus' and ground when the yoke was connected. Most of this disappeared when the yoke was removed. That, of course, was the tip-off on what was wrong."

(Continued on page 150)
A ccurate equalization, within 2 db or less, of phono recording characteristics has long been a requisite of high-fidelity systems. The typical proud owner of a home music system would be outraged if he found that his preamplifier departs four or five db from the RIAA playback curve when he switches to this position. Yet many an audiophile encounters errors the serious in the playback of commercially recorded tapes, which are daily increasing in quantity and quality.

The reference here and in the rest of the discussion is to tapes operating at 7.5 ips, the speed in most common use because it is the slowest one (longest playing time) that permits a frequency response consistent with high-fidelity standards. The majority of the 7.5 ips recorded tapes call for NARTB playback equalization or Ampex's slightly modified curve, which differs at the very low end. Ampex's playback curve has about 1.5 db less bass boost at 50 cycles and about 2.0 db less boost at 30 cycles, a difference which is minor enough to be ignored here.

While most professional tape recorders of recent manufacture employ playback equalization reasonably close to the NARTB characteristic, at present the majority of moderate price ones do not. In some cases this cannot be helped because, for reasons of economy, the same equalizer network is used in both the record and playback modes, so that conformity with NARTB playback is out of the question. Other moderate price recorders, however, in keeping with the desirable practice of supplying treble boost principally in record and bass boost during playback, utilize different equalizer networks in each mode of operation. Nevertheless, although the opportunity is ready at hand, many in the latter group of recorders still fail to utilize NARTB playback equalization.

Where a tape amplifier does not employ the NARTB playback characteristic, the deviation is always in the direction of supplying less boost than called for by NARTB. The reason, in part, is that a smaller quantity of bass boost reduces the problem of hum pickup, a dominating factor in the signal-to-noise ratio of a tape recorder. Moreover, the nature of tape recorder equalization is such that the less the bass boost, the less is the required treble boost in record. Reduced amounts of equalization necessitate less gain, making for a more economical tape amplifier. The relationship between bass boost and record treble boost derives from the fact that the playback head—apart from certain high-frequency losses that will be discussed—has an output which rises 6 db per octave with increasing frequency. When a small amount of bass boost is employed, that is, when bass boost starts at a relatively low turnover frequency, then in playback the turning output of the head, in effect, supplies treble boost above this turnover frequency. Therefore less treble boost is needed during "record."

The following discussion will first describe NARTB playback equalization. It will then examine a typical case where a tape amplifier of good quality, using a separate equalizer for playback, departs from the NARTB curve, so that it may be seen how serious are the resulting errors when a commercially recorded tape is played. The third part will discuss a popular bass boost circuit which lends itself to exact shaping of the playback characteristic. Lastly, means of compensating playback head losses will be

Equalization standards are discussed and specific recommendations are made for shaping playback curve.

FIG. 1. Standard NARTB and Ampex tape playback equalizations.
described inasmuch as these losses are a part of the total playback characteristic.

Promulgated in 1953 as the official standard for 15 ips tape recording, the NARTB playback curve has become an unofficial standard for 7.5 ips as well. This development may be ascribed to *Ampex's* adoption of the NARTB curve (in essence) for 7.5 ips and to the widespread use of *Ampex* equipment in the tape recording industry.

Fig. 1 shows the NARTB playback characteristic as well as *Ampex's* slightly modified version of it. Record equalization must be such as to result in more or less flat response, with one important exception: To the extent that there are playback treble losses serious enough to require compensation, these losses must be equalized in playback. Fig. 1 does not include treble boost for compensating playback losses inasmuch as these vary from recorder to recorder. Playback treble losses are chiefly due to gap width of the playback head. The wider the gap, the greater the losses.

Losses at 7.5 ips due to gap width are indicated in Fig. 2 for three commercially available heads. Inasmuch as tape heads have a 6 db per octave rising characteristic with frequency, gap loss equals the vertical distance between the 6 db per octave line and the head response to a flat recorded signal, as represented in Fig. 2. In the case of a very narrow gap, the loss may be small enough within the audio range so that no treble boost is considered necessary.

Returning to Fig. 1, it can be seen that the NARTB curve entails a relatively tremendous amount of bass boost, 36 db all told. There are two turnover frequencies. The principal one occurs at 3180 cycles, where gain is 3 db below minimum. The lower turnover frequency is at 50 cycles, where response is 3 db below maximum.

**Non-NARTB Characteristic**

Curve 1 in Fig. 3 shows the playback curve of a high-quality tape amplifier, one that was described in the December, 1956 issue of this magazine. The curve is based on the values given in the schematic of the article, and has a lower turnover frequency of about 50 cycles and an upper one of about 700 cycles. As described in the article, the amplifier is used with a .0005" head, resulting in a fall-off in playback response approximately as shown by Curve 2. Total playback response is therefore the sum of Curves 1 and 2. Comparing total response with the NARTB characteristic, it may readily be seen that equalization is deficient in bass and excessive in treble by 4 db or more over substantial portions of the audio spectrum.

Fig. 1 is not intended to be critical of a particular amplifier. Rather, it shows a typical situation. To remedy this situation, it is necessary to alter the values employed in the bass boost circuit and to provide for treble boost that will compensate the treble losses due to the head.

**Shaping the Bass Boost**

Fig. 4 shows, with a slight modification introduced for the sake of simplicity, the playback boost circuit employed in the amplifier previously referred to. It is one of several variations of a popular and relatively simple circuit, which permits bass boost to be easily shaped with the desired degree of precision.

To understand how the circuit of Fig. 4 achieves bass boost and how this boost may be shaped, it is first necessary to reduce it to an equivalent circuit, as shown in Fig. 5. Fig. 5A shows that the output stage plate resistance ($r_p$), load resistor ($R_L$), and following grid resistor ($R_g$) are effectively in parallel with each other and in series with equalization capacitor $C$ and equalization resistor $R$ to ground. $C$, of Fig. 4, has small enough reactance to be ignored. Fig. 5B simplifies the equivalent circuit, with $R$ being equal to $r_p$, $R_L$, and $R_g$ in parallel. At very high frequencies, where $C$ has relatively little reactance, $R$ and $R_L$ form a voltage divider remaining after voltage division constitutes what may be referred to as a shelf (see Fig. 1). As frequency declines, the reactance of $C$ increases and the output leg of the voltage divider increases in relation to $R$, so that output increases. At the frequency where the reactance of $C$ equals $R$, response is 3 db above the shelf. This is the upper turnover frequency, $f_U$. In the case of the NARTB curve, $f_U$ occurs at 3180 cycles (see Fig. 1). With further decline in frequency, the reactance of $C$ and output continue to grow. However, when the reactance of $C$ approaches $R$, in magnitude, the increase in output nears an end. At that frequency, $f_C$, where the reactances of $R$ and $C$ are equal, output is 3 db below maximum. For the NARTB curve, $f_C$ is 50 cycles.

Given the input tube's plate resistance, load resistor, and following grid

---

2. In the original circuit, capacitor $C$ was connected after coupling capacitor $C_1$, rather than directly to the plate of the input tube. Inasmuch as the two capacitors were in series as far as equalizer action was concerned, the value of $C_1$ had to be taken into account in calculating the appropriate value for $C$. With $C_1$ connected directly to the plate, the value of $C_1$ may be ignored, simplifying matters.
resistor, the value of $R_r$ can easily be calculated, being the parallel value of these quantities. For the circuit of Fig. 4, $R_r$ is about 150,000 ohms. $C$ is approximately determined by formula $C = \frac{1}{2\pi f R_{r}}$. If $f_t$ is to be 50 cycles according to the NARTB standard, then $C$ is approximately .02 mfd, $R$ is determined by the formula $R = \frac{1}{2\pi f C}$. If $f_t$ is to be 3180 cycles per NARTB, $R$ is about 2500 ohms. A variable resistor is often used for $R$ so that the upper turnover frequency, which is of principal importance, may be obtained with the desired precision.

In some cases a triode input tube is used in place of a pentode. Triodes have much smaller plate resistance than pentodes, so that the resulting value of $R_r$ per the equivalent circuit of Fig. 5B is a good deal less. This will result in a larger value for $C$ and a smaller one for $R_r$.

As previously stated, Fig. 4 is but one of several variations of a basic circuit. It has been shown that the plate resistance of the input tube plays a deciding role in determining the lower turnover frequency. But plate resistance may vary from tube to tube of the same type, or it may change as the tube ages, thus altering the lower turnover frequency. This problem is manifest in a triode with a triode because the triode, having a low value of plate resistance, is the principal factor in determining $R_r$. To minimize the effect of the triode's plate resistance upon $R_r$, the circuit of Fig. 6 is sometimes used. $R_2$ (typically 100-200 ohms) being added. As shown in the equivalent circuit, $R_r$ is effectively in series with the parallel combination of $r_p$ and $R_2$. $R_2$ is in parallel with all the rest. Thus changes in $r_p$ have relatively little effect.

The circuit of Fig. 6 has both a corollary advantage and disadvantage. The advantage is that playback treble boost may be obtained easily by bypassing $R_2$ with a suitable capacitor, thus helping to compensate for head and other playback treble losses. The disadvantage is that the addition of $R_2$ may result in high-frequency losses. One of the difficulties in using triodes for high-fidelity purposes is their relatively high input capacitance due to Miller effect. Input capacitance is a function of tube gain. In the circuit of Fig. 4, there is very little gain at high frequencies because of the loading effect of $C$ and $r_p$, that is, $C$ of virtual short circuit and $R$ is only a few thousand ohms. In the circuit of Fig. 6, however, interposition of resistor $R_2$ prevents the equalizer components from loading down the tube at high frequencies. Therefore gain remains high and so does input capacitance.

Also frequently used for bass boost is the feedback network shown in Fig. 7. This has the virtue of minimizing distortion at frequencies where feed- back is appreciable (treble range). On the other hand, it is more difficult to obtain precise equalization with a feedback circuit because gain does not vary inversely with feedback but varies inversely with the quantity $1 + AB$, where $A$ is gain without feedback and $B$ is percent of output voltage fed back. To have a linear relationship between gain and feedback, it is necessary to start with a great deal of gain so that the factor $AB$ is considerably greater (at least four times) than 1 throughout the range where equalization takes place. On the other hand, if there is too much feedback (too high a value of $B$) in order that $AB$ should be at least 4, there is danger of overloading the output tube, with consequent distortion.

The circuit of Fig. 7 operates as follows: At very low frequencies (below 50 cycles), the shunt reactance of $C$ is so great that feedback is limited to a very small value by $R_r$, which is 620,000 ohms. As frequency increases, the reactance of $C$ decreases, bypassing $R_r$, increasing feedback, and decreasing gain. At 50 cycles, $C$'s reactance equals $R_r$; at this point feedback has increased 3 db and gain has dropped 3 db. With further increase in frequency, the reactance of $C$ continues to drop, so that feedback rises and gain declines. When the reactance of $C$ starts to become as small as $R_r$ plus $R_2$, then feedback is essentially limited by these resistors; hence feedback approaches a halt and gain no longer drops as fast. $C$'s reactance equals $R_r$ plus $R_2$ at 3180 cycles, where gain is 3 db above minimum. In order to precisely control the upper turnover frequency, $R_2$ should be variable.

Compensating Treble Losses

While gap width is the principal reason for playback head losses, hysteresis and eddy current losses in the head also produce a drop in treble response, although in well-designed heads the latter losses are minor, perhaps only one or two db at 15,000 cycles. Furthermore, there may be some treble losses due to capacitance of the cable between the playback head and the input tube, and due to input capacitance of this tube. All these losses, to the extent that they exist, should be compensated in the playback amplifier so that response is reasonably flat to at least 10,000 cycles and possibly to 15,000 cycles. On the other hand, it is not necessary to maintain flat response to 15,000 cycles to completely satisfy the NARTB standard inasmuch as this standard permits response to be 4 db down at 15,000 cycles (and about 2 db down at 10,000 cycles).

Generally speaking, where the tape amplifier is well-designed and good heads are used, one can assume that playback treble losses due to cable capacitance, input tube capacitance, hysteresis, and eddy currents are minor. Therefore the principal task is to compensate gap width losses. The amount of compensation required for gaps of .0005", .0025", and .00015" is indicated in Fig. 2. In the case of a .0005" gap, the loss is 11 db at 10,000 cycles and 19 db at 12,000 cycles. The severity of the decline in response beyond 10,000 cycles makes it impractical to strive for flat playback response beyond this frequency when using a .0005" gap. It must be recognized that to the extent treble boost is used to elevate the audio signal, various forms of high-frequency noise are also accentuated. Playback response flat or nearly flat to 15,000 cycles is quite feasible with a .00025" gap. At 15,000 cycles, response is down only 5 db, easy enough to compensate. In fact, Ampex recorders, which use heads with a .00025"

![Fig. 4. Playback equalizer of amplifier.](image)

![Fig. 5. Configurations for the equivalent circuits to that shown above in Fig. 4.](image)

![Fig. 6. Modified bass boost circuit to minimize effects of plate resistance change.](image)
mid-range frequencies there is current feedback and reduction in gain due to an essentially unbypassed cathode resistor, while at high frequencies the capacitor reactance becomes small enough to bypass the resistor, decreasing feedback and increasing gain. By repeating this procedure two or more amplifier stages, a fairly sharp treble boost may be obtained. Of course, this procedure involves a loss of gain at low- and mid-frequencies, so that the playback amplifier must have sufficient reserve gain to permit this modification.

As previously discussed in connection with Fig. 6, treble boost can be obtained without any additional sacrifice in gain by placing a capacitor of suitable value across $R_t$. Value of the capacitor is determined by the formula $C = 1/(2\pi f R_t)$, where $f$ is the frequency at which it is desired that treble boost shall be 3 db up. Additional stages of treble boost are still needed to produce the desired slope. A sharply rising treble boost characteristic can be obtained in one stage by using $LC$ components. An example is Fig. 8. The large cathode resistor $R_t$ produces substantial current feedback and reduces gain. This resistor is paralleled by $LC$ in series. As $LC$ approaches resonance, its impedance decreases rapidly in the manner of a tuned circuit, so that $R_t$ is bypassed. As a result, gain rises sharply. The values shown in Fig. 8 produced a peak in response at 16,000 cycles, although a lower resonant frequency would be suitable for a .0005" head inasmuch as response much beyond 10,000 cycles is impractical for such a wide gap. Given the desired resonant frequency and given the value of $L$, the value of $C$ is obtained by the formula $C = 1/(2\pi f L)$. A TV width coil in the range of 20 to 50 mhy. is suitable for $L$. The amount of boost produced by the circuit of Fig. 8 depends upon the value of $R_t$. The larger its value, the greater the boost. The size of $R_t$ should be experimentally determined and will ordinarily range between 5000 and 50,000 ohms.

Another basic method of producing a sharply rising characteristic is to resonate the playback head with a capacitor. The value of the capacitor will probably lie between .0001 and .001 mfd., depending upon head inductance and the desired resonant frequency. Playback heads generally have an inductance ranging between .25 and 1 henry. Assume, for example, that the head has an inductance of .5 henry and it is desired to resonate the head at 15,000 cycles. Then a capacitor of .00322 mfd. is indicated by the formula $C = 1/(2\pi f L)$. Of course there is no guarantee that the rise in response due to resonating the head will exactly match the gap loss. Often, however, there is enough of a correspondence to make this a worthwhile procedure, especially since it is a simple and inexpensive method and costs nothing in terms of gain. The resonating capacitor can be switched in during playback only, or it can be left in permanently, so that it also produces treble boost in the record mode. Correspondingly, the record treble boost circuit would have to supply that much less pre-emphasis.

Given a tape amplifier that meets NARTB equalization for playback—NARTB (or Ampex) bass boost as shown in Fig. 1 and compensation, if needed, for gap and other treble losses—it remains for the amplifier to supply record equalization that produces overall flat response. It is not the purpose of this article to discuss the modifications required to produce such response. It may be said here, however, that treble boost circuits along the lines of those indicated in Figs. 6 and 8 are commonly employed; also, the use of small cathode bypass capacitors is frequent. The behavior of these circuits has been explained, and the reader wishing to do so can experiment with various component values to achieve the desired record equalization.

It should be pointed out that use of the NARTB characteristic in playback involves putting a relatively large amount of signal on the tape at high frequencies (as low as 1000 cycles). This necessitates substantial amounts of treble boost if bias current is to be great enough to hold distortion to an acceptably low value; the more bias, the larger the treble losses in record. This is a considerable amount of record treble boost, in turn, requires that the tape amplifier have sufficient reserve gain from which this boost can be drawn. If the amplifier is quite marginal in the sense that it has very little record gain to spare, it is fruitless to attempt to modify the amplifier so that it conforms to NARTB requirements. Most tape amplifiers, however, have an appreciable amount of reserve gain, so that it is practical to modify them in accordance with NARTB principles.

If the owner does not wish to tamper with the record equalization of his machine, yet desires accurate playback of commercial records, another course is open to him. By means of a switch, the proper capacitor and resistor values for NART3 playback equalization can be inserted into the playback equalizer whenever desired.

**Fig. 8.** RLC treble boost circuit.

72

RADIO & TV NEWS
Cut testing time in half—DOUBLE TUBE SALES

NEW MODEL 650

Fastest, Most Complete, Portable DYNAMIC MUTUAL CONDUCTANCE TUBE & TRANSISTOR TESTER

Checks over 99% of the tubes most widely used in television receivers, plus popular home and portable radio tubes. Tests over 500 tube types. Lists over 125 tube types, with settings, on socket panels for maximum operating speed. Complete listing in fast telephone-index type selector. Includes 16 spare sockets and sufficient filament voltages for future new tube types. Tests each section of multiple tubes separately for Gm—Shorts—Grid Emission—Gas Content—and Life. Provides instantaneous Heater Continuity check. Shows tube condition on "Good-Bad" scale and in micromhos. Special bridge assures automatic line compensation. No multiple switching—No roll chart. Includes pin straighteners. Transistor Tester checks junction, point contact and barrier transistors, germanium and silicon diodes, selenium and silicon rectifiers. Net, $169.95

Famous MODEL 500 Money-Making Portable DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

Servicemen say: "Best tube tester I've ever owned for speed and dependability!" "Makes money. Paid for itself several times. Really indispensable!" "Have two...one for the shop and one for house calls." "Adds income and saves unprofitable call-backs!" That is why thousands of the Model 500 are now in profitable use all over the nation. Tests tubes for Shorts, Grid Emission, Gas Content, Leakage, and Dynamic Mutual Conductance—in a matter of seconds. Life Test detects tubes with short life expectancy. Shows tube condition on "Good-Bad" scale and in micromhos. One switch tests everything. No multiple switching—No roll chart. Special bridge maintains automatic line compensation. 7-pin and 9-pin straighteners. Net, $109.95

NEW MODEL 510 ACCESSORY SOCKET PANEL

Adds over 50% more sockets to the B&K Model 500 Dyna-Quik. Enables you to quick-check many more tube types, old and new. Fits inside the cover of the Model 500. The Model 510 Accessory Socket Panel comes completely wired, ready to install and connect. Net, $29.95

Each Dyna-Quik Tube Tester completely tests each tube in seconds
Eliminates substitution testing
Shows customer true condition and life expectancy of tubes
Sells more tubes right on-the-spot
Cuts servicing time, wins customer confidence
Saves costly call-backs, brings more profit

One extra tube sale on each of 5 calls a day pays for the Dyna-Quik in a few weeks.

B&K MANUFACTURING CO.
3726 N. Southport Ave., Chicago 13, Illinois
Expert: Empire Exporters, 458 Broadway, New York 13, U.S.A.
everybody's doing it!

Frank Perkins

Composer and arrangor Frank Perkins listens attentively to his Decca hi-fi album "Music For My Lady" as its beautiful sounds are recreated with Heath high fidelity equipment. Music is a very important part of Frank's life, since his background includes composing and arranging musical scores for motion pictures, and for music publishers. Songs he has written include "Stars Fell on Alabama", "Emaline", "The Scat Song", "The Way I Feel Tonight", "After All These Years", and "Turn Back The Clock". Frank Perkins has discovered the beauty of Heath Hi-Fi sound and the fun of "do-it-yourself" Heathkit construction. So, why don't you?

Heathkits

...fun to build and a thrill to own!

and here's why...

1. You get higher quality at lower cost by dealing direct, and by doing your own assembly.
2. You receive personal, friendly, service (before and after sale) for complete satisfaction.
3. You benefit from the latest in engineering designs because of our concentration on kit-form equipment only. 
4. You may depend on performance as advertised—backed by Heath's world-wide reputation for quality. 
5. You can take a full year to pay with the HEATH EASY TIME PAYMENT PLAN.
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 70 watts is +1 db from 5 cps to 80 kc, with controlled rolloff above 100 kc. At 70 watts output harmonic distortion is below 2% to 20,000 cps and IM distortion below 1% at 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-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 broadband 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, cascaded RF, amplifier, and has AGC. A ratio detector provides high efficiency modulation 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 hi-fi 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 +1 db from 15 to 30,000 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.
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 complement the finest in program sources and speaker systems. Faithful sound reproduction is assured with a frequency response of =1 db from 5 to 160,000 cps at 1 watt, and harmonic distortion is less than 1% at 25 watts, with IM distortion less than 1% at 20 watts. Hum and noise are a full 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8, and 16 ohms. Exclusive Heathkit features include the “tweeter saver”, and the “bas-bal” balancing circuit, requiring only a voltmeter for indication. Years of reliable service are guaranteed through the use of conservatively rated, high quality components. KT66 tubes and Peerless output transformer are typical. Shipped express only. Shpg. Wt. 31 lbs.

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

HEATHKIT DUAL-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

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

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

HEATHKIT SINGLE-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

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

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

HEATHKITS...

by DAYSTROM

bring you the lasting satisfaction of personal accomplishment

HEATHKIT GENERAL-PURPOSE 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model A-9C will provide you with high quality sound at low cost. Features a built-in preamplifier with four separate inputs, and individual volume, bass and treble controls. Frequency response covers 20 to 20,000 cps within =1 db. Total harmonic distortion is less than 1% at 3 db below rated output. Push-pull 6L6 tubes are used, with output transformer tapped at 4, 8, 16 and 500 ohms. A true hi-fi unit using high-quality components throughout, including heavy-duty "potted" transformers. Shpg. Wt. 23 lbs.
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 17½" D. Constructed of veneer-faced plywood, ¾" thick, suitable for light or dark finish. All wood parts are precut and predrilled for easy, quick assembly. Shpg. Wt. 30 lbs.

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 29½" H x 23" W x 17½" D. Constructed of veneer-faced plywood, ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

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 22½" D x 34½" 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.

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 triggering source for telemetering and pulse work, and checking audio, video and Hi-Fi amplifier response. Frequency response is ±5 db from 20 CPS to 1 MC on both sine and square waves, with less than ±25% sine wave distortion, 10-10,000 CPS. Square wave output impedance 600 ohms, sine 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.

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.
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 local 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.

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.

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 1½% 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 VT-1A will measure AC (RMS) and DC voltages in ranges of 0-1.5, 5, 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 meghohm. Center-scale resistance readings are 10, 100, 1000, 10k, 100k, 1 meghohm and 10 meghohms. A db scale is also provided. The precision and quality of this VTVM cannot be duplicated at this price. Shpg. Wt. 7 lbs.

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 1½ 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.

High quality test gear you will be proud to own

Priced low to fit your budget

ETCHED CIRCUIT VTVM
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.

$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.

$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.

$29.50

HEATHKIT "IN-CIRCUIT" CAPACITOR 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—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 shunted 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.

$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, .05 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.

$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.

$23.50

HEATH COMPANY A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH.
February, 1958
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 mf, inductance from 0.1 mmh 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.

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 6 or 0 to 16 volts. Two meters constantly monitor output voltage and current. Will also double as a battery charger. Shpg. Wt. 23 lbs.

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 50 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.

Heathkits...

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.

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.
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 the plate 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, 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

HEATHKIT DX-40 PHONE AND CW TRANSMITTER KIT
A most remarkable power package for the price, the new DX-40 provides both phone and CW facilities for operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 75 watt plate power input on CW, or control carrier modulation peaks up to 60 watts for phone operation. Modulator and power supplies are built right in and single knob 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. A 4-position switch provides convenient selection of three different crystals or a jack for external VFO. The crystals are reached through access door at rear of cabinet. You can build this rig yourself and be proud to show it off to your fellow hams. Get your DX-40 now for many hours of operating enjoyment. Shpg. Wt. 25 lbs. MODEL DX-40 $64.95

HEATHKIT DX-100 PHONE AND CW TRANSMITTER KIT
Listen to any ham band between 160 meters and 10 meters and note how many DX-100 transmitters you hear! The number of these fine rigs now on the air testifies to the enthusiasm with which it has been accepted by the amateur fraternity. No other transmitter in this power class combines high quality and real economy so effectively. The DX-100 features a built-in VFO, modulator and power supplies, complete shielding to minimize TVI, and pi network output coupling to match impedances from approximately 50 to 600 ohms. Its RF output is in excess of 100 watts on phone and 120 watts on CW, for a clean strong signal on all the ham bands from 10 to 160 meters. Single-knob band switching and illuminated VFO dial and meter make it easy to use, too. This transmitter was designed exclusively for easy step-by-step assembly. Shpg. Wt. 107 lbs. MODEL DX-100 $189.95

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.
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 reacts the transmitter. Incorporates a heavy-duty six-ampere relay, a thyatron 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. If 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 OF-1
$9.95

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

MODEL GD-1B
$21.95

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

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

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

MODEL AR-3
$29.95

(less cabinet)

HEATHKITS...
BY DAYSTROM
are outstanding in performance and dollar value

RADIO & TV NEWS
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 are 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 an actual power source of only 250 volts DC at 15 to 20 milliamperes 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 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. 1 lbs.

MODEL VF-1
$19.95

HEATHKIT BALUN COIL KIT
The Heathkit Balun Coil Kit model B-1 is a convenient transmitter accessory, which has the capability of matching unbalanced coil 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 miniatures 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 250 volts DC output at up to 60 milliamperes. 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
$7.95 Each

12 VOLT MODEL VP-1-12
$7.95 Each

February, 1958

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 waveform 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 6000 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.

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, 10 and 100 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.

Heathkits...

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 ensures 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.

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.
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 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.

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 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 3¼" 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.

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 red-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.

HEATHCOMPANY A Subsidiary of Daystrom, Inc. BENTON HARBOR 15, MICH.

February, 1958
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.

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-docks 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 5-1/8"W x 5-1/16" 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.

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.

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 power levels 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 35/8" W x 62/3" L x 9" D. An easy way to put your mind at ease concerning transmitter operation. Shpg. Wt. 2 lbs.

Now offer you completely modern marine equipment with outstanding design features.
HEATHKIT TRANSISTOR
RADIO DIRECTION FINDER KIT

The Heathkit Transistor Radio Direction Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5½" H x 5½" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 5 lbs.

MODEL DF-1

$54.50

HOW CAN YOU MISS?
The Heath Company maintains a technical consultation service, should you experience some sort of difficulty in construction or operation. Although only a very small percentage of our customers ever have occasion to use this service (usually only beginners in electronics) it is still reassuring to know that technical help is available when needed. A service department is also available, should you wish a complete factory check of operation and alignment or repair. After you build your first Heathkit you’ll realize how easy it is.

Free Catalog
Send for this informative booklet listing more than 100 "do-it-yourself" kits.
elimination of “white noise.” The system is housed in a natural wood enclosure which is available in various finishes. The speaker has a molded plastic basket which adds a modern look to the advantages of a non-magnetic mounting. The company’s “tri-polymer” cone is also featured. The response of the speaker is said to be from 1 to 18,000 cps. Peak power capacity is 20 watts and inputs are 4 to 8 ohms.

**G.I. SPECIAL**

**Components Corporation** of Donville, N. J., has announced the availability of the “G.I. Special” turntable, designed specifically to meet the needs of Armed Forces personnel who are located in areas served by 50-cps power.

Either 50- or 60-cyle operation is obtained by merely shifting the belt to the appropriate step on the turntable’s specially designed pulley. The unit is available for 33 1/3- and 45-rpm operation.

**20-WATT AMP-PREAMP**

Altec Lansing Corporation, Anaheim, Calif., is offering a 20-watt power amplifier and preamp as one of the featured units in its line for 1958. Tradenamed the “Quartet 344A,” the circuit incorporates four independent volume controls; a printed circuit with all components attached through riveted eyelets; and six inputs, three low-level for magnetic phono pickup, microphone, and tape deck and three high level for tuner, tape reproducer, and stereo.

Frequency response is 20 to 22,000 cps; 20 watts output with 40 watts peak; 138 db gain, 32 db bass control range, and 35 db treble tone control range. The unit measures 5 1/4 x 14 1/4 x 8 1/8 inches with cabinet.

**“AUDIOMATIC” PLAYER**

Thorens Co., New Hyde Park, N. Y., has developed a unit which offers the convenience of a changer with the precision of a turntable. The unit is being marketed as the “Audiomatic” push-button player.

The Model CBA-83 carries a full year guarantee, has a direct-drive motor and adjustable speed control, push-button automatic arm action and finger-tip reject operation, completely foolproof mechanism, muting switch and tracking weight adjustment screw, manual operation, 50/60 cps, 100/250 volt operation, and full 12” turntable.

The base plate is 12” x 15” with 3 1/4” clearance required below the plate and 3” above. The company will supply additional details on request.

**HEAVY-DUTY TAPE DEGAUSSER**

Designed for both the professional and the serious home recordist, the new “710” heavy-duty degausser just introduced by Aerovox Corp. of New Bedford, Mass. will erase magnetic tape without the necessity of rewinding.

Demagnetization is accomplished quickly and simply by placing the tape over the spindle provided and rotating the reel three or four times until every portion of the tape has been exposed to the field area which exists within the rectangle outlined on the top of the unit. Continuing the rotation, the reel is slowly lifted off the spindle to a height of approximately 6 to 8 inches and the power is then turned off. This enables the tape to reach zero magnetization.

The unit is designed to be used with 117-volt, 60-cycle power sources. It will handle all 7” and 10” spools as well as smaller reels. The company’s parts distributors are handling the item.

**MAGNETIC TAPE PREAMP**

**RV Instruments**, a division of Electro-Voice, Inc., Buchanan, Mich., is now offering a three-stage transistor amplifier, the Model 6010, designed for playback use with magnetic tape heads.

The new unit compensates for the standard NTSC curve + 7 db from 20 to 20,000 cps. Gain at 1000 cps is 42 db. Precision low-noise resistors and selected transistors assure unusually low noise output of 400 microvolts, unweighted. The maximum output is 1.5 volts r.m.s.; the input impedance is 40,000 ohms; output impedance is 15,000 ohms; and operating temperature a maximum of 10 degrees C.

The unit is packaged in a 1 3/8” x 3/8” aluminum can provided with an octal base for ease of installation. The power required is 6 volts at 1 ma.

**GRILLE CLOTH SPECIAL**

**General Cement Mfg. Co.,** 400 S. Wyman St., Rockford, Ill., is now offering a special offer to dealers covering its line of new and modern grille cloth material.

The grille cloth comes in pieces one yard long and 50 inches wide, providing more than enough for the average application. The pieces are individually packaged, with a wide choice of patterns and shades available to match almost any type of hi-fi, radio, or TV cabinet now being marketed. Light wood and plastic cabinets have been included and there are colors and styles to match them as well.

A wire display rack is offered with an order of 100 packages. Write the company for details on the special price.

**IN-LINE RECORDING HEAD**

**Nortronics Company,** 1015 S. Sixth St., Minneapolis 4, Minn., has announced the development of a new in-line recording head, the Model TLD-S.

Developed for high-fidelity recording and reproduction in stereo and monaural applications, a new interchannel magnetic shield provides a high degree of crosstalk rejection. The head can be compensated to provide flat response between 30 and 10,000 cps. It is compact in construction, has precise gap alignment, features long life, and has negligible tape oxide accumulation.
make the most of your work...use a high precision JBL LOUDSPEAKER!

You will spend many hours into learning the fundamentals, and then the fine points of high fidelity. You will spend time and energy freely in building the very finest sound system you know how. Remember this when choosing your loudspeaker.

Get a speaker of the highest precision—one that bears the symbol "JBL"—one that is worthy to demonstrate your best efforts. JBL precision and advanced design are responsible for JBL efficiency—highest in the world. JBL efficiency gives you the smoothest, cleanest, most realistically lifelike sound you can get.

MODEL D10
15" EXTENDED RANGE LOUDSPEAKER

The only speaker of its kind... only one made with a 4" voice coil... only single unit speaker to give you complete, true high fidelity coverage of the entire audio spectrum. Your basic speaker. Use alone at first, later add JBL high frequency unit and dividing network for supreme excellence of JBL 2-way system.

MODEL D208/D216
8" EXTENDED RANGE LOUDSPEAKER

A thrilling piece of miniaturized precision craftsmanship. As perfect in its details as larger JBL units. A true precision transducer in every sense of the term. Properly enclosed, the D208 (eight ohms, D216 is 16 ohm model) gives impressive, rich, full range coverage of audio frequency range.

MODEL 075 HIGH FREQUENCY UNIT

Exciting to behold, the precision-machined 075 embodies a new concept in high frequency reproduction. A ring, rather than a diaphragm, radiates sound energy into the annular throat of an aluminum exponentially tapered horn. Above 2500 cps, 075 sets a new standard for linear reproduction.

MODEL 175DLH
HIGH FREQUENCY ASSEMBLY

The finest of high precision drivers designed for 1200 cycle crossover is combined with a machined exponential horn and acoustical lens for optimum sound reproduction in the home. The lens, an exclusive JBL development, acoustically illuminates a 90° solid angle with equal intensity regardless of frequency.

Please send me the following:

Free Catalog of JBL Signature Products
Name and address of Authorized JBL Signature Audio Specialist in my community
TECHNICAL BULLETINS ON:
D130 D123 D208 175DLH 075

Only a few of the many precision JBL products are shown on this page. Whatever your needs, you will find exactly the right system or unit for you in the complete, free 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.

"JBL" means JAMES B. LANSING SOUND, INC. 3249 Casitas Avenue, Los Angeles 39, California

February, 1958
NEW STANDARD OF PERFORMANCE

The Model TLD-S can be used in new equipment, for modernizing older recorders, for replacement, and for conversion.

STEREO TAPE SYSTEM

Tandberg, 10 E. 52nd St., New York, N. Y., is now offering a stereo tape system which consists of the Model 3-stereo recorder/reproducer and two companion Model 266 speaker systems.

The recorder/reproducer has been designed to provide reproduction of both monaural and stereo tapes from 40 to 16,000 cps at speeds of 71/2, 31/2, and 1 7/8 ips. The unit will also handle complete monaural recording.

The matching speakers each contain one of the company's Model 165BK dual-cone wide-range 8" speaker units. The enclosures are finished on all four sides so that they can be used horizontally or vertically, depending on the individual room interior.

TWEETER DEMONSTRATOR

General Electric Company has issued a colorful, compact counter demonstrator which permits customers to hear how a G-E A1-404 tweeter improves hi-fi treble response in a single-cone speaker system.

The pre-assembled unit, including tweeter and the company's A1-421 crossover network, is connected to the store's single-cone speaker system. A flip of the switch in the center of the unit cuts in the tweeter with its 1500 to 15,000 cps response.

The demonstrator is available from G-E Hi-Fi, Box 101, Liverpool, N. Y.

NEW MOVING COIL PICKUP

Electro-Sonic Laboratories, Inc., 35-54 Thirty-sixth St., Long Island City 6, N. Y. has developed a new moving coil pickup which incorporates the firm's patented d'Arsonval galvanometer principle and offers other improvements.

Designed to replace the company's "Concert Series" cartridge, the new unit offers improved mechanical rigidity and voltage output. Known as the Model C60, the cartridge can be used in any record changer or quality arm. Frequency response is 18 to 20,000 cps ± 1 db (Elektra 25 Test Record). Electrical output is at least five times greater than that of the "Concert Series" which means that no transformers or transistor amplifiers are required. Vertical stylus force is from 2 to 6 grams and output impedance is 40 ohms.

TAPE RECORDER HEADS

Sonotone Corporation of Elmsford, N. Y. has developed a new series of high-fidelity, low-priced tape recorder heads for the initial equipment market and will later offer them to the replacement market.

Frequency response of these new heads is 20 to 15,000 cps. The head presents a smooth, hard, and unbroken face to the tape resulting in a minimum of wear on the tape. The smooth face eliminates ridges or grooves in the tape head that rub the oxide coating off the tape and cause it to pile up.

Although the heads are rugged and completely shielded, they are miniaturized. Currently available are record-reproduce heads, erase heads, and a dual record-reproduce-erase head.

NEW BEAM POWER TUBE

The Electron Tube Division of Radio Corporation of America, Harrison, N. J. has announced the development of a new 9-pin miniature beam power tube which has been designed especially for use as an output tube in high-fidelity audio equipment.

The 6973 features linear operation over a wide range of power, high power sensitivity, and high stability. These features in addition to low heater power (6.3 volts at 450 ma.) permit the design of compact, relatively low-cost audio equipment where high output voltage with low harmonic distortion is a primary consideration.

A technical bulletin giving complete specs on this new tube is available.

SCOTT AM-FM TUNER

H. H. Scott, 111 Powdermill Road, Maynard, Mass., is in production on a new medium-priced AM-FM tuner, the Model 300.

Completely new in styling, engineering, and performance, the unit's extreme simplicity makes it adaptable to any decor. The tuner incorporates the firm's exclusive wide-band FM detector which improves selectivity while the

REVOLUTIONARY DESIGN MAKES IT IMPOSSIBLE TO SCRATCH RECORDS!

IT TRACKS AT ONE GRAM!
ITS FREQUENCY RESPONSE IS 20 TO 20,000 CPS (±2db)!

ONLY WITH THE STUDIO DYNETIC

- Record and needle wear are drastically reduced!
- You never have to level your turntable!
- You don't have to worry about groove-jumping!
- You can get superb fidelity, even from warped records!

You get the excellent response, low distortion and high compliance of dynamic cartridge construction, plus high output, minimum hum pick-up and the elimination of tone arm resonance and needle talk. There are also the additional benefits of the elimination of the pickup of low frequency rumble and motor noise. This superb unit sells for $79.50 net. Your hi-fi dealer will be happy to arrange a demonstration.

Write to Sales Department for reprints of informative, published articles.

SHURE BROTHERS, INC., 210 HARTREY AVENUE, EVANSTON, ILL.
circuit is drift-free without the need for a.f.c. Cross-modulation is minimized so strong local stations do not appear at several points on the dial.

The AM section features wide-range circuitry and the smooth-acting slide rule dial is extra long for station separation.

The tuner measures 15¼" x 5½" x 12½" in its mahogany accessory case. Complete technical details and a free catalogue on this equipment are available from Department P of the company.

AUDIO MIXER

Miami Instrument Co., Box 384, Tamiami Station, Miami 44, Fla. has developed a versatile audio mixer for use with recording and p.a. systems.

The unit features plug-in transformers, preamplifiers, and line amplifiers. These plug-in units may be arranged to provide up to seven individually controlled input channels. Outputs of ± 20 dbm into 50, 250, or 600 ohms or up to 30 volts into high impedance may be obtained from the line amplifiers.

The inputs may be microphones, tape or disc players, tuners, etc. The mixer is available in rack mounting, sloping panel, or custom versions. All models are approximately 3½" high.

"ANNIVERSARY" TUNERS

Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, N. Y. has introduced two new "Anniversary Series" FM-AM tuners to the market.

The Models 90-R tuner and Model 90-T tuner and audio control center both incorporate the company's exclusive "Gold Cascode RF Amplifier" and companion circuitry. The "MicroRay

February, 1958
No skilled musical instrument maker, including even those in abroad tribes, has ever found a rectangular box satisfactory. In spite of this, today many HFI speaker systems proclaim the ultimate in high fidelity, yet they employ nothing more than the most elementary horns to perform the complicated function of transforming the vibrations of the loudspeaker into sound.

In the Karlson Enclosures, especially curved Internal and external structures are used to provide you with the highest performance capabilities available in the industry today. Actually the Karlson enclosure is one of the most beautiful musical instruments ever created and is capable of reproducing every sound from a baby's breath to the mighty roar of thunder. After long and rigorous tests, we know definitely that the Karlson Enclosures can outperform all other units now available on the market at any price.

Despite their fantastic performance characteristics these units are available to you in 20 different models in Kit, Unfinished and Finished Forms, at prices you can afford, ranging from $19.50 to $175.00.

SEND FOR OUR COMPLETE CATALOG TODAY AND LEARN NOW THE KARLSON ENCLOSURE THAT IS RIGHT FOR YOUR SPECIFIC NEED.

KARLSON ASSOCIATES, INC., Dept RTN8
1420 Rt. 22 East
Brooklyn 29, New York

SAVE 1/2 — PAY PART BY PART — HAVE FUN
Assembling the SCHOBER ELECTRONIC ORGAN in Kit form

Now you can afford a real, full concert organ, just like those made by the foremost organ manufacturers. Because over 1/2 the cost is saved when you assemble it yourself. And it's REALLY EASY: only 24 separate units, all with printed circuits, and detailed to the smallest step instructions. In addition, you purchase each of the 24 kits when you are ready for it — and can afford it.

You can get a real kick out of putting the Schober Electronic Organ together — and then sitting down and pulling the stops for Strings, Trumpets, Clarinets, Diapasons, Flutes, etc. Electronic Percussion optional; chimes available.

Compact Console

One of the many exclusive features of this exceptional organ is its handsome console, in a wide variety of finishes. It is equally at home in a traditional or modern setting, and takes little more space than a spinet piano.

Free Literature

Complete descriptive booklet and price list are available on request. And, if you wish to hear the glorious pipe organ tone of the Schober Electronic Organ, a 15' long-playing demonstration recording is available for $2. This is refundable when you order. Write today and see what a fine instrument you can get at such a low price.

The Schober Organ Corp.
2248-B Broadway, New York 24, N. Y.
*Designed by Richard H. Doff

Tuning Indicator" provides ease of tuning and great accuracy on weak signals. The push-button "FM Mutting-AM Bandwidth" control eliminates inter-station noise and on-station side response. Silver-plated shielding of the entire front end limits undesirable noise, interference, and radiation.

"KNIGHT" TAPE RECORDER
Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has added a tape recorder to its "Knight" line of audio equipment.

The Model KN-4010 is a dual speed unit with push-button controls, two built-in speakers and a "roving" speaker, an 8-watt push-pull amplifier, and a transistor preamp for minimum hum and noise.

Additional features include a handy digital index counter which permits the user to pinpoint any portion of a recording, an automatic shut-off which stops the machine the instant the tape is finished, high-frequency a.c. erase, and a special safety interlock which prevents accidental erasure of the tape.

The machine is housed in a charcoal gray case and will operate from any 110-120 volt, 60 cycle a.c. outlet.

EMC STEREO TAPE PLAYER
EMC Recordings Corporation, St. Paul, Minn. is now marketing a new stereophonic tape player which plays both stacked stereo and dual track and dual track monaural tapes.

A feature of the stereophonic tape player is its simplicity of operation. Only three knobs are used to control volume, tone, and balance. Beginners or those seeking an inexpensive stereo tape playing system can use the unit for one channel and a radio or television set for the second channel. One simple control regulates motor speed and handles tape start, stop, play, rewind, fast forward, and neutral.

Tape speed is 7.5 ips. Wow and flutter is less than 25% with noise at least 50 dB below 3% distorted signal. Frequency response is 40 to 12,000 cps ± 2 db and 30 to 15,000 cps ± 5 db. The unit is available complete or as a tape deck mechanism separately.

LABORATORY AMPLIFIER
Summit Electronics, Inc., 7 Industrial Place, Summit, N. J. has announced a new precision power amplifier for laboratory measurement applications and for home use in elaborate high-fidelity set-ups.

The Type 100 has been licensed by Western Electric and features exceptionally flat frequency response with unusually low harmonic and IM distortion. The noise and hum level are 70 dB below full rated output of 30 watts.

Several models are available for varying input impedance requirements, with output impedance switch-con-
The cables are supplied in a wide range of lengths from 10" to 72" with various combinations of phono pin plugs and jacks, alligator clamps, spade lugs, and phone jacks. The molded construction of these units permits them to withstand severe strains and to outlast conventional soldered connections.

Bulletin No. FR3259 carries complete specifications on this new line. The booklet is available from parts distributors or from the manufacturer direct.

NEW "3M" RECORDING TAPE

Minnesota Mining and Manufacturing Co. of St. Paul, Minn. has announced a new "double play" magnetic tape which is said to be twice as strong as any other tape of its type.

Designated as the "Scotch" brand magnetic tape No. 200, it is made from durable polyester film which has been "tensiled" by a new process which doubles the strength of the conventional polyester film. Because of this new process, the tape can be used on any tape recorder without the danger of stretching or breaking.

The 7" reel, which contains 2400 feet of tape, is capable of four full hours of recording at 3.75 ips and two hours at 7.5 ips. The 101/2 inch reel for special applications will record 16 hours at 1½ ips. This reel holds 4800 feet of tape.

20-WATT AMPLIFIER

The Specialty Electronic Components Dept. of General Electric Co., Auburn, N. Y. is in production on a new 20-watt amplifier which retails in the moderate price class.

The Model PA-20 has a frequency response from 20 through 20,000 cps, a phono hum level of -60 db at full output, over-all distortion level below audible perception, phono input sensitivity of 5 to 7 mv. at full output, and accurate phono equalization.

The amplifier incorporates an unusual LC-tuned circuit in its built-in rumble filter for a very sharp low-frequency cut-off of 12 db per octave below 40 cps. This effectively filters rumble and sub-audio frequencies with.

THE FISHER "100"

30 Watt Amplifier

FROM THE DRAWING BOARD, through every painstaking step of development and testing, to the proud accomplishment of the finished product, FISHER leadership is in evidence throughout! Now, FISHER announces a magnificent new power amplifier so outstanding in design, so superior in performance and so conservatively built that it will give you many years of "clean," trouble-free service.

HIGH POWER! 30 watts of power delivered to the speaker terminals in continuous sine-wave operation; 70 watts of reserve peak power to handle orchestral transients and peaks up to 30 milliseconds in duration, with no trace of clipping, ringing or raggedness.

THE FISHER "100" has ample reserve power to drive even the lowest-efficiency loudspeaker system. Its absolutely clean tonal output eliminates listener fatigue and adds markedly to the enjoyment of your home music system. Hear it at your dealer now!

WRITE TODAY FOR COMPLETE SPECIFICATIONS

FISHER RADIO • 21-23 44th DRIVE, LONG ISLAND CITY 1, N. Y.
An audio system is like a chain. For optimum performance, all the links must be equally strong... there can be no compromise with "weak-link" components in the system.

It was on this premise that the Ampex A122-SP Portable Stereophonic System was designed. Each link in the chain—from recording and playback heads to speaker—was forged to the same exacting standards and precision tolerances which guide the manufacture of world-famous Ampex professional recording and playback equipment.

Heads—Facing surfaces of head gaps lapped to an optical flatness so precise they reflect a single light band (1/2 micron) on flatness gaps. This, plus initial surface polish of 6-8 micro-inches, insures sustained frequency response with negligible change in characteristics over many thousands of hours of operation—many times longer than with ordinary heads.

Amplifier-Speakers—Ampex-designed, Ampex-built as an integral part of system...yet may be used separately with other units of your system (has front-panel input switching for Tape, Tuner, TV, or Phonograph). Amplifier sensitivity 0.25 v for maximum power output: 20-20,000 cps ± 1/2 db output with well under 1% harmonic distortion. Speaker features unusually high total gain energy, converts a maximum of output power into sound energy, with smooth, peak-free response.

Complete Specifications—Write today for free new full-color brochure containing complete specification sheet and description of full line of unmounted units consoles, modular table-tops and portable cabinets.

TAPE RECORDERS

Hi-Fi Components

WRITE FOR FREE CATALOGUE

CARSTON

215-82 E. 88 ST.
NEW YORK 28, N.Y.

30 Watt Hi-Fi Super Lin Kit

FREQUENCY RESPONSE
FREQUENCY RESPONSE
6-50,000 cps...
6-10,000 cps...
TUNER 250/285 &
TUNING 250/285 &
STANDARD PREAMPLIFIER
STANDARD PREAMPLIFIER
SHIPPING WEIGHT 10 lbs.
SHIPPING WEIGHT 10 lbs.
$42.00
$42.00

Sale Price.

Mail for Free Catalogue

CUTICK ELECTRONICS HIFI RADIO T.V. PARTS
131 Washington St.
WOBUS 5-5866
New York 7, N.Y.

out appreciable effect on bass response. The unit has interstage feedback phono compensation which gives low distortion and allows the use of practically all low and high input cartridges on the market.

The PA-20 has a compact, leather-grain finish cabinet only 4½ inches high, with extra-size knobs and a gold brushed escutcheon for compatibility with a wide range of tuner cabinets and furniture styling.

NEW EICO SPEAKER SYSTEM

Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y. has released a new generic type of speaker system which has been designated as the HFS-2 standard speaker system.

The system utilizes the new slot-loaded conical horn invented by A. Stewart Hegeman and a new omni-directional cone tweeter for extended radiation in all directions. The spectrum from 30 to 200 cps is handled by the slot-loaded split conical horn of 12 feet total length rear loading an 8½" driver, 200 to 6000 cps is produced by frontal radiation from the same 8½" driver, and the range from 6000 to 20,000 cps is handled by a separate coaxial mounted free-floating cone tweeter plus fixed inner loading cone mounted in the open above the horn mechanism box. The acoustical crossover is at 200 cps while the electrical crossover network is at 6000 cps. Rated impedance is 16 ohms.

The system is being offered in mahogany, walnut, and blonde birch finishes. The enclosure measures 36" X 15½" X 11½". It weighs 45 pounds.

MATCHED TUNER-AMPLIFIER

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. is now offering a custom hi-fi tuner and amplifier which have been matched in style and performance.

Marketed as the "Music Mates" the amplifier uses the new premium quality EL84 tubes in push-pull and has a power output rating of 15 watts. Fre-
quency response is 20 to 20,000 cps ± .5 db and distortion is less than 1%.

The new amplifier features separate bass, treble, volume, and loudness controls and has five input channels with tape and record equalization.

The companion AM-FM tuner features temperature-compensated circuitry and efficient a.f.c. action to minimize drift and lock in program material. An a.f.c. defeat switch is provided for tuning in weak stations. The Armstrong circuit with Foster-Seeley discriminator employs 6 tubes plus a matched pair of crystal diodes and rectifier. Built-in FM and AM antennas are said to provide excellent reception.

**AUDIO CATALOGUES**

**LAFAYETTE COMPONENTS**

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y. has just issued a single-page flyer, ST-81, which describes its new master audio control center and stereo AM-FM tuner in some detail.

Each unit is pictured and complete specifications given. The control center is available in either kit or wired form while the tuner is available as a kit.

**SCOTT HI-FI CATALOGUE**

H. H. Scott, 111 Powdermill Rd., Maynard, Mass has just issued a two-color catalogue which pictures and describes the company's complete line of hi-fi equipment.

Included in the new publication are three amplifiers, five tuners, a turntable, and two power amplifiers. There are photographs showing how these components look in the home, including one taken in the music room of Metropolitan Opera star Jerome Hines.

The catalogue is available without charge on request.

**"WIGO" SPEAKER CATALOGUE**

United Audio Products, a division of United Optical Manufacturing Corp., 202 E. 19th St., New York 3, N.Y. has just published a compact folder which describes its complete line of "Wigo" loudspeaker systems.

Ten models, including single- and dual-cone tweeters, 8" mid-range speakers, a 12" extended range speaker, a 12" coaxial-mounted system, and 12" and 16" woofers, are described in detail along with complete specifications.

The company will supply a copy of this new catalogue free on request.

**"CATHEDRAL SERIES" SPEAKERS**

Cleton Inc., 1974 East 61st Street, Cleveland 3, Ohio has just released an elaborate 8-page catalogue which describes and pictures its new "Cathedral Series" of high-fidelity speakers.

The new line consists of 14 speakers and one three-speaker combination board with crossover network. Covered in some detail are woofers, full scale-wide range units, tweeters, and coaxial high-low duets with built-in crossovers.

The company will supply copies of this colorful catalogue on direct request.

---

**THE REK-O-KUT TURNTABLE ARM**

Most superbly styled of all arms — this is also the one turntable arm that offers best compliance, lowest resonance, optimum tracking... to give you better sound! That is why it is the one arm invariably sold with every turntable — outselling all other turntable arms combined! Write for catalog and free Strobe disc. $26.95 12" Arm, $29.95 16" Arm.

**EXCLUSIVE FEATURES!** • Patented sealed Versa-Twin bearing pivot provides superior horizontal compliance. • For free vertical motion, arm pivots are mounted in chrome steel ball-bearing races. • Micrometer gram weight adjustment gives correct stylus pressure without need for stylus gauge. • Has easy arm-height adjustment. Takes all popular cartridges.

**REK-O-KUT**

HIGH FIDELITY TURNTABLES—TURNTABLE ARMS
38-19 108th St., Corona 68, N.Y.
THE average amateur operating position is an unsightly and confusing array of connecting leads and chassis. Usually the ham begins with a fairly neat layout for the transmitter and receiver. However, it is not long before he decides to add a c.w. monitor or a secondary frequency standard and soon the table is cluttered with subchassis and interconnecting cables. To eliminate this situation, the author undertook to build, in a single unit, the most frequently needed station accessories. No direct connections are needed to either the transmitter or receiver, eliminating the necessity to dig into their circuitry.

Combined in a 6" x 6" x 6" cabinet are the following station accessories: (1) 100 kc. and 1000 kc. secondary frequency standards; (2) a c.w. monitor; (3) code practice oscillator; and (4) an r.f. indicator for transmitter tuning. While originally designed for home station operation; this is a handy gadget to have along on Field Day.

Although many hams find a 100 kc. secondary frequency standard to be adequate, it is a real advantage to have available a 1000 kc. signal as well since those 100 kc. whistles are mighty close together when you reach the ten-meter band! With a 1000 kc. signal, however, it is a cinch to find a 1 mc. check point. Then by flipping switch S1, the 100 kc. note is made available and it is easy to count the number of whistles to the desired calibration frequency. A second switch, S2, permits the oscillator to be turned off when it is not needed.

Employing a Valpey DFS dual-crystal assembly permits the use of a single trimmer to zero-beat both crystals with WWV. The oscillator circuit is that recommended by the crystal manufacturer.

The remaining functions are provided by a modification of the "Monitor" circuit given in the "ARRL Handbook." When r.f. from the transmitter is fed in at J1, it is rectified by the 1N34 diode. Current flowing through R3 develops sufficient negative bias to cause cut-off of the first half of the 12AU7. With this tube cut off, the neon-bulb oscillator will generate an audio tone. Since this is nothing more than an RC time-constant circuit, varying the resistance of R1 will change the frequency of oscillation. This tone is then amplified by the second half of the 12AU7, then a 6AQS provides sufficient power to drive a miniature speaker.

This same circuit may be used as a code practice oscillator. If a key is inserted at J2, closing the key contacts will place —12 volts on the grids of the first triode, causing it to cut off with resultant operation of the neon bulb oscillator. Since it is used only to provide bias, the life of the battery will be essentially its shelf life.

Turning S1 to its other position causes the current from the rectified r.f. to pass through M1. Potentiometer R1 permits this current to be limited to prevent meter damage at high r.f. levels. This circuit actually functions like an untuned field-strength meter and provides a handy means of monitoring the amount of r.f. actually going into the transmitting antenna—a more reliable means than simply watching the final plate current during tune up. It works well on all bands through 10 meters. For reliable operation of this or the "Monitor" circuit above 20 meters, it may be necessary to ground the unit cabinet directly to the transmitter chassis.

Although a a.c.-d.c. power supply would have been less expensive, a transformer power supply was chosen for greater safety. For safety reasons, all equipment at the operating position should be grounded. With a transformer supply there is no chance of having a "hot" chassis because the power plug was inserted the wrong way.

A 6" x 6" x 6" aluminum utility cabinet houses all of the components without undue crowding. Begin construction by mounting a sheet aluminum deck two inches from the bottom edge of the cabinet. Before fashioning the deck, the inside dimensions of the cabinet should be accurately measured in order to assure a snug fit. It will be necessary to file a shallow notch in two corners of the deck in order to clear overlapped portions of the cabinet sides. Before fastening the deck to the cabinet, be sure to scrape the paint from a portion of the inside of the cabinet to permit good electrical bonding between chassis and cabinet. Rubber grommets should be used to protect all leads passing through the chassis, as well as the power cord. It will be necessary to fashion a mounting strap for the two series-connected V5068 batteries. Capacitor C1 is most conveniently located just in front of the 6AK6 socket. The NE-2 is mounted between one outside terminal of R1 and a nearby ground lug. Be sure to observe the po-
larity indicated in the schematic for the 1N34, the battery, and \( M \). Note that the positive side of the meter is grounded. The circuit will fail to operate if the 1N34 diode is connected with reversed polarity.

For convenience the diode was mounted on a terminal strip fastened to the rear wall of the cabinet. Hold the diode leads with a pair of needle-nose pliers to prevent heat damage during soldering. Jacks \( J_1 \) and \( J_2 \) were mounted on either side of the rear wall to prevent the crystal oscillator from possibly causing operation of the monitor circuit. The dual-crystal assembly is mounted on one wall—the mounting strap providing the necessary ground connection. Be sure to remove the paint beneath this strap.

The speaker is mounted on the cabinet cover and a series of 3/8" holes were drilled around the top edge of the cabinet to provide ventilation. The crystal is purposely mounted below the chassis to protect it from the heat of the tubes. As a finishing touch, application of decals to the panel will give the unit a "commercial" appearance.

Using insulated wire, make several turns around the receiving antenna lead-in and plug it into \( J_1 \). Alternatively, this lead may simply be placed near the antenna terminal for the receiver. Run another insulated lead from \( J_1 \) to a place where it can pick up r.f. from the transmitting antenna. In some cases it is merely necessary to make a couple of turns around the lead-in. Some experimentation may be necessary to get the right amount of r.f. pickup. The chassis of the unit should be connected to the station ground system and, preferably, directly to the transmitter chassis.

To put the unit in operation, simply advance \( R_s \) until the power switch clicks on. With \( S \) in the "monitor" position, an audio tone should be heard when the transmitter key is depressed. Adjust \( R_s \) for the most pleasing tone and the gain control for the proper volume. To use the unit as a code oscillator, simply plug a key into \( J_2 \) with \( S \) in the "monitor" position. For transmitter tuning, \( S \) must be in the "tune" position. Adjust \( R_s \) for the proper meter deflection.

A simple adjustment is needed to tune the secondary frequency standard. Let the unit warm up for at least an hour and then tune your receiver to one of WWV's frequencies. Then carefully adjust \( C_t \) until the oscillator zero-beats with the WWV signal. It may be desirable to repeat this adjustment after the components have aged after 15 to 20 hours of use.

---

February, 1958
"Servicing TV Sync Systems"

by Jesse Dines

Valuable time-saving book for Service Technicians. Covers fully the theory of operation, circuit function and circuit variations of the 18 different types of sync systems used in TV receivers. Explains various types of sync separator, horizontal and vertical oscillator, and horizontal AFC circuits used in sync systems. Method of analyzing and troubleshooting these circuits are supported by actual picture tube photo and waveforms illustrating types of sync troubles. Includes valuable data on oscillator coils, transformers and printed electronic circuits used in sync systems. Has chapter on practical servicing hints. This book will definitely help the technician to better understand and more easily service any type of sync system trouble. Written clearly and simply for quick and easy understanding. 320 pages; 221 illustrations, 5½ x 8½".

PRICE $3.95

SEE THIS MONEY-MAKING BOOK AT YOUR ELECTRONIC PARTS DISTRIBUTOR OR MAIL COUPON TO HOWARD W. SAM'S...

FREE TRIAL COUPON

Howard W. Sams & Co., Inc., Dept. 1-BB
2201 E. 46th Street
Indianapolis 5, Indiana

☐ Send me Jesse Dines' book "Servicing TV Sync Systems" for 10 days FREE examination. In 10 days I will pay for the book, plus small delivery cost, or return postage paid.

We pay delivery costs if you remit with this coupon. Some return privilege.

Home...........................................
Address...........................................

City..................................................Zone... State (outside U.S.A. priced slightly higher)

THE VIEWS EXPRESSED IN THIS PAPER ARE THOSE OF THE WRITERS AND NOT NECESSARILY THOSE OF THE EDITOR. SUBSCRIPTION RATES $2.00 A YEAR.

World Radio Laboratories' ham shack is used for

ham training, demonstration, and actual rag-chewing.

Appended to the r.f. section of the WRL "Globe King" 500B transmitter (at right). The power of this transmitter under single-sideband conditions is 720 watts peak envelope power input. It is tunable over the entire amateur bands from 10 through 160 meters. The phase power input is 540 watts on either phone or cw.

The HT-32 exciter may also be used as a completely separate and independent low-power portable transmitter. This unit provides single-sideband, phone, or cw operation from 80 through 10 meters. The peak envelope power input is 144 watts.

The output of the high-power rig is fed to a high-gain 20-meter beam through an external antenna relay.

Atop the exciter unit are two loudspeakers which are connected to the two receivers at the left. The upper receiver is the Hammarlund HC-1-10, a twelve-tube superhet with dual conversion. Full-dial coverage of the 6- to 160-meter amateur bands is provided. The receiver provides an Auto-Ranging feature that allows you to passband the audio as the gain is increased. Thus the response to strong signals is broad band and to weak signals is narrow band. Other features include crystal-controlled second conversion oscillator, O-multiplexer, crystal calibrator, and separate linear deelectro for SSB.

The bottom receiver is the National NC-109, an eleven-tube general coverage unit tunable from 540 kc. to 10 mc. in four bands. A separate product detector is used for SSB and cw reception. A gang-tuned r.f. amplifier stage, plus two i.f. and two audio stages are used.

The idea of using a pair of receivers is so that a continuous civil defense monitor system can be employed. In this case, the Hammarlund HC-1-10 may be used as the amateur band receiver while the National NC-109 may be used as the monitor receiver.

Tucked onto the wall behind the equipment are some of the large number of QSL cards from hams that have been worked from the station. Other cards are from the many hams who have just dropped in to operate the station or to say "hello." (Cover Photo by G. C. Lucas)
Build the Best—build ALLIED knight-kits

the finest electronic equipment in money-saving kit form

LOWEST COST
ALLIED’S giant buying power passes biggest savings on to you—you do the easy assembly and your finished instrument equals the performance and appearance of equipment selling for several times the low KNIGHT-KIT cost. Your savings are BIG.

EASIEST TO BUILD
KNIGHT-KIT “Step-and-Check” instruction manuals with wall-sized picture diagrams are marvels of clarity—it’s like having a good instructor at your side. No experience required—you can easily build any KNIGHT-KIT and get professional results.

MONEYBACK GUARANTEE. When properly assembled, KNIGHT-KITS fully meet published specifications or we refund your money in full.

LATEST DESIGN
Each ALLIED KNIGHT-KIT incorporates the very latest circuitry for top-quality performance. Tried and proved professional design and the use of premium quality parts through-out help insure your building success to bring you quality results.

EASY TERMS. If your KNIGHT-KIT order comes to $45.00 or more, you can make your purchase on our attractive Easy Payment Plan.

HIGH FIDELITY EVERYONE CAN AFFORD
- World’s Finest Hi-Fi Kits
- Custom-Styled
- Easiest to Build Hi-Fi
- Money-Saving

knight-kit 18-Watt Complete Hi-Fi Amplifier Kit

Model Y-786
$39.95
Only $2.99 down

Here is a custom-styled, easy-to-build complete Hi-Fi amplifier at a price that defies comparison. Delivers full 18 watts output with wide-range, flat frequency response for true hi-fi reproduction. Features 8 inputs for every possible signal source, including NARUBB-equalized tape head input. At full 18 watts output, distortion is only 0.5%; uses new RCA 6973 hi-fi output tubes. Frequency response is ± 1 db, 20-30,000 cps; tape head and magnetic cartridge sensitivity, 5 microvolts for 18 watts output; hum and noise level better than 60 db below 18 watts. Output tap for 4, 8 or 16 ohm speakers. Controls: Input and Record Equalization; Bass Boost and Attenuate; Treble Boost and Attenuate; Volume. Simplest assembly is made possible through the use of an exclusive printed circuit switch and two printed circuit boards—most of the kit wiring is already done for you. With custom-styled French-gray “space-saver” case on tapered feet finished in chrome, 4 x 13 x 8”. Complete with case, tubes, all parts, and step-by-step instructions, for easy, error-free assembly. Shpg. wt., 15 lbs.

Easy Terms to fit your Budget. ALLIED KNIGHT-KITS may be purchased under our Easy Payment Plan. Your order need total only $45.00 or more—only 10% down, small monthly payments thereafter. No red tape—fast handling assured.

ORDER FROM ALLIED RADIO
100 N. WESTERN AVE. • CHICAGO 80, ILL.
Now you can have Custom-Styled Hi-Fi in ALLIED

**knight-kit 30-Watt Complete Hi-Fi Amplifier Kit**
Model Y-762

- Full Equalization, ±1/2 db of Recommended Accuracy
- Printed Circuit Switches  
- Printed Circuit Boards
- 8 Inputs For Every Possible Signal Source
- Full 30 Watts Output  
- Custom-Styled Beauty

$76.95
Only $7.59 down

**knight-kit High Fidelity FM Tuner Kit**
Model Y-751

- Authentic High Fidelity FM Response
- Flywheel Tuning  
- Automatic Frequency Control
- Printed Circuit  
- Pre-Adjusted Coils and IF’s
- 4 Microvolt Sensitivity Guaranteed

$38.95
Only $1.89 down

Comparable to the best in Hi-Fi—at far less cost! Deluxe features include: Linear-deluxe Williamson-type circuit for flawless response; equalization for all records within ±1/2 db of recommended accuracy; 2 exclusive new printed circuit switches in preamp section (no complex wiring to do); 3 printed circuit boards for time-saving, error-free assembly; separate, continuously variable Level and Loudness controls; use of premium 12AT7 tube for low noise and hum; DC on all filaments of preamp tubes; exclusive A-A-B-B speaker selector switch (use speakers of mixed impedances without mismatch); 8 inputs: Tape Head direct; G.E. and Pickering cartridges; Ceramic cartridge; Microphone; Auxiliary; Tape Preamp; Tuner (with separate Level Set control). Power amplifier response, ±1/2 db, 15-100,000 cps at full 30 watt level; distortion—harmonic, 0.55% at 30 watts—FM, 0.74% at 20 watts. Separate Bass and Treble controls; rube filler switch; variable damping. Output, 8 and 16 ohms. With smart French-gray cabinet, 4 x 15 x 15”. Ready for easy, money-saving assembly. Shpg. wt., 32 lbs.

Model Y-762. 30-Watt Hi-Fi Amplifier Kit. Net only .......... $76.95

Here is top value in creative engineering, impressive hi-fi performance and distinctive design—a tuner you'll be proud to build and own. Covers the full FM band, 88 to 108 mc. Features Automatic Frequency Control (with disabling feature) to "lock-in" stations and prevent drift; Inertia Flywheel Tuning for velvet-smooth, accurate station selection; pre-adjusted RF coils; pre-aligned IF’s; cascaded broad-band RF amplifier; drift-compensated oscillator; neon bulb pointer. All critical wiring is already done for you in the form of a printed circuit board—assembly is simple. Sensitivity is 4 microvolts for 20 db of quieting across entire band; output, 2 volts at 1000 microvolts input; IF bandwidth, 200 kc; response, 20-20,000 cps. with only 0.6% distortion. Output jacks for amplifier and tape recorder; cathode follower output. Ideal for use with the **knight-kit** amplifiers, or any amplifier with phono-tuner switch. Features custom-styled case in French-gray, with tapered chrome-finished feet, 4 x 13 x 8”. Includes all parts, tubes and step-by-step instructions for easy assembly. Shpg. wt., 12 lbs.

Model Y-751. Hi-Fi FM Tuner Kit. Net only ............. $38.95

**knight-kit Deluxe 3-Way Speaker System Kit**
Model Y-337

- Pre-Finished "Quik-Craft” Corner Enclosure
- Klipsch Designed and Licensed
- Famous Knight 12" 3-Way Speaker
- Easy to Assemble—Top Hi-Fi Quality
- Choice of Enclosure Finishes

$89.50
Only $8.95 down

Deluxe quality high fidelity speaker system at a money-saving low price. Easy to assemble—all you need is a screwdriver. System includes Knight "Quik-Craft" corner-type folded-horn enclosure kit, and the famous-value Knight 3-Way 12-inch speaker. Just assemble the enclosure—no finishing required—all surfaces are finished in hand-rubbed Korina blonde, mahogany or walnut. The speaker is the new 3-way type: 12" woofer cone for bass (full 1½ pound woofer magnet), conical radiator for mid-frequencies, built-in compression-type tweeter (with wired-in 500 ohm speaker); 3-way bass and treble controls. Specify Korina blonde, mahogany or walnut when ordering. Shpg. wt., 44 lbs.

Model Y-937. 3-Way Speaker System Kit. Net only ......... $89.50

**knight-kit 10-Watt Hi-Fi Amplifier Kit**
Model Y-753

$23.50 Low-cost, authentic hi-fi amplifier. Response, ± 1 db, 50-20,000 cps. Input for crystal phono or tuner; chrome-plated chassis is punched for preamp kit below, to permit use of magnetic phono. Only 0.5 volt drives amplifier to full output. Separate bass and treble controls. Only 1½ harmonic distortion. Matches 8-ohm speaker, 5 x 13 x 6”. With all parts, tubes and instructions. Shpg. wt., 13 lbs.

Model Y-753. Net only ............. $22.50
Y-235. Preamp Kit. $3.10
Y-757. Metal Cover ........... $3.95

ALLIED RADIO America's Pioneer in Electronic Kits
knight-kits

THE VERY FINEST MUSICAL QUALITY—SO EASY TO BUILD
MONEY-SAVING HI-FI EVERYONE CAN AFFORD

knight-kit High Fidelity Preamplifier Kit
Model Y-754
$39.95

- Exclusive Printed Circuit Switches and Boards
- Equalization ±¼ db of Recommended Accuracy
- 8 Inputs Including Tape Head
- Self-Powered
- DC on All Tube Filaments

Sensational Hi-Fi design at amazing low cost. Provides precise record equalization guaranteed within ±¼ db of recommended accuracy—more accurate than all but the most expensive factory-built preamps. Includes exclusive new K N I G H T-K I T printed circuit switches for easy, error-free assembly; 2 printed circuit boards eliminate all other wiring, except for power supply and control leads—so easy to build. Has built-in power supply; includes premium 12AX7 and ECC82 tubes. Frequency response, ± 0.5 db, 10-50,000 cps. Has 8 inputs; Tape Head; G. E. Phono; Pickering Phono; Ceramic; Microphone; Auxiliary; Tape Preamp; Tuner. Level adjustment for tuner input. Includes separate Bass and Treble controls; separate Level and Loudness controls; Rumble Filter switch; DC on all tube filaments; cathode follower output; 2 extra AC outlets. You get every advanced hi-fi feature in this easy-to-build preamplifier at the lowest possible cost. Includes beautiful custom-styled French-gray case, with taped chrome-finished legs, 4 x 13 x 8”. With all parts, tubes, step-by-step instructions; ready for easy assembly. Shpg. wt., 12¼ lbs. Model Y-754. Hi-Fi Preamplifier Kit. Net only $39.95

knight-kit 25-Watt Hi-Fi Basic Amplifier Kit
Model Y-755
$44.50

- Hi-Fi Response, ± 0.5 db, 10 to 120,000 cps
- Only 0.15% Distortion at 30 Watts Output
- Printed Circuit Wiring Board; Chrome-Plated Chassis
- Williamson-Type Circuit with Over 25 Watts Output

Here's superb Hi-Fi performance at less than half the cost of a comparable commercially-assembled unit. Williamson-type linear-deluxe circuit delivers over 25 watts of virtually undistorted reproduction. Ideal for use with the knight-kit preamp at left. Includes printed circuit board for simplified, error-free assembly. Remarkable hi-fi response, ± 0.5 db, 10-120,000 cps at 20 watts. Harmonic distortion, ± 0.15% at 50 watts; ± 0.4% at 20 watts. Hum level, 85 db below 25 watts output. Output impedances, 4, 8 and 16 ohms; output tubes, 2-5881. Includes balance control for precise matching of the output tubes; variable damping control for maximum performance with any speaker system—prevents low-frequency distortion from overdamping or underdamping. Very attractive black and chrome styling, 6½ x 14 x 9”. An outstanding engineering achievement in a basic hi-fi amplifier, delivering performance equal to the finest commercially-assembled units. Includes all parts and tubes; with step-by-step instructions, ready for easy assembly. Shpg. wt., 25 lbs. Model Y-755. 25-Watt Amplifier Kit. Net only $44.50

knight-kit 2-Way Hi-Fi Speaker System Kit
Model Y-789
$49.95

- Easy to Assemble—Pre-Finished Enclosure
- High Fidelity Response, 45 to 14,000 cps
- 12” Woofer and Horn-Type Tweeter
- A Wonderful Money-Saving Speaker Value

BIG SAVINGS—assemble your own quality K N I G H T-K I T 2-way speaker system—it’s quick and easy! The cabinet is pre-finished in full-grained, high luster blonde or mahogany—you just assemble 7 pieces, mount the speaker components and enjoy rich, thrilling hi-fi sound—at incomparably low cost. Special Jensen-engineered baffle features “dusted port” construction to bring out the full beauty of bass notes, perfectly matching the Jensen woofer and compression tweeter; genuine L-pad control is rear-mounted to permit adjustment of tweeter for best tonal balance. Impedance, 16 ohms. The assembled unit delivers a frequency response of 45 to 14,000 cps. Enclosure measures 26 x 19 x 14”. Beautifully styled to blend in any room. Kit includes Jensen 12” woofer, Jensen compression-type tweeter, pre-finished wood parts (with grille cloth installed), acoustic material, glue, hardware and step-by-step instructions. Absolutely no furniture finishing required. Specify blonde or mahogany finish when ordering. Shpg. wt., 33 lbs. Model Y-789. 2-Way Speaker System Kit. Net only $49.95

knight-kit 2-Watt Hi-Fi Speaker System Kit
Model Y-779
$39.95

- Easy to Assemble—Pre-Finished Enclosure
- High Fidelity Response, 45 to 14,000 cps
- 12” Woofer and Horn-Type Tweeter

knight-kit HI-FI IS AVAILABLE ON EASY TERMS TO FIT YOUR BUDGET
Fascinating ALLIED knight-kits FOR EXPERIMENTERS AND HOBBYISTS

**Knight-Kit 2-Transistor Pocket Radio Receiver Kit**

Model Y-262
- Loud, Clear Local Reception
- Newest Printed Circuit Board
- Built-In Loop Antenna
- Complete Kit—Nothing Else To Buy

$14.65

It's fun to build this pocket-size two-transistor radio— and you'll enjoy its crystal-clear local broadcast-band reception wherever you go! Fits in your pocket, or with its button-down flap, can be worn from your belt. Completely self-contained with built-in ferrite loopstick antenna—no external antenna needed. Extremely efficient reflex type 2-transistor circuit actually does the work of 3 transistors! Printed circuit board reduces building time to about one hour. Has air-dielectric variable capacitor for easy, accurate station tuning. Operates for months and months on long-life alkaline battery supplied. Sensitive miniature earpiece provides crystal-clear tone. Handsome tan carrying case, plastic-impregnated, is styled to resemble leather; only 4½x3½x1¼". Kit includes all parts, transistors, earpiece, battery and case. Shpg. wt., 1½ lbs.

Model Y-262. Net only .................................................. $14.65

**Knight-Kit "Trans-Midge" Transistor Receiver Kit**

Model Y-767
- Tiny, cigarette-pack-size one-transistor radio kit—fascinating to build—so low-priced. This novel miniature receiver will provide endless listening pleasure the moment assembly is completed. Covers the local AM broadcast band with exceptional sensitivity and selectivity. Special features include: Efficient, slug-tuned coil for excellent station separation; external knob for easy station tuning; low-drain transistor operating for months from single penlight cell supplied; hinged-back, red plastic case. Kit includes all parts, transistor, battery, compact case and easy-to-follow instructions for quick assembly. (External antenna and headphones required.)

$24.5

Model Y-767. Not only .................................................. $24.5

Model Y-149. 4000 Ohm Headphones. 1 lb. ........... $2.15

C-100. Antenna Kit. 1½ lbs. .......................... $1.03

**Knight-Kit 5-Transistor Superhet Personal Portable Radio Kit**

Model Y-766
- Styled to Equal the Finest
- Push-Pull Audio Drives 3½" Speaker
- Printed Circuit for Easy Building
- 20 Hour Battery Playing Life

$29.95

Beautiful, easy-to-build transistorized personal portable with every ultra-modern design feature: 5 Texas Instrument Co. transistors, latest printed circuit chassis for easy, error-free assembly; bigger-than-average 3½" speaker; class B push-pull audio output, built-in high-gain ferrite loopstick antenna, plus phone jack output for private listening. Provides sensitive reception of the AM broadcast band with exceptional tone quality. Ultra-smart high-impact ivory plastic case has handsome gold trims with ebony accents; includes pull-out handle; only 7½x4¼x1¼". With all parts, transistors, 9 volt transistor radio battery, carrying case and instructions anyone can easily follow. Shpg. wt., 2 lbs.

Model Y-766. Not only .................................................. $29.95

**Crystal Set Hobby Kit**

Model Y-261
- Entertaining, educational. Delivers clear headphone reception of local broadcast stations. With all parts, ready for easy assembly. (Antenna and headphones required.)

$2.15

Model Y-261. Not only .................................................. $2.15

**1-Transistor Radio Kit**

$3.95

Offers excellent AM local broadcast headphone reception. Printed circuit board for easy assembly. Operates from single penlight cell for months. Complete with all parts, transistor and penlight cell. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-765. Not only .................................................. $3.95

**Wireless Broadcaster Kit**

$9.90

Play music or make announcements through your radio set—no connection to set required! Loads of fun—easy to build. Works up to 50 feet from set. Shpg. wt., 3 lbs.

Model Y-705. Not only .................................................. $9.90

**Order From ALLIED RADIO**

100 N. Western Ave. • Chicago 80, Ill.
**FUN TO BUILD... INSTRUCTIVE... LATEST CIRCUITS FOR TOP PERFORMANCE**

**WIDEST CHOICE OF QUALITY HOBBYIST KITS**

---

**knight-kit** Photoelectronic Relay Kit

**Model Y-702**

$13.50

Advanced-design, ultra-sensitive photoelectronic relay—build it yourself and save! Dozens of uses: For automatic control of lights, door annunciator, burglar alarm, counting devices, etc. Provides dependable operation up to 250 feet with white light, up to 125 feet with "invisible" light (red filter) from Light Source Kit listed below. Selectable operation, with "trip" for burglar alarm to provide continuous ringing of alarm; and "auto" if relay is to operate each time beam is broken (for chimes, counting devices, turning on lights at darkness). Has SPST relay operated by thyatron. 6 V. terminals provide power for accessories. For 105-120 v. 50-60 cly. AC use: 6 lbs.

Model Y-702. Relay Kit. Net only $13.50

Model Y-703. Light Source Kit. With bulb and red filter. Shpg. wt., 3½ lbs. Net. $6.75

---

**knight-kit** "Ocean Hopper" All-Wave Radio Kit

**Model Y-748**

$11.95

This top-performing regenerative receiver puts a world of listening pleasure at your fingertips. Tuning range (using coils listed below) is virtually world-wide; covers 1.55 ke to 30 mc, including every type of radio transmission: AM broadcast, marine, aircraft, distress channels, direction-finding, Amateur, frequency standard, foreign broadcast, and police. With bandspread tuning. For use with headphones or 3-4 ohm PM speaker. Kit is supplied with standard broadcast band coil and all tubes and parts. (Less extra coils, headphones, speaker and cabinet.) Shpg. wt., 5 lbs.

Model Y-740. Net only $11.95

Model Y-746. Cabinet for above. 3½ lbs. Net $2.90

Extra coils available: Long Wave Coil (135-470 kc), Net 79c. Short Wave (1.65-4.1 mc), 2.90. 6-17.5 mc and 15-35 mc. Each 65c.

---

**knight-kit** 2-Way Intercom System Kit

**Model Y-295**

$14.75

• Low Cost—Easy to Assemble
• High Gain—Clear Tone
• Handsome Metal Cabinets
• Includes 50-FT Cable

Easy to build at lowest cost—ideal for home, office, shop or school. Consists of Master unit and Remote unit. Remote unit may be left "open" for answering calls from a distance, for "baby sitting," etc. Remote also may be set for "private" operation—"can-tuned" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier, combination volume control and on-off switch, plus pilot light. Each unit has 4-PM dynamic speaker. System responds to every whistle. Handsome Antique white cabinets, each includes high-gain PM speaker and headphone jack. Shpg. wt., 3 lbs.


Y-296. Extra Remote Station Kit. 3 lbs. $3.75

---

**Electronic Photoflash Kit**

**Model Y-790**

$9.45

Ideal for use in a portable photograp—just add recorder player and 3-4 ohm speaker. 1½ watts output. Inverse feedback circuit. Easy to assemble. Shpg. wt., 3 lbs.

Model Y-244. Net only $28.50

**Code Practice Oscillator Kit**

**Model Y-239**

$3.95


Model Y-239. Net only $3.95

---

**Phono Oscillator Kit**

**Model Y-760**

$5.85

"Broadcasts" recorded music through any standard radio set up to 60 feet away. No direct connections to set required. Easy to build—fun to use. Shpg. wt., 2 lbs.

Model Y-760. Net only $5.85

---

**FINEST ELECTRONIC EQUIPMENT IN EASY-TO-BUILD MONEY-SAVING KIT FORM**
**Better By Far—ALLIED knight-kit**

**ORDER FROM** ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

---

**knights-kit Low-Cost Tube Tester Kit**

Model Y-143

- With 16 Filament Voltages
- 600 Latest Tube Types Listed
- Easy-to-Read 4½" Meter
- Tests Series-String TV Tubes

Expertly designed for complete, up-to-date coverage of tube types. Tests series-string TV tubes; tests 4, 5, 6 and 7 pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Tests for open, short, leakage, heater continuity and performance (by amount of cathode emission). Big 4½" square meter has clear "GOOD-7-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of filament voltages from 60 to 170 volts to check virtually all receiving tubes; blank socket for future type tubes. Universal-type selector switches permit selection of any combination of pin connections. Single-unit, pre-assembled 10-level function switch simplifies and speeds assembly. Up-to-date illuminated roll chart lists over 600 tube types. Counter model case, 5 x 14 x 10". Easy to build. 14 lbs. Model Y-143. Not only...$29.75

Y-142. Portable Case model. 15 lbs. Not...$34.75

Y-141. Picture Tube Adapter. 1 lb. Net...$4.25

---

**knights-kit RF Signal Generator Kit**

Model Y-145

Build this wide-range, extremely stable RF signal generator—save two-thirds the cost of a comparable wired instrument! Large, semi-circular dial is clearly calibrated; range is covered in 5 separate bands for close accuracy in setting individual frequencies. Ideal for aligning RF and IF stages in radio and TV sets and for troubleshooting audio equipment. Delivers output on fundamentals from 100 kc to all the way out to 112 mc; useful harmonics to 234 mc. Has built-in 400-cycle sine-wave audio oscillator for modulating RF; audio is also available externally. Features high-stability Colpits circuit. Convenient jack for external modulation. Maximum audio output 10 volts; RF output over 0.1 volt on all ranges. Step and continuous-type attenuator controls. Supplied with precision-wound coils that require no adjustment. 7 x 10 x 5". Shpg. wt., 11 lbs. Model Y-145. Not only...$19.75

---

**knights-kit Vacuum Tube Voltmeter Kit**

Model Y-125

- 200 µA Movement, 4½" Meter
- Includes AC, Peak-to-Peak
- Balanced-Bridge, Push-Pull Circuit
- ¼ Film-Type Resistors

Top buy in an extremely stable, highly accurate VTVM. Easy to assemble—entire chassis is printed circuit board. Perfect for radio-TV service work, lab and Amateur use. Features low-leakage type switches; ¼ film-type precision resistors; balanced-bridge, push-pull circuit (switch to any range without readjusting zero set); zero center scale and direct-reading db scale; polarity, reversing switch. Ranges: Input Resistance, 11 meg; DC and AC rna, 0-1-5-15-50-150-1500; AC Peak-to-Peak, 0-14-40-140-1400-4000; Response, 30 cycles to 3 mc, Omhas, 0-1000-10K-100K and 0-1-100-1000 meg, db, -10 to +3. Includes all parts, tubes, battery, test leads and portable case, 7½" x 5½" x 4½". Easy to assemble. Shpg. wt., 6 lbs. Model Y-125. Not only...$24.95

Y-126. Hi Voltage Probe; extends DC to 50,000 V. $4.75

Y-127. Hi-Frequency Probe; extends AC to 250 mc...$3.45

---

**Transistor Checker Kit**

$80

Checks gain ratios of all types of transistors; checks germanium and silicon diodes; checks for continuity and shorts. A valuable instrument at very low cost. Easy to assemble. Shpg. wt., 23 lbs. Model Y-149. Not only...$8.50

---

**Flyback Checker Kit**

$195

Checks condition of all types of horizontal output transformers and deflection coils, as well as TV linearity and width. 4½" meter; widest range in the field. Shpg. wt., 6 lbs. Model Y-118. Not only...$19.50

---

**Sweep Generator Kit**

$437.5

Extreme linearity on a pair with costly lab instruments; fundamentals to 250 mc; output flat within 1 db; electronic blanking. Easy, money-saving assembly. Shpg. wt., 16 lbs. Model Y-123. Not only...$43.75

---

**Capacitor Checker Kit**

$125

Tests capacitors while in the circuit! Has widest range—20 mfd to 2000 mfd. Exclusive circuit for cancelling lead capacity. "Magic Eye" indicator. Have only 5% over factory-rated units. 5 lbs. Model Y-119. Not only...$12.50

---

**6V-12V Battery Eliminator Kit**

$32.95

High current rating; unusually variable filtered output; delivers 15 amps at 6 volts, 10 amps at 12 volts. May be used as battery charger. Two meters provide simultaneous current and voltage readings. Model Y-129. Not only...$32.95

---

**ORDER FROM** ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.
ADVANCED-DESIGN INSTRUMENTS FOR SERVICE, INDUSTRIAL AND RESEARCH USE IN EASIEST-TO-BUILD, MONEY-SAVING KIT FORM

**Knight-kit 20,000 Ohms/Volt VOM Kit**

Model Y-140

Outstanding quality and performance at money-saving low price. Features 1% precision multipliers; 4½’’ meter accurate within 2% of full scale deflection; 50 microamp sensitivity for 20,000 ohms/volt input resistance on DC; front panel “Zero adjust”; single switch to select function and range. 32 ranges; AC, DC and output volts. 0-2.5-5-10-20-100-1000-2000 kilo-ohms. Resistance, 0-2000-200,000 ohms and 0-20 meg.; DC ma, 0-0.1-10; DC amps, 0-10; Decibels, – 30 to +63 in six ranges. Moisture-resistant film-type resistors for extreme accuracy. Carefully engineered circuit design achieves high sensitivity and extremely versatile application. Kit includes all parts, battery, test leads and black bakelite case with highly legible white markings; size 8½’’ x 5½’’ x 3½’’. Easy to assemble. Shpg. wt. 5 lbs.

Model Y-140. Not only... $29.50

**Knight-kit High-Gain Signal Tracer Kit**

**Model Y-135**

A remarkable value in an easy-to-build instrument which permits visual and aural signal tracing of RF, IF, video and audio circuits. Has highest gain in its price class. Traces signal from antenna to speaker. Reproduces signal at plate or grid connection of any stage. Identifies and isolates “dead” stages. Features: usable gain of 21,000; “magic eye” with calibrated attenuators for signal presence indication and stage-by-stage gain measurements; built-in 4’’ PM speaker, combination 2-position probe, one for RF (6 mfd. input), the other for audio. Provides noise test; built-in watt-meter calibrated from 25 to 1000 watts; provision for external scope or VTVM. Binding posts provide output transformer and speaker substitution test, plus external 280 volt B+. With all parts, tubes and probe. 7x10x5’’ 12 lbs.

Model Y-135. Not only... $26.50

**Voltage Calibrator Kit**

$12.75

Permits use of any scope as precision peak-to-peak AC voltmeter. Puts a true square wave voltage on scope screen. Selects any voltage between 0.1 and 100 volts; feeds external signal directly to scope for instant comparison. Shpg. wt., 5 lbs.

Model Y-136. Not only... $12.75

**Knight-kit 5" General-Purpose Scope Kit**

**Model Y-146**

- Phantastron Linear Sweep
- 25 mv/inch Sensitivity
- Printed Circuit Board
- Retrace Blanking Circuit

Feature for feature the world’s best oscilloscope kit value. A standout in its class with all these fine features: Printed Circuit wiring board and laced harness for quick, error-free assembly. Phantastron Sweep Circuit for high linearity of sweep from 15 to 150,000 cps. 25 Millivolts Per Inch Sensitivity—3 times that of similarly priced scope kits. Calibration Voltage—1 volt peak-to-peak square wave, fully regulated. Vertical Amplifier—frequency response ± 3 db, 3 cps to 1.5 mc (± 6 db to 2.5 mc). Includes: Directly coupled positioning controls; retake blanking circuit; frequency-compensated vertical input attenuator; positive and negative internal sync, high 2nd-anode voltage for high-intensity trace; input capacity, 45 mfd. Kit includes CRT. 9½’’ x 13½’’ x 17¼’’. 26 lbs.

Model Y-146. Not only... $42.00

**Resistance Substitution Box**

$5.95

Easily determine resistor values required in a circuit. Makes available 36 standard 1-watt resistance values in 2 ranges between 15 ohms and 10 megohms, with 10% accuracy. Slide switch selects range, 18-position switch for value selection. Shpg. wt., 2 lbs.

Model Y-139. Not only... $5.95

**Capacitance Substitution Box**

$5.95

Makes it easy to find capacitor values needed in a circuit. Provides 18 standard values from 0.001 mfd. to 22 mfd. ± 20%. All values are 600 volt, except 1.5 and 22 mfd. which are 400 volt, 18-position selector switch. Shpg. wt., 2 lbs.

Model Y-138. Not only... $5.95

**Audio Generator Kit**

$31.50

Excellent design; range, 20 cps to 1 mc; less than 0.05% distortion; 600 ohm output. Ideal for hi-fi testing; offers the flat response of a lab standard. Shpg. wt., 16 lbs.

Model Y-137. Not only... $31.50

**R/C Tester Kit**

$19.50

Measures capacitance and resistance. Balanced bridge circuit; indicates power factor; tests capacitors at rated voltage. Large, easy-to-read dial and "magic eye." Shpg. wt., 10 lbs.

Model Y-124. Not only... $19.50

EASY TERMS AVAILABLE

Take advantage of the most liberal Easy Pay plan in electronics. On Knight-Kit orders totaling $45 or more—just 10% down, small monthly payments thereafter. Low carrying charges—no "red tape."
A sensational communications receiver value with all the selectivity, sensitivity and features of high-priced commercial units. Uses printed circuitry throughout, including the exclusive new KNIGHT-IT printed circuit band-switch, for remarkably easy assembly. Covers 540 kc to 31 mc in 4 ranges; calibrated, electrical bandspread on 80-10 meter Ham bands; slug-tuned Hi-Q coils; continuous, VR tube-regulated B+ applied to HP oscillator lets you switch from standby to receive with no drift; built-in Q-multiplier peaks desired signal or nulls interference; de-ayed AVC; provision for crystal calibrator (below). Sensitivity, 1.5 microvolts for 10 db signal-to-noise ratio. Selectivity: variable from 300 cps to 4.5 kc at db down. Exalted BFO injection. Controls: Main tuning, bandspread, band selector, Q-multiplier selectivity, Q-multiplier tune, null-off-peak, BFO pitch, RF gain, AF gain, BFO-MVC-AVC-ANI, off-shby-rec-cal, antenna trimmer, and phone jack. Cold-rolled 14 gauge steel chassis. Handsome metal cabinet, 10 x 10 x 16½". (Less phone, 8-0 cm loudspeaker and S-meter: 23 lbs.)

Model Y-726. Amateur Receiver Kit. Net: $104.50

A complete self-powered VFO Kit. Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. A lot of bandspread; separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism; 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output: 40v on 80, 20v on 40. With Spot-Off-Transmit switch for spot frequency tuning. Extra switch controls for operating relays and other equipment. Attractive metal cabinet, 8½ x 6 x 6½". Ready for easy assembly. Shpg. wt.: 8 lbs.

Model Y-725. VFO Kit. Net only: $28.50

Model Y-725. 50-Watt CW Transmitter Kit. Net only: $38.95

There's exceptional value in this very popular bandswitching transmitter kit. Compact and versatile, it's the perfect low-power rig for the beginning novice as well as the seasoned veteran. Has bandswitching coverage of 80, 40, 20, and 15 and 10 meters. Rated at 50 watts—actually operates at up to 60 watts on 80 and 40 meters. Oscillator is efficient 6AG7; final is reliable 807. Crisp, clean, cathode keying of oscillator and final. Built-in provision permits use with random length antennas. Has highly effective TVI suppression. Other features not usually found in transmitter kits at this low price include: Ceramic-insulated final tank capacitor; pre-assembled switches; pre-wound parasite chokes; ceramic coil forms; coax connector; crystal and VFO socket on front panel; power take-off jack for accessory equipment. Meter reads either plate or grid current of final. Takes crystal or VFO without circuit changes. Cabinet interior and chassis are copper-finished. Size, 8½ x 10½ x 8½". With tubes and all parts for easy assembly. (Less crystal and key.) Shpg. wt.: 19 lbs.

Model Y-255. 50-Watt Transmitter Kit. Net only: $38.95

Model Y-255. 50-Watt CW Transmitter Kit. Net only: $38.95

Model Y-256. 100 kc Crystal Calibrator Kit. Net only: $10.50

Model Y-255. $38.95

MODEL Y-255. Ideal for the Novice
       • PI Antenna Coupler
       • Bandswitching—
         80 to 10 Meters

Model Y-255. $38.95

ONLY $5.85 down

FREE 404-PAGE ALLIED CATALOG

Order the 1958 ALLIED 404-Page Catalog for complete listings of more than 50 KNIGHT-ITS, covering Hi-Fi, Hobby, Test Instrument and Amateur Kits. The 1958 ALLIED Catalog is your complete Buying Guide to the world's largest stocks of everything in Electronics.

Send FREE 404-Page 1958 ALLIED Catalog.
Rhombic Antennas for TV

(Continued from page 65)

ditions, is the lower fading rate encountered with the addition of the second stack.

Signal fading at great distances from the transmitter location is a function of changing heat and humidity layers throughout our lower atmosphere. As they change, the signal strength will "shift layers" and, where it was strong a few seconds ago, become weak. Signals in the v.h.f. bands go over the horizon in layers, thin layers or relatively strong signals being interspersed with thicker layers of relatively weak signals. This effect shows up as fading. The second stack will be far enough away from the first so that, when layer shifts occur, at least one of the stacks is more likely to remain within the relatively strong signal layer a greater portion of the time than a single stack would.

A second stack will be identical to the first. The recommended distance between the two stacks (the stacking distance) may be obtained from line 8D in Table 3. The two stacks are connected together by running a length of 450-ohm line, with a single twist, between them, putting them in parallel. (See Fig. 4.) The stacking distance should be maintained at all support poles and at all points between the two arrays.

The possibilities of the rhombic for relaying signal into valleys or other "pockets" where signal is absent are excellent. Some readers may recall cases, in the fairly recent past, in which low-lying communities have set up booster stations on mountaintops in order to re-radiate the signals available there to their homes. Unfortunately the FCC takes a dim view of such operations, classifying them as unauthorized transmitters and action was taken to close down these boosters.

There is a legal way of bringing signal into such locations, however. If a relay rhombic is used. The trick is to construct two identical rhombic antennas (two stacked units may be used, if the extra gain is required) connected and oriented as shown in Fig. 5. The pick-up unit is directed toward the transmitter(s) in the conventional manner. The second array, acting as a re-radiator, is then directed toward the area to be served. The two are then tied together with a length of 450-ohm or other suitable transmission line. If a valley is to be served from a greater height, the second rhombic should be pointed downward into the valley or else the narrow horizontal pattern in which it radiates may pass over the desired area altogether. The connecting length of line should be kept as short as is convenient.

Correctly designed and built rhombics, used in the ways described here, can widen the range of acceptable TV reception substantially.
Far East Ham Convention on Guam


The profusion of palm trees, 80-degree temperatures, and tropical island living, provided the background for the Second Far East American Radio Relay League Convention recently held on Guam. The convention, sponsored by the Chief of Naval Operations and hosted by the Marianas Amateur Radio Club attracted hams from all over the Pacific.

Mr. William W. Willis, President of the Marianas Amateur Radio Club, kicked off the convention with a welcoming speech followed by introductions of various members. Addresses were then given by several top military and civilian officials on Guam, including Governor Richard B. Lowe, Mr. D. H. Nueker, High Commissioner of the Trust Territory, Rear Admiral W. B. Amnon, Commander Naval Forces Marianas, and Major General C. W. Schott, who is the Commanding General of the Third Air Division (SAC).

The Navy offered its facilities to the conventioneers, who were mostly naval and Air Force personnel, giving them the use of the U. S. Naval Hospital Auditorium, a tour of the U. S. Naval Communications Station, and the facilities at Gab-Gab Beach, a popular recreation area at the U. S. Naval Station. The convention closed with a critique, a lavish banquet at the Navy Officer’s Club, and the singing of “Auld Lang Syne.” The general opinion was that a wonderful time was had by all and that next year’s convention would be looked forward to with great anticipation and enthusiasm.

Mr. Paul Fenner, FCC inspector from Hawaii, is shown registering for the Second Far East Radio Convention that was recently held on Guam.

Capt. W. A. Smith, USN, who holds amateur call letters KG6AGO and who attended the recent ham convention on Guam, is shown here making a DX contact.
What Do You Know About Recording Tape?

By HERBERT G. HARD
Vice President, Research
ORRadio Industries, Inc.

More and more people are becoming interested in tape recording and the uses of tape in the home, in the school, in the church, and in industry. Growing interest in the magic of magnetic recording prompts a good many questions from the ever increasing number of tape recorder fans.

Every year ORRadio Industries receives hundreds of letters asking many interesting and important questions about recording tape. In this article we have tried to answer just a few of the most commonly asked questions.

1. How should tape be stored?
The tape should always be stored on the rewind or take-up reel. In the course of recording, or playback, the tape winds on the take-up reel forming a smooth and uniform pack. If it is rewound at fast speed onto the feed reel, it will almost invariably have an uneven pack. Tape should never be stored where it is likely to encounter extreme temperatures or humidity, like in hot attics or damp basements. Storage at ordinary room temperatures is usually satisfactory. Tape should be kept away from magnetic fields such as might be produced around large motors. Stored tape should be re-spoiled in playback mode at least once every six months and preferably every 30 days. Frequent respoiling also prevents "reel set." This is a more or less permanent deformation of the tape resulting from winding pressure over prolonged storage periods.

2. What is "print-through" and how can it be avoided?
"Print-through" is the transfer of the magnetic signal to adjacent layers on a reel of tape. In order to avoid "print-through" the following precautions should be observed. Do not over-record. When recording, set the record level as low as possible in order to get a noise-free signal. Rewind recorded tapes frequently. Store at room temperature since higher than normal temperatures accelerate "print-through."

3. What is meant by "single track" and "dual track"?
Single track recording is made with a full track recording head which is almost as wide as the ¼-inch tape. Dual track recording is made with a half track head. It records only half the width of the tape. With a dual track head, the user can record first the bottom half and then the top half of the tape, thus gaining twice as much playing time on one reel of tape. Dual track tapes cannot be readily edited.

4. What types of film, or base, are used for recording tape and what are the differences between the bases?
The two commonly used tape bases are cellulose acetate and "Mylar," which is DuPont polyester film. Each of the base materials has its advantages. Acetate has been the standard film of the recording industry for ten years. It is less expensive than "Mylar." When acetate breaks, it breaks clean and a neat splice can be made without losing any of the recording. "Mylar" is stronger than acetate and will not tear easily. It will take a greater pull before stretching. It also has a high resistance to extreme temperature and humidity.

5. How long will tape last?
The life of good quality recording tape is indefinite. Tests have shown such tapes can be recorded and played up to 10,000 times without appreciable loss of recorded material. A tape with a smooth surface will last longer because it has less oxide shedding due to head contact. "Mylar" tapes will last longer than acetate because "Mylar" does not become brittle with age.

6. Are any precautions necessary for the thinner tapes?
Ordinary care will suffice in the case of 1-mil tapes but certain precautions should be observed in using the half-mil double-play tape. A tape recorder, properly adjusted, exerts a pull of 6-9 oz. while running and 10-16 oz. in start or stop on rewind and fast forward modes. Half-mil tape has a stretch value of 32 oz. which ordinarily provides an ample safety margin. However, special care should be taken on fast forward and rewind. The tape must not be taut between reels when starting and stopping. If the tape is slack, it will be snapped into motion and stretching is almost sure to result.

7. How is a tape splice made?
Take the two broken ends of tape, overlap them, and cut through the overlapped ends at a 45-degree angle. Place the two ends together, and lay over a piece of splicing tape. Be sure the splicing tape is not on the coated, or oxide, side of the tape. Trim the edges of the splicing tape with a slight inside curve. Pressure sensitive tape is not satisfactory for splicing, as it makes a "gummy" splice. The job is facilitated by using a splicer.

February, 1958

Tape made with "Mylar" is run from the recorder into boiling water and around a cake of ice. There is no change in strength, flexibility, or dimensional stability.

Here are expert answers to most commonly asked questions pertaining to magnetic recording tape.

-90-
IMPEDEBRIDGE KIT
Heath Company of Benton Harbor, Mich., is now offering an improved model of its impedance bridge instrument which is being marketed as the Model 1B-2A.

The new model features more constant filament voltage and more consistent performance. In addition, the instruction manual has an entirely new schematic that clarifies circuit functions in various switch positions. The 1B-2A is a completely self-contained unit with built-in power supply, a 1000-ohm resistor, and detector. An 100-0-100 μf capacitor provides for null indications. It will measure resistance from 0-1 ohm to 10 megohms, capacitance from 10 μf to 100 μf, inductance from 10 mhy to 100 henrys, dissipation factor from 0-200 to 1, and storage factor (Q) from 0.1 to 1000. The decade resistors are 1/2% units for maximum accuracy.

"FIELD ACCELERATED" TRANSISTORS
Philco Corporation's Spring City, Pa., plant is now in production on a new class of "field accelerated" transistors which have been made possible by the MADT (micro alloy diffused-base transistor) process.

The new family of transistors makes possible the transistorization of high-gain, high-frequency amplifiers; high-speed computers; high-gain wideband video amplifiers; and other critical high-frequency circuits.

They are available in various voltage and frequency specifications for the design of high-performance transistorized equipment through the entire v.h.f. and part of the u.h.f. spectrum.

PRINTED CIRCUIT RESIST
LePage's, Inc. of Gloucester, Mass., a subsidiary of Permacel Tape Corporation, is now in production on a new printed circuit resist which has been developed especially for the purpose of streamlining the production of printed circuit boards.

The new coating is a photosensitive resist which covers the copper surface of a circuit board before the image is transferred from a negative to the copper. The resist is a pre-sensitized solution and is ready for immediate use without mixing or other preparation. The new coating keeps well in solution form and will remain stable for six months, according to the company. A pamphlet on this new product is available on request.

NEW "LIMPANDER" MODEL
Electronic Systems Engineering Co., 903 Cravens Bldg., Oklahoma City, Okla., has recently released a new model of its limiter-expander unit which has been designated as the Model LE-3.

This audio preamplifier with high-gain, non-feedback automatic gain control incorporates a unique background noise squelching system. It features low impedance and 600-ohm input as well as 600-ohm output which facilitates the incorporation of the unit in existing installations. The limiter portion of the amplifier has time constants of 50 microseconds on attack and 20 milliseconds on release. Consonant amplification is accomplished without the excessive distortion of clipper circuits.

The high-speed background noise squelching system makes it possible to use high-gain, consonant-amplifying, limiting in noise filled rooms.

Write the company direct for full specifications on this new device.

NEW "260" V.O.M.
Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill. has introduced a new model of its popular and well-known "260" volt-ohm milliammeter.

Designated as Series III, the improved model has many design changes which afford quicker operation, increased sensitivity, higher accuracy, and greater dependability, according to the company. Among its new features is a polarity reversing switch, spread-out scales for faster reading, and a rugged printed circuit.

Complete information on the new Series III model is available from electronic distributors or the company itself. In Canada, Bach-Simpson Ltd. of London, Ontario will answer inquiries.

"SUNFLEX" TRANSISTOR RADIO
Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., is now offering an economical two-transistor radio receiver kit for earphone operation, powered by either solar or penlite batteries.

Utilizing two transistors and a crystal diode in an ingenious reflexed complementary symmetry circuit, the "Sunflex" is said to give three-transistor performance. An external antenna plug-in lead is supplied for reception of distant stations. Local reception is obtained without external antenna or ground connections.

The kit comes complete with all parts, transistors, diodes, chassis, plastic case, etc., but less earphones and solar battery. The assembled unit measures 4 1/2"x3 1/2"x1 1/2". The solar battery is available at extra charge and is rated at 3.2 volts, 2 ma.

HIGH-HEAT SOLDER PENCIL
Orga Company, 8015 Wilshire Blvd., Beverly Hills, Calif., has designed a new pencil-type instrument for precision, high-temperature soldering applications.

The new unit, Model 25, weighs less than an ounce, reducing hand fatigue and providing faster soldering, yet achieves tip temperatures of 1000 degrees F while the handle remains cool. It features a 25-watt built-in element supplied with replaceable 1/4" nickel end tip. Also available are 1/4" copper-chrome alloy tips.

The pencil operates on 12 volts, 2 amperes, either a.c. or d.c. It can be operated from a battery supply or 110-volt a.c. lines by using a stepdown transformer.

NEW BUD RADIO PRODUCTS
Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio has added two new units to its line of radio and electronic enclosures.

The first item is a universal meter case which can accommodate either a 2- or 3-inch meter by means of a knock-out ring. It also featured is a piece-one detachable bottom and back which makes installation and servicing much simpler. Two knock-out holes are pro-
vided in the top for installation of feed-through insulators if required.

The second product is a universal sloping panel cabinet which also features a one-piece detachable bottom and back. Components may be mounted on back, bottom, sides, or front and still be accessible for service or replacement. Two different viewing angles are possible depending upon whether the cabinet is placed on its bottom or back. Four sizes are being made available.

Both units are being offered in either steel or aluminum. Write the company for literature and prices.

NEW OBLIQUE PLIER
Mathies Klein & Sons, 7200 McCormick Road, Chicago 45, Ill. has announced the availability of a new shear-cutting oblique plier, No. 207-SC.

The new instrument, on which a patent is pending, is 5½" long and the shear-cutting blade will cut dead soft or extremely hard wire. Blades may be replaced, hence the plier never needs sharpening. Regular cutting knives in the nose add to the usefulness and a coil spring keeps the jaws apart for instant use.

HIGH-FREQUENCY TRANSISTORS
The Semiconductor Division of Radio Corporation of America, Somerville, N. J. has introduced a new germanium p-n-p alloy-type transistor (2N274) embodying the "drift" principle and a junction transistor of the germanium p-n-p alloy type, the 2N404.

The compact design of the 2N274 opens new applications in military and commercial equipment where space is limited. It operates at frequencies extending from the standard AM band well up into the short-wave bands.

The 2N404 is designed for use in switching circuits of compact, medium-speed military and industrial electronic computers. It has flexible leads and is hermetically sealed in a metal case which is .360" in diameter with a body length of .25". Leads are spaced to conform to EIA (formerly RETMA) standards for automation requirements.

NEW RCA COLOR TUBE
The Tube Division of Radio Corporation of America, Harrison, N. J. is now in production on a new directly viewed, round, graded-hole shadow-mask tube for use in color television receivers.

The 21CYP22 is designed with an all-glass envelope which reduces the high-voltage insulation requirements of the color receiver. It is also provided with an external conductive bulb coating which, with a portion of the internal conductive coating, forms a supplementary filter capacitor. The graded-hole shadow mask featured in the design has holes that increase gradually in diameter from the outer edge of the mask inward to the center. As a result, the mask permits increased light output from the screen.

The new tube is capable of producing full-color and black-and-white pictures measuring 19¾"x15½" with rounded sides and having a projected area of 261 square inches. The overall diameter is 20¾" and over-all length 25½".

A technical bulletin on the 21CYP22 is available on request.

NEW COLOR CAMERA
General Electric Company's Technical Products Dept., Schenectady, N. Y. has introduced a new "live" color television camera which is smaller in size, simpler in design, and easier to operate than any now available, according to the company.

It is said to be the first such device to incorporate printed circuits and transistors. These design features permit the camera to measure a mere 3½"x16"x22" and weigh 215 pounds.

A newly developed optical system which is said to eliminate the need for many glass surfaces through which color signals were previously required to pass, results in improved color quality. A single control cable is used to connect the camera to the station control console.

WIDE-BAND OSCILLOSCOPE
Electronic Industries, State Road, Patterson, N. Y., one of the newest firms in the rapidly expanding kit field, has recently introduced a wide-band, high-sensitivity 5-inch oscilloscope kit which has been especially designed for laboratory and television servicing applications.

The Model 535 has a 10 mv r.m.s. em. sensitivity from d.c. to 5 mc., an electronically regulated power supply, and push-pull circuitry throughout. Built-in continuously variable calibrating voltages of 100, 10, 1, and .1 volt peak-to-peak at an accuracy of 3% are provided.

The scope is housed in a blue hammer tone finished cabinet with a photo-etched anodized panel. The unit measures 12"x16"x18½" and weighs slightly less than 40 pounds. It will operate on 105 to 125 volts, 50/60 cycle a.c. It draws 150 watts.

TRANSISTORIZED STANDARD
Transistor, Inc., 186 Granite St., Manchester, N. H. has developed a new frequency standard which is designed to be used either as a laboratory or production test tool.

The Model FS-195 is completely transistorized and self-powered, it provides crystal-controlled standard frequency outputs for rapid calibration of oscilloscope sweeps and signal genera-

Showed here is prototype test model of the first airborne digital computer in actual production. The unit, called the Digilair, was announced recently by Hughes Aircraft Co. It is shown installed in an F-102A Air Force all-weather interceptor. The computer is small enough to fit into a 21-inch table model television cabinet.
NO NEED to Compromise!

Today, the best costs no more than ordinary equipment. You'll be far, far ahead with Weston equipment, for it will remain accurate and serviceable for years to come. Available at your distributors, or write for Test Equipment Bulletin... Weston Instruments, Newark 12, N. J.

WESTON Model 980 VOM

Unapproached for accuracy. Self shielded. Spring backed jewels for ruggedness. Dependable Weston etched circuit, with 28 functional ranges available through one simple dial. only $43.50

WESTON Model 981 TUBECHECKER

Filtered d-c potentials afford the only true Gm measurements. Four signal voltages available to suit requirements of various tubes. Frequency 5000 cycles. Voltage divider network for precise grid bias settings. Tube interelectrode leakage measurements high as 10 megohms. only $199.50

WESTON TEST EQUIPMENT The Quality Line

TAPE RECORDERS

HI FI COMPONENTS

Tapes—Accessories UNUSUAL VALUES Send for Free Catalog

DRESSNER 69-82 RA-174 ST.
Flushing 65, N. Y.

MERITAPE Low Cost, High Quality Recording Tape—In boxes or rolls.

BARGAIN SERVICEMEN!

Write for SENSATIONAL CATALOG

HENSHAW RADIO SUPPLY 3619 TROOST KANSAS CITY, MO.

RADIO & TV NEWS

GET INTO ELECTRONICS


VALPARAISO TECHNICAL INSTITUTE Dept. RD Valparaiso, Indiana

tors, or may be used for marker injection in sweep generator displays.

Careful control of its harmonic content provides a continuous spectrum well beyond 200 mc, at usable levels. As a result, this unit may be used to calibrate communications receivers in both the high-frequency and very-high-frequency bands. The successive use of the 1 mc, 100 kc, and 10 kc markers allows identification of calibration points as closely grouped as 10 kc. A 400-cycle modulating tone is provided to enable rapid recognition of the crystal-controlled spot frequencies in the absence of b.f.o. provisions in the receiver being calibrated.

"FAST-CHECK TUBE TESTER"

Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y. has developed and is marketing a new economically priced tube tester that will make a complete tube test in seconds and check tubes from a complete TV set in a matter of minutes.

Known as the "Fast-Check Tube Tester, Model FC-1," the new circuit eliminates time-consuming multiple switching and checking of roll charts. Just two settings on the panel enable the technician to check for quality, shorts, and life expectancy of over 600 tube types which covers more than 99 per-cent of all TV tubes including the newest series-string TV tubes, automatic battery type 12-volt tubes, voltage regulators, magic eye, and gas regulator tubes.

The tester has 41 tube sockets to accommodate all present and future tube types.

Shown here is a view inside Olson Radio Warehouse's new Akron, Ohio plant. The three-story, 300,000 square foot building is equipped with the latest stock control and handling devices. Olson, which has been in business 27 years, is the country's second largest electronic component parts distributor, with seven large warehouse-retail outlets.
with your customer relations problems.

The manufacturer will also help you in many ways to get started in this business, and this assistance can be most important. One of the first things to do after you are ready to handle the work is to contact makers of this type of equipment. Tell them about yourself and your desire to service their units in your area. Most of them will be glad to hear from you. Even if, at the moment, they have no need for your services, they will not forget you and will call on you when they need you.

However, before you strike out for yourself, remember that this is a business and requires more than just technical ability. In order to show a profit at the end of the year you must also know how to operate a business. It might, therefore, be best to look into the many opportunities for full-time salaried employment in this field.

Some operators have their own service departments and need skilled technicians. Also, the independent shops already in this business constantly need technicians. In fact, if you are technically qualified to do this work, it is entirely possible to work in one of these shops while you are studying for your license examination. The FCC rules actually require that a licensed man be responsible, so you can earn a salary while studying for your license by doing the work under the supervision of a licensed man.

If you are a shop owner presently doing radio and television service, all you need do is acquire the necessary extra equipment, hire a licensed technician, and you are in business. In this case, it might pay you to get a van-type truck and build yourself a mobile service shop. This is better than trying to make room in an already overcrowded shop.

Also, if you have the qualifications and can operate a business of your own, but don’t have the necessary money to purchase the required equipment, you can still get in through the back door, so to speak. If you are lucky enough to be located in an area where a shop is really needed, you should be able to pick up some contracts. With these contracts to prove you mean business and have the ability to pay, it is possible to borrow the money from a bank. Some operators will advance money, to be applied on the monthly contract payments, in order to help you get needed equipment.

If you live near the water or near an airport, check into the possibility of picking up a few jobs there. Invest this extra money in needed test equipment.

Mobile radio communications maintenance is big business. It is getting bigger every day. It will pay you, if you are qualified, to look into it very seriously.

February, 1958
Recharging and Storing Dry Batteries

Precautions that should be observed in attempting to rejuvenate dry batteries and some storage suggestions.

A GOOD many of our readers have sent us questions concerning the possibility of recharging dry cells and batteries. Since dry batteries are basically primary cells in which the chemical reaction that takes place during discharge is not readily reversible, strictly speaking a complete recharging is not possible. On the other hand, by following techniques similar to those used for storage battery recharging, it is possible to extend the life of a dry battery. We usually refer to this process as "rejuvenation," and it is not clear whether there is actually any large amount of reactivation of active material or if there is merely a small amount of local surface action. Irrespective of the mechanics, enough experimenters have tried recharging dry batteries with enough success to make it worthwhile under certain limited conditions. In most cases of home use of batteries, recharging would not be too practical because the results are just not worth the time, effort, and equipment required. But for the experimenter who may be interested here are some of the facts.

In general, there are two methods that can be used for recharging. One involves the use of more or less steady d.c. while the other uses a combination of a.c. and d.c.

Limitations and Precautions

The battery active materials should not be completely exhausted before recharging is tried. Hence, the voltage under load should not be allowed to fall below 1 volt per cell. In a 9-volt battery then, the load voltage should be above 6 volts. Also, the battery should not be allowed to stand in a discharged condition for very long as it becomes increasingly difficult to recharge such a battery. After the charging has been completed, the battery should be put back into service immediately. This must be done as the shelf life of a recharged dry battery is short.

As to the amount of charging current to be used, this varies depending on the size of the cell to be recharged as well as its normal discharge current. In the main, however, rather low current rates are used. For a penlite cell, or a battery made up of penlite cells, the charging current should be in the range of 4 to 40 ma. For a standard flashlight cell, or a battery made up of standard flashlight cells, the charging current should be in the range of 25 to 250 ma. The charging current should be applied for a period of about 12 to 16 hours in order to be most effective.

The simplest way to obtain the required charging current is to use a.c. or d.c. or both. The system is to use a half-wave dry-disc rectifier that is connected to a step-down transformer. The rectifier used need not have a high current rating since low charging rates are used. The secondary voltage of the transformer should be about 25 per-cent higher than the total voltage of the battery to be charged. Be sure to connect the positive output of the rectifier circuit to the positive terminal of the battery. A series resistor that should be used to regulate the charging current and to keep it within the limits mentioned.

Some experimenters have found that a combination of a.c. and d.c. is more effective in recharging. For some experiences along these lines, we refer our readers to the article "Dry-Cell Battery Charger" on page 128 of our October, 1957 issue.

Storage

Although battery manufacturers have done much to improve the shelf life characteristics of dry batteries, the fact remains that the capacity of these batteries is reduced during prolonged storage. What's more, the smaller dry cells deteriorate more quickly than the larger sizes.

To reduce excessive loss of capacity, dry batteries should be stored at low temperatures. Under these conditions the local chemical action and evaporation that would occur are both retarded. If dry batteries are refrigerated, for example, their shelf life would be tripled, according to one manufacturer.

There is not too much danger of freezing dry batteries, as the ordinary dry cell freezes at about -6 degrees F. There have been cases where batteries have been kept near this temperature for many years, and after having been brought up to normal room temperature slowly, it was found that they suffered very little loss of capacity. Batteries that are kept at low temperatures for long periods of time must be thawed out slowly to prevent condensation of moisture that would cause leakage in the jackets.

It has also been found that batteries will last longer if they are given "rest periods" instead of being used steadily. For example, if batteries are to be used for extended periods of time, it would make sense to obtain a duplicate set which could be alternated with the original.
FREE LAFAYETTE'S 1958 CATALOG

The Complete Catalog Featuring "The Best Buys In The Business"

Send for Lafayette's 1958 Catalog—the most complete, up-to-the-minute electronic supply catalog crammed full of everything in electronics at our customary down-to-earth money-saving prices.

Depend on LAFAYETTE for all of your needs . . . complete stocks—immediate shipment—personal technical assistance—proven dependability.

FOR THE NEWEST AND FINEST IN
- Hi-Fi Components and Systems
- Exclusive Lafayette Transistor Kits
- Largest Supplies of Transistors and Miniature Components
- Tape Recorders and Stereophonic Equipment
- Radio and TV Tubes, Parts and Antennas
- Industrial Electronic Supplies and Equipment
- Binoculars, Telescopes and Microscopes
- Amateur Receivers and Transmitters

FEATURING
The most extensive line of Lafayette's own kits—providing the greatest value in easy-to-build kits at the lowest prices. In addition to hi-fi amplifier, pre-amplifier and stereo tuner kits, Lafayette makes available the largest selection of transistor kits anywhere.

CONTAINS HUNDREDS OF EXCLUSIVE LAFAYETTE ITEMS NOT AVAILABLE IN ANY OTHER CATALOG OR FROM ANY OTHER SOURCE — SEND FOR YOUR COPY NOW!

A "must" for the economy-minded hi-fi enthusiast, experimenter, hobbyist, engineer, technician, student, serviceman and dealer.

Our 38th Year

LEADERS IN HI-FI
The most complete selection and largest stocks of hi-fi components and systems—available for immediate delivery at the lowest possible prices. Save even more on Lafayette endorsed "best-buy" complete systems.

send for the world's leading electronic, radio, t.v., industrial, and hi-fi guide

LAFAYETTE RADIO, DEPT. RB
P. O. BOX 511, JAMAICA 31, N. Y.

☐ Send FREE LAFAYETTE Catalog 305

Name .............................................
Address ..........................................
City ................. Zone . . . . State ...............

February, 1958
New 4-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 use, robustness and reliability. Heavy-duty cast aluminum panel, with rubber shock isolators. All metal enclosure, powder coated to assure long life. This instrument will provide accurate reading for all speeds within ±7% using efficient, frictionless magnetic brake. Heavy-duty constant speed 4-pole induction motor specially designed for speed-maintaining control. Includes adjustable speed control. It is ideal for speed test, alignment tuning, and other applications requiring accuracy. It can be used as a tachometer or a speedometer. Truly a delight for the connoisseur. Price: $8.95

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.

**NEW POCKET AC-DC VOM MULTIMETER**

2,000 ohm per volt sensitivity on both AC and DC. 100 and 3 meters. 1% precision resistors. Silver contact switch. Full scale ranges.
New! YEARS AHEAD!

Lafayette STEREO TUNER KIT

THE MOST FLEXIBLE TUNER EVER DESIGNED

Use it as a Binaural-Stereophonic FM-AM tuner
Use it as a Dual-Monaural FM-AM Tuner
Use it as a straight Monaural FM or AM tuner

- Separately Tuned FM and AM Sections
- Dual Cathode Follower Output
- Armstrong Circuit with FM/AFC and AFC Defeat
- 12 Tuned Circuits

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

FM specifications include grounded-grid triode low noise front end and triode mixer, double-tuned dual limiters with Foster-Seeley discriminator, less than 1% harmonic distortion, frequency response 20-20,000 cps ± 1/2 db, full 200 kc bandwidth and sensitivity of 2 microvolts for 30 db quieting with full limiting at one microvolt. AM specifications include 3 stages of AVC, 10 kc whistle filter, built-in ferrite loop antennas, less than 1% harmonic distortion, sensitivity of 5 microvolts, 8 kc bandwidth and frequency response 20-5000 cps ± 2 db.

The controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and instructions, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13½" x 10½" x 4½". Shpg. wt., 18 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit and the "Triumvirate" of these 3 units form the heart of a top quality stereo hi-fi system.

KT-500

LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL

- Self-Powered
- DC On All Filaments
- 24 Positions of Equalization
- Tape Head Input, High Impedance
- Dual Cathode Follower Output Stages

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07% harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phone, tuner or tape. Tasteful styling, brilliantly executed. Size 12½" x 9½" x 3¼". Shpg. wt., 10½ lbs.

KT-300--Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions, Net 39.50

LT-30--Same as above completely wired and tested with cage and instruction manual, Net 59.50

DELUXE 70 WATT BASIC AMPLIFIER

- Conservatively Rated At 70 Watts
- Inverse Feedback
- Variable Damping
- Motorized Balance and Bias Adjust Controls
- Available In Kit and Wired Form

Here's ultra-reliability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wire range linear Chicago output transformer, variable damping control, meter for bias and balance and gold finish chassis. Frequency response 10-100,000 cps ± 1 db. Hum and noise 90 db below full output. IM distortion less than 1¾% at 70 watts, less than 0.25% below 30 watts. Harmonic distortion less than 1¾% at 70 watts, 2¾% at 30 watts. Distortion 1%, 8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14½" x 10 x 7½" including cage and knobs. Shpg. wt., 40 lbs.

KT-400--Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions, Net 69.50

LA-70--Same as above completely wired and tested with cage and instruction manual, Net 94.50

Lafayette Radio

165-08 Liberty Ave.
JAMAICA 33, N. Y.

NEWARK, N. J., 2 Central Rd., 100 SIXTH AVE., NEW YORK, N. Y.
BRONX, N. Y., 542 E. Fordham Rd.
PLAINFIELD, N. J., 139 West 2nd St.
Leo Says: "Designed ALL THE WAY for the Amateur! World Radio Laboratories!"

"The World's Largest Distributor of Amateur Radio Equipment!"

the HAMMARLUND HQ-110

A top amateur receiver for full coverage of 6, 10, 15, 20, 40, 80 and 160 meter amateur bands. 12-tube dual conversion superheterodyne. Separate linear detector for SSB and CW Q-multiplier. Separate stabilized beat-frequency oscillator for SSB and CW reception. Built-in 100 KCS crystal calibrator. 2nd conversion oscillator crystal controlled. Amateur net, less Telechron clock-timer: $229.00. Clock-timer, $10 extra.

FREE 1958 CATALOG!

More than 15,000 bargains for the amateur, kit-filer, experimenter. Send for your copy today!

ANDREAS: INTERMITTENT SOUND

Intermittent sound or fluctuating level of sound in VO-21 and VP-21 chassis may originate in either the sound take-off transformer (Part No. SA-373) or the ratio-detector transformer (Part No. SA-374). Before considering replacement for either transformer, apply a hot soldering iron to the legs of the transformers to make certain that the coil wires are making good connection to the legs.

If the condition is of such a nature that the sound fluctuates or becomes intermittent only after the set has been in use for a long while and if the audio tubes have already been tested or replaced without eliminating the symptom, it may be more economical to replace both transformers at the same time.

G-E: VERTICAL SYNC

In certain problem areas, there has been some difficulty with vertical sync on portable TV receivers in the "Q2" series, using 14" picture tubes. The manufacturer has been able to overcome this problem by changing the values of four resistors in the a.g.c. and video-detector circuits. These four are marked with asterisks in Fig. 1. The resistors, with old and new values, are:

- $R_{om}$ from 22 megohms to 20 megohms,
- 5%, 1/2 watt, carbon;
- $R_{om}$, from 22 megohms to 1.5 megohms, 10%, 1/2 watt, carbon;
- and $R_{om}$, from 22,000 ohms to 33,000 ohms, 10%, 1/2 watt, carbon.

AUDIO-OUTPUT TUBE FAILURE

Fordite notes that there has been some problem with premature failure of the 25C5 audio-output tubes used in some of their radio receivers. The broadcast sets in which this symptom has been noted carry the following stock numbers: 4-A-169, 4-A-170, 4-A-171, 4-A-172. The short life of the tubes has been found to result from excessive grid emission which is present in the tubes as they are received from their
a quarter-century
of PRECISION
know-how
is now yours...in

quality test
instruments
in kit form
...the only line of test instrument
kits engineered and produced
under the auspices of a major
test equipment manufacturer...
and conveniently available directly
from your local electronic
parts distributor.

OLYMPIC: FUZZY PICTURES
Under certain conditions of trans-
mission, chassis in the DD or DDU
series will exhibit pictures that appear
to be fuzzy or smeared. To compensate
for this condition, a simple network
consisting of two capacitors and a
single resistor is added to the cathode
circuit of the video amplifier, a 6AW8.
If this circuit has not already been in-
corporated in the receivers in question,
there will be a white lead going from
the contrast control to a choke which
in turn, connects to pin 6 of the 6AW8.
To install the network, consisting of a
470-µfd. capacitor, a .01-µfd. capaci-
tor, and a 68-ohm resistor (shown in
Fig. 2), simply break the white lead
and insert the network as per the
illustration.

MAGNAVOX TUNER DETENTS
Tuner detent spring life in 700584
and 700587 tuners, used in current
models, can be extended by applying
Lubriplate 105 at the point of contact
between the detent gear and the
spring itself. The manufacturer sug-
gests that this measure be taken
whenever a chassis using either of
these two tuners comes in for shop
service, regardless of whether the
tuner is involved in the service com-
plaint or not. The lubricant should
be applied generously, as indicated in
Fig. 3, in the area that has been
shaded in gray. In this connection,
note that it is very important that
both sides of the point of contact
on the detent spring be well lubricated,
as well as the point of actual contact
itself. When treated in this fashion,
the springs should last the life of the
receiver without the need for replace-
ment. If an untreated spring should
wear out, it is easily replaced, how-
ever. To order replacement detent
springs, refer to Magnavox part num-
ber 700588.

February, 1958

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Net Price: $28.50
Model G-30
RF SIGNAL GENERATOR KIT
• 160 Kc to 240 Mc in 5 bands
• 120 Mc fundamental output
Net Price: $28.50
Model G-30PC:
Same as Model G-30 but
with pre-calibrated front end.
Net Price: $35.50

Net Price: $20.95
Model S-50
5" CATHODE RAY OSCILLOSCOPE KIT
• push-pull vertical and
horizontal amplifiers.
Net Price: $47.50

Net Price: $20.95
Model C-20
RESISTANCE-CAPACITY-RATIO BRIDGE KIT
• 10 mWfd to 2000 mWfd
• ½ ohm to 200 mehms
Matching, hinged, removable cover
Net Price: $20.95


Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

Net Price: $31.50
Model B-10
BATTERY ELIMINATOR KIT
• less than 0.3‰ ripple
• no external filter adaptors required
Net Price: $41.95

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.
A DIVISION OF
PRECISION
Apparatus Company, Inc.

Available and
an display of
leading electronic
parts distributors.

Write for
free descriptive
bulletin.

Net Price: $25.50
Model M-40
HIGH-SENSITIVITY V-O-M KIT
• 20,000 ohms/volt DC
• 10,000 ohms/volt AC
Net Price: $31.50

PACO ELECTRONICS CO., INC.
Superior's New Model TD-55
Emission Type

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.

Tests all tubes.

Tests easy to use:
...for quality magneto. deflected picture
Comes in the set
up
in the set
down

Transistors!

SUPERIOR'S

New Model TW-11

Standard Professional
Tube Tester

Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid,
Thyratron, Minatures, Sub-miniatures, Novals, Sub-mins, Proximity Fuse Types, etc.

Uses the new self-cleaning Lever Action Switches for individual
element testing. All elements are numbered according to pin
number in the RMA base numbering system.

Model TW-11 does not use combination type sockets. Instead
individual sockets are used for each type of tube. Thus it is
impossible to damage a tube by inserting it in the wrong socket.

Free-moving built-in roll chart provides complete data for all
tubes. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either
phono or external amplifier detects microphonic tubes or noise
due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

Separate Scale for Low-current Tubes

Previously, on emission-type tube testers, it has been standard
practice to use one scale for all tubes. As a result, the calibration
for low-current types has been restricted to a small portion of
the scale. The extra scale used here greatly simplifies testing of low-
current types.

The model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes
housed in a beautiful hand-rubbed
oak cabinet complete with portable
cover.

$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 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
T.C. tube which sells for a
little
more and is supposed to be "as good as" the
metered instrument. Superior does make
a T.C. that actually operate
sensitive
leakages between
all tubes. Continuity between various sections is individu-
ally indicated. All elements are numbered in strict
accuracy with the R.M.A. specification. The 4 position fast-action
snap switches are all numbered in exact accordance with the,
standard R.M.A. numbering system.

$15.85
NET

Superior's
New Model TV-12

Trans-Resistance Tube Tester

The new Model TV-12

Testing Transistors

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 im-
proved Trans-Conductance circuit.

Testing Transistors

A transistor can be safely and accurately
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.

$15.85
NET

$15.85
NET

$47.50
NET

$72.50
NET

EXAMINE BEFORE YOU BUY!

USE APPROVAL FORM ON NEXT PAGE
Superior’s New Model 76

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

TRY ANY
of the instruments on this or
on the facing page, for 10 days
before you buy. If completely sat-
fied then send down payment and pay
balance as indicated on coupon. No
Interest or Finance Charges Added!
If not completely satisfied return
unit to us, no explanation
necessary.

New! Superior’s
New Model 76

IT’S A CONDENSER BRIDGE
IT’S A RESISTANCE BRIDGE
IT’S A SIGNAL TESTER
IT’S A TV ANTENNA TESTER

1. CAPACITY BRIDGE SECTION
4 Ranges: 0.0001 Microfarad to 0.005 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.

2. RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

3. 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.

4. 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 an-
tenna, so why not check the TV anten-
ta first? Locates a break in any TV antenna measures the loca-
tion of the break in feet from the set terminals.

Optional add-on TV-4000 TV Antenna Analyzer.

Complete with R.F. and A.F. probes and test leads...

$26.95 NET

Superior’s new Model TV-50

GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:
A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

7 Signal Generators in One!

R.F. Signal Generator for A.M. • Bar Generator
R.F. Signal Generator for F.M. • Audio Frequency Generator
Cross Hach Generator • Color Dot Pattern Generator • Marker Generator

R.F. SIGNAL GENERATOR: Provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. * VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Generator provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. * BAR GENERATOR: Projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. * CROSS HATCH GENERATOR: Generator will project a cross-hatch pattern on any TV picture tube. The pattern will consist 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: 50 Mc., 10.7 Mc., 3579 Kc., 60 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3379 Kc., 85 Mc., 5 Mc., 19.7 Mc., (3579 Kc. Is the color burst frequency.)

MODEL TV-50 comes absolutely complete with shielded leads and operating instructions. Only

$47.50 NET

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Bapt. D-430, 3848 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 under-
stood 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 immedi-
ately due and payable.

Name ____________________________
Address ____________________________
City __________________ Zone _______ State _______

All prices net, F.0. B., N.Y.C.

February, 1958

123
Report on the Soviet Earth Satellite

Summary of radio observations and instrumentation employed in man’s first artificial earth satellite.

The material below is based on a composite of unofficial reports on the first USSR satellite which was launched on October 4, 1957. The information was taken from the “IGY Bulletin,” a survey by the U. S. National Committee for the International Geophysical Year.

Instrumentation

The first announcement by Radio Moscow indicated that there were two transmitters in the satellite, one operating at 20.000 mc. and the other at 40.002 mc. The pulse of each signal was 0.3 sec., followed by a pause of similar length during which the other signal was transmitted. On Oct. 8 the signals were not received for several hours. Later, signals resumed but became continuous. The transmitter power was specified to be 1 watt. U. S. monitors agreed that the signals were modulated with telemetry data. Appropriate instruments within the satellite reported on atmospheric temperature and density. Also, information on micrometeorite bombardment was probably transmitted.

Radio Observations

First U. S. radio reception of the satellite’s signals was reported by RCA Communications, Inc. at Riverhead, L. I. The observation occurred at 8:07 p.m. EDT, October 4, the day of the launching. At 8:15, the signal was strongest from the south. First reception at the Naval Research Laboratory in Washington, D. C., was at 8:30 p.m. By October 6, six of ten Minitrack stations had been converted from 108 mc. —the frequency to be used by the U. S. satellites—to 20 and 40 mc, in order to track the USSR satellite.

Radio reception was soon general and reports of continuous monitoring were received from Antarctic IGY stations, including the South Pole—which is in a position to hear the satellite on virtually every passage—as well as from IGY Drifting Station A, an ice floe located about 500 miles from the North Pole.

Reports from the Amundsen-Scott South Pole Station indicated that the satellite’s radio signals cut in abruptly but faded out gradually and that there were numerous variations in signal strength, duration, and pulse rate.

The USSR was reported to be encouraging amateur assistance, offering special cards to hams reporting receipt of the satellite’s radio signals.

Radio Moscow announced on October 26 that the satellite’s radio had used up its power and had stopped working. On the same day, the Naval Research Laboratory reported that no signals had been received by Minitrack stations since 5:50 p.m. EDT, October 25, and that no other information had been relayed to NRL from other radio receiver sources since 7:30 p.m. EDT, October 25. Thus, after 3 weeks of continuous operation, space’s first radio transmitter had gone dead.

---

**Example of orbit prediction of USSR satellite prepared by U.S. Naval Research Laboratory. Times computed for latitude 40°N; released October 15, 1957, 11:30 a.m.**
MR. ELECTRONICS MAN:

If you’re willing to lose your job tomorrow to a technically-trained man, don’t read this!

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

The “how” is CREI home study training in the growing electronics field. CREI offers you advanced, professional home study training in Electronic Engineering Technology including SERVO, MECHANISMS, COMPUTERS, RADAR, AUTOMATION, AERONAUTICAL ELECTRONICS, BROADCASTING, COMMUNICATIONS AND MANUFACTURING, and the ELECTRONIC PRINCIPLES ASSOCIATED WITH GUIDED MISSILES, TELEMETRY, ASTRONAUTICS, and INSTRUMENTATION. You don’t have to be a college graduate. You do have to be willing to study—at home. You can do it while holding down a full-time job. Thousands have. Since 1927 CREI has provided alert young men with the technical knowledge that leads to more responsibility, more job security, more money. And CREI has constantly kept pace with the rapid expansion and progress in electronic achievement. 30 years of experience qualifies CREI to train you.

What qualifies you for CREI? If you have the equivalent of a high school education, and are good at mathematics, and have some electronic experience—you can qualify for CREI training and for the benefits which await you upon graduation. But remember this: CREI starts with fundamentals and takes you along at your own speed. You are not held back by a class, not pushed to keep up with others who have more experience or education. You set your own pace. CREI instructors guide you through the lesson material and grade your written work personally. You master the fundamentals, then get into more advanced phases of electronics engineering principles and practice. Finally you may elect training at career level in highly specialized principles of electronic engineering technology as applied to guided missiles, servomechanisms, radar computers, telemetry, automation, instrumentation and other ultra modern applications.

How good is CREI training? Ask an electronics engineer. Ask a high school or college physics teacher. Ask a radio station engineer. Check up on our professional reputation: CREI courses are accredited by the Engineers’ Council for Professional Development; CREI is a member of the National Council of Technical Schools.

Look at this partial listing of organizations that recommend CREI training for their own personnel: United Air Lines, Canadian Broadcasting Corp., Trans-Canada Airlines, Douglas Aircraft Co., The Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadian Ltd., Federal Electric Corp. and U. S. Information Agency (Voice of America). Finally, ask a CREI graduate to tell you about our Placement Bureau, which has more requests for trained men than we can fill.

What’s the next step? Certainly get more information than we can cram into one page. The postcard below, completely filled out, will bring you a fact-packed booklet. It describes courses offered, career opportunities, full details about the school, and tuition details.

---

FREE BOOKLET! MAIL THIS POSTAGE-FREE POSTCARD TODAY

CAPITOL RADIO ENGINEERING INSTITUTE
ECPD Accredited Technical Institute Curriculum - Founded 1927
3224 16th St., N.W., Washington 10, D. C.

I₂B₂

(R.N. Feb. 58)

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

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

Name __________________________________________ Age _______________________
Street __________________________________________
City __________________________________________ Zone ______ State ______
Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

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

EMPLOYED BY __________________________________________

TYPE OF PRESENT WORK __________________________________________

EDUCATION: __________________________________________

YEARS HIGH SCHOOL __________________________________________

YEARS COLLEGE __________________________________________

IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED ____________________________

---
The data that launched thousands of careers is yours FREE

TELLS how you can be successful in ELECTRONICS... including:

Television... Broadcasting... Guided Missiles... Radar... Instrumentation... Computers... Automation... Aeronautics... Servomechanisms... Aeronautical Electronics... Telemetering... Communications... Manufacturing

Send for your Free Copy today!

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

It brings you completely up to date—answers important questions on newest career developments in electronics, including Radar, Guided Missiles, Servomechanisms, Computers, as well as Aeronautical Electronics, Broadcasting (AM, FM, TV), Military, Navy and CAA Electronics, Communications and Electronics Manufacturing.

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.

However, CREI does not promise you a "snap." With accredited technical school curricula such as CREI offers, you must study to convert your ambition into technical knowledge which you can sell in the fabulous field of Electronics.


CREI courses are prepared by recognized experts, in a practical, easily understood manner, and constantly revised to meet the new electronic challenges of our time. You get the benefit of time-tested study assignments under the personal supervision of a CREI staff instructor. Your studies are accomplished on your own time, during hours selected by you, and controlled by your own will power. This complete training is the reason that graduates find their CREI diplomas keys to success in even the most advanced of electronic applications. CREI alumni hold top positions in America's leading firms.

At your service is the CREI Placement Bureau, which finds positions for advanced students and graduates. Although CREI does not guarantee jobs, requests for personnel far exceed current supply. Now is the time of decision for you. Luck will not propel you forward unless it finds you trained. Contacts won't budge you an inch unless you have the skill to back them up. The answer is: Technical Training... and willingness to learn. Together they will bring you increased earnings in the new Age of Electronics. Fill out the postcard below completely and mail it now. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—your future—is up to you!

Industry Calls For CREI Training
By Name...

SO SHOULD YOU!

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

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

VETERANS: If eligible for training under the new G.I. Bill of Rights, check the coupon for full information.
New Device Reads Written Numerals

Experimental unit using transistors is run by ordinary flashlight cells.

A NEW EXPERIMENTAL device the size of a portable typewriter that can read handwritten numerals or identify numerals as they are being written was demonstrated recently. The machine, invented by Tom L. Dimond of Bell Telephone Laboratories, could be modified to read handwritten letters. The unit may eventually become a valuable addition to telephone offices in picking up handwritten information on long distance billing tickets.

The device indicates the number that is being written by lighting up the correct digit on a numbered panel. This information could also be transferred to an accounting machine, computer, or other data processing device.

Several experimental models have been built. Each is completely self-contained. The unit is operated from ordinary flashlight batteries. Its small size is made possible by the use of transistors.

(A) The two dots on the writing screen must be used as a guide in the formation of numerals. (B) Wide variations are permissible in forming numbers, such as are illustrated here with the number 3.

Designed exclusively for service

Tobe Service Capacitors are the only capacitors literally “designed from the ground up” to meet the exacting requirements of modern radio and TV servicing. Before a capacitor was ever produced, Tobe engineers determined the ideal characteristics—then borrowed from their 36 years experience in the design and manufacture of high-quality commercial and industrial types. Result: capacitors like the plastic-sleeved streamlined “Jets” that stand up in the toughest circuits.

You owe it to yourself to try Tobe Service Capacitors on your next job. The line is complete—and they cost no more! See your Tobe Distributor today for full details or write Tobe Deutschmann Corporation: Distributor Division, 2900 Columbia Ave., Indianapolis 5, Ind.

February, 1958

Old Hands at Dependability
SEVERAL months ago I sounded a warning about anticipated price increases on recordings. By the time you read this, both Columbia and Capitol discs will be going for $4.98 instead of the old $3.98 price. There may even be others by that time and very soon the price change will be industry-wide. You can’t say I didn’t give a holler in time! The effects of this return to higher prices can’t be accurately assessed at this time. Perhaps it will lead to a slump in classical record sales. If that does happen you can look for an early return to the lower price.

One effect, however, is quite certain and that is the recording tape will occupy a more advantageous position. With some of the lower-priced tapes, people will begin to compare the shrinking margin between the price of imported tapes versus the quality of longevity and deterioration of the two media. In a case like this, tape would win, hands down. This disc price rise is sure to give the stereo tape market the lift it needs. I also feel that one of the possible reasons for the return to higher price disc is in paving the way for the stereophonic disc. It has been generally conceded that when the stereo discs come, they will be at or near the original LP price. The possibility of $4.98 as the universal price for either monaural or stereo should not be far fetched.

Speaking of the stereo discs, it can be reported that as of this writing, Capitol, Columbia, Victor, and Decca have all purchased Westrex cutters. This does not necessarily mean these companies are going to adopt the Westrex stereo disc system, as reported elsewhere. The Westrex cutter is capable of cutting stereo discs by its own “45-45” method, but it is also capable of cutting straight vertical/lateral stereo. The companies are experimenting with both systems and no one has officially adopted one or the other. A persistent rumor has one of the majors introducing the stereo disc in July, but unless the system has been decided upon by then, this won’t happen. I’ll do my best to keep you posted.

TCHAIKOVSKY

VIOLIN CONCERTO IN D


It is hardly necessary to note that there are several recordings of this concerto, among which are some outstanding examples of virtuosity and fine recorded sound. More to the point is to urge you not to overlook this version because of an embarrassment of riches.

For with all due respect to the illustrious executants on the other discs, none can quite match the magic wrought by Heifetz. This is the stereo disc is peculiarly his, a commanding, authoritative tour de force of violin playing. This is audibly evident, as he sweeps into the work with bold assurance and impetus, lending you with his golden beauty of his tone, the facile case with which he overcomes the technical difficulties of the score.

Brilliantly en rapport with Reiner, Heifetz affords us a reading which is unlikely to be surpassed for some time to come. Soundwise, this has the formidable advantage of Orchestra Hall acoustics, which lend a great "presence" to the soloist and orchestra.

The work was recorded fairly "close-up," affording crisp, clean definition to the instruments, yet avoiding any sterility in the strings. Excellent transient response was noted throughout the disc and dynamic range was wide and expressive. There are several other versions which can equal this recording in terms of sound, but with this fabulous Heifetz performance as a plus to the fine sound, this is easily the recording of choice.

DVOŘÁK

SERENADE FOR STRINGS IN E MAJOR

Israel Philharmonic Orchestra conducted by Rafael Kubelik. London LL1720. Price $3.98.

The Israel Philharmonic’s tenure with Angel Records was surprisingly short and now the LPs are coming from a London company. What precipitated the Israel Philharmonic’s move to London, I don’t know. Certainly on the basis of the few LPs issued by Angel, however, they have displayed considerable resources and much promise. Here, under the baton of the versatile Kubelik, they give every evidence of continued improvement.

The Dvořák "Serenade" has had three previous recordings on LP, none of which were wholly satisfactory. Kubelik has always had a way with strings and under his urgings the Israel group performs this lovely sound with great tonal beauty. The first strings seem to be the best trained, although everyone work throughout the recording is of very high order. A fine balance between the various choirs is maintained by the engineers and as a whole, the sound is very clean, quite spacious with good dynamic expression.

STRAVINSKY

PETROUCHKA

FIREBIRD SUITE


I listened to this recording once ... I listened to it twice ... and yet a third time. I twiddled diab on my preamp, adjusted this and adjusted that, I did everything but stand on my head to no avail. Here was one of the really great performances of "Petrouchka" and the "Firebird," with a technical fault so obtrusive that it spoiled the magnificence of the reading. Papa Pierre is not at fault ... this incredible septetarian who was ... shall we say midwife at the debut of so many Stravinsky masterpieces ... affords here readings that must be considered as near definitive. In "Petrouchka" alone he has illuminated passages which previously was somewhat murky in meaning and meter, I have discovered subtleties and nuances in the score heretofore unknown. He has introduced me to the depth and strength of just the right emphasis here, just the right diminuendo there, just the very proper handling of this score, bar by bar.

The sound in general is lovely, very clean, well balanced, good acoustics and good dynamics. But Gadzooks! Some cluck didn’t monitor the tape too carefully and on the disc we have the most repulsive and annoying "pulsations" I have encountered in a hum was practically a concomitant of many European tapes in the early days of LP, but I thought this was a problem long since licked. Experimentally not and for shame R.C.I. I can only hope that this hum was confined to my copy. I can hope still further that when the stereo tapes of this program are released, the hum will be conspicuous by its absence. You might try a few copies and see what gives ... maybe I got a dud. But even if the hum is there, do yourself a favor and listen to the excellent recording.

BERLIOZ

ROMAN CARNIVAL OVERTURE

REVENUTO CELLINI

WAVERLY HALLS, FRANS-JUGES


A jumbo collation of Berlioz overtures nicely served by Sir Adrian and engineered to a turn by Westminster. Sir Adrian’s greatest asset here is in his lack of pretension, which allows the works to stand by themselves. He wisely lets the many-faceted Berlioz draw our main attention while he gently guides us through the intricacies of the scores. Very full, open sound, with great warmth in strings, mellow woodwind, robust brass, and notably accurate percussion. Wide dynamics here and a broad acoustic perspective.

DEUTSCHMEISTER ON PARADE

The Deutschmeister Band conducted by Julius Herrmann. Westminster XWN6058. RIAA curve. Price $3.98.

Ever since the first big oompah issued from the Deutschmeister Band’s original Westminster recording several years ago, it has been a big favorite with the hi-fi fans. In this, the latest in the series, the Band reaches a new high mark. In a group of 10 marches some familiar and others total strangers, the Band dispords itself with the spirit and precision that have made it world-famous.

DELIBES

COPELIA (COMPLETE BALLET)


This is a notable first edition for Ansermet and London Records. Yes, this is the complete ballet of "Copel la," not the suite with which we have had long familiarity. It has been almost an axiom that Suites taken from ballets have always been justified on the grounds that what was excited was nearly always dull and tedious. Not so with "Copel la." There are pages and pages of wonderful music beyond the familiar sections to enjoy and savor, enough to fill both sides of two LP records.

A format at the top of his form in music like this and he gives us a reading full of verve and life. He elicits some great playing from the Suisse Romande men and there is much evidence of care and thought from the London engineers have contributed a sound of superb delineation ... every facet of or-
NOTICE!! TELEMARINE MOVES TO MANHATTAN! PRICES SLASHED FOR THIS OCCASION

COME SEE OUR NEW HOME, SIX FLOORS OF OUTSTANDING ELECTRONIC BARGAINS, NOW CONVENIENTLY LOCATED IN NEW YORK CITY

BC-683 MOBILE FM RECEIVER

Priced at $129.95

2-CHANNEL FM TRANSCEIVER

MICROPHONE JACK, PHONE JACK

PRICE: $159.95

Loran ORNAMENT EQUPT., APN-4, AT LOWEST PRICE EVER!!

We make a "Bargain" on this popular model APN-4 Loran which can be used as a precision aerial plotter for navigation purposes. All are Used but in Excellent condition and complete with complete operation and instruction manuals. Shipped complete with all the accessories necessary for use, including a unique Loran signal receiver. Not Tested.

BC-663 MOBILE FM RECEIVER

Priced at $129.95

LORAN ORNAMENT EQUPT., APN-4, AT LOWEST PRICE EVER!!

We make a "Bargain" on this popular model APN-4 Loran which can be used as a precision aerial plotter for navigation purposes. All are Used but in Excellent condition and complete with complete operation and instruction manuals. Shipped complete with all the accessories necessary for use, including a unique Loran signal receiver. Not Tested.

HI-PRECISION FM SIGNAL GENERATOR - MOBILE BAND

PRICE: $199.95

LIMITED QUANTITY BARGAINS

Not all items carry a definite price, but we make a "Bargain" on these items. All items are Used but in Excellent condition, unless otherwise noted.

For a complete list of all electronic bargains, see our Tea-Leaf Communications Catalog, or write us at

TELEMARINE COMMUNICATIONS CO., INC.

140 WEST B'WAY, NEW YORK 13, N.Y.

Cable Address: Telemariner, N.Y.

February, 1958

Page 129
The only quality AM-FM Tuner designed for STEREO

There's no such thing as obsolescence with H. H. Scott's new AM-FM Stereo tuner, Model 330-C. Use it as an AM tuner; as an FM tuner; or use both sections together for simultaneous AM-FM stereo reception. Top quality reception is assured on both FM and AM by H. H. Scott's unique wide-band FM circuitry and wide range AM circuitry.

That's why if you're planning to buy a tuner there is only one logical choice . . . the tuner that's designed for the future . . . the H. H. Scott Stereo Tuner.

Technical Specifications:

**330C AM-FM Stereophonic Tuner:**

**FM Section:** Sensitivity 2 microvolts for 20 db. of quieting; 2 monoeye wide-band detector; wide band circuits assure freedom from drift and high selectivity; 2½ db. capture radio, automatic gain control.

**AM Section:** Wide range AM circuitry for reception of high fidelity AM broadcasts; adjustable band-width including wide-range, normal, and distant positions; sharply tuned 10 kc. whistle filter.

Tuning meter on both FM and AM; output includes: stereophonic, FM and AM monaural outputs, multiplex output, and tape recorder; dimensions in accessory mahogany case 15½ x 5½ x 12½; $224.95.

Choice of handsome cases at $9.95 and $19.95.

Prices slightly higher west of Rockies.

For FM only installations choose the H. H. Scott FM tuner, Model 310C . . . the most sensitive, most selective tuner you can buy today. $109.95.

Famous musicians like guitarist Andría Segovia choose H. H. Scott components for their own homes.

The H. H. Scott 330C Stereo tuner is shown below in a Stereo system with two H. H. Scott 99 complete amplifier.

H. H. Scott, 111 Powderrmill Road, Maynard, Mass. Export Dept. Telsco International Corp. 36 West 40th St., New York City

BUSH me free copy of your completely new catalog R-2.

NAME
ADDRESS
CITY STATE

chrestation planing like a jewel. Here is sweet smooth strings and mellow woodwind, sparkling brass and sharp percussion. Here we have rich orchestral detail and spacious acoustics. Add wide dynamics and frequency response and we have a recording of uncommon merit. For balletomanes a "must" album.

**VIOLINETS**

**CONCERTO #4 FOR VIOLIN AND ORCHESTRA**


Francescatti is by now a seasoned and superb violin virtuoso, excelling in certain works and more than holding his own in most of the standard repertoire. His reading of the "Symphonie Espagnole" is at the top of the list for its rounded sweetness of tone and his dazzling technique. However there are other good recordings of the Lalo work and the item of real interest here is the lovely and rarely heard Viuientemps concerto. This is an ingratiating score, quite melodious and not relying too heavily on violin gymnastics to sustain interest.

After so much of the standard fare this is a refreshing novelty which deserves to be heard more often. With these two great orchestras on one disc a comparison of their sound is interesting. In both cases the recording is close-up and highly detailed, with excellent balance between soloist and orchestra. Acoustically, the Academy of Music in Philadelphia favors string tone more than the Carnegie Hall locale of the Philharmonic which favors brass and percussion. All in all a good coupling and a very worthwhile recording.

**STRAUSS**

**EIN HELDENLEBEN**


This is an odd recording of this great work. It has the huge sonority which the score demands, yet in critical places . . . the Battle Scene . . . for instance the dynamics are strangely subdued. Böhm gives a fine reading of the work, but his is not on the order of a Mengelberg or Reiner. His performance is best described as competent and honest. The sound is very huge with a great hall liveness. The recording was not too close up and detail suffers accordingly. The most outstanding feature of this recording was the orchestral balance and the great sonority of the contra-bass. This was in the best European tradition and had there been more projection to the sound, this would have been far more successful.

**PROKOFIEV**

**ROMEO AND JULIET (COMPLETE BALLET)**


The Concert Hall Society has engaged in a venturesome project of recording complete ballets, many of which are comparatively obscure. These are impressive productions under the sponsorship of the International Ballet Guild. The packaging is quite deluxe, with lavish background data on the ballets and many illustrations depicting the performance history of the particular ballet. In this album we have the first complete recording of Prokofiev's "Romeo and Juliet." On listening, it is obvious there is much more to the score than the snippets we have had in

120

RADIO & TV NEWS
 recordings up to now. This is wholly impressive music, with relatively little dross among the gold. The orchestration is typically Prokofiev, replete with plenteous woodwind and his easily identified rhythmic figures. The only basis for comparison we have is the various "suite" recordings, the most extensive of which is the Stokowski/Victor version. It must be admitted that in spite of its completeness, neither the performance nor the sound measure up to the Stokowski disc. Bashish seems competent enough and his orchestra plays quite well, but he fails to capture the magical essence of the score or to emphasize its sensual beauty in the same fashion as Stokowski.

Soundwise this is a good clean recording, with fine string tone, really excellent woodwind sound, good brass. The trouble is that there is not enough weight or body to the sound, the orchestra seeming smallish compared to the Stokowski forces. But after all, the Maestro poured the experience of years into his reading and recording and in music of this character, Stokowski is literally unbeatable. However, for those who are ballet enthusiasts and who want a full length view of this work, this is altogether an admirable production and is recommended without reservation on that basis.

SEGOVIA AND THE GUITAR

There are other good classical guitarists on records, but there is only one Segovia. This unassuming artist has been "Mr. Guitar" for many years now and seems to be in no danger of being supplanted. Here in a varied program of works by classical composers such as Scarlatti and Dowland, and countrymen Manen and Espla, Segovia shows why he is supreme in his art. The incredible dexterity of his playing, the rock-bound rhythm, the colors and shadings of his phrasing, his expressive dynamics all contribute to his fabulous musicianship.

The most interesting work on this disc is by his Spanish contemporary, Manen. In the free form of a fantasia it runs the gamut of emotions through a solemn largo to a gay and lively allegro. Segovia's guitar is flawlessly reproduced, with great tonal beauty and superb transients. The plus attraction of dead-quiet surface helps the cause of realism.

MENDELSSOHN
SYMPHONY #3 ("SCOTCH")
FINNALS CAVE OVERTUTE

The third symphony of Mendelssohn has not received the attention afforded some of his other works, notably the 4th symphony. Thus this new recording is doubly welcome for its content and the excellence of interpretation. Dorati has always had a knack for Mendelssohn and his reading here is exemplary. He essayed judicious tempi throughout the score, being just a bit faster than most other recordings of the work. His is a very spirited reading, as full of vigor and life as the robust Scottish highlands which inspired Mendelssohn to write the work.

His reading of the "Finnal's Cave Overtu"e is quite exciting, capturing in music the restless swell and surge of the sea. The sound throughout is superb. The somewhat thick-textured Mendelssohn is perfectly articulated here with rich sounding strings, bright brass, persuasively live woodwinds and sharp clean percussion. The famous tympani rolls in the "Finnal's" come through well defined and with weighty impact. As in all of the English series of recordings, Dorati gets some beautiful playing from the London Symphony. Large acoustic frame here coupled with sparkling orchestral detail. Frequency range was

---

**YOU ALWAYS GET MORE THAN YOU EXPECT**

WHEN YOU BUY TELLA ANTENNAS!

THE TENNA MANUFACTURING CO.
CLEVELAND 25, OHIO

MADE BY THE WORLD'S LARGEST MAKER OF AUTOMOBILE ANTENNAS

---

**ENGINEERING**

Prepared for publication by our House Staff.

B.S. DEGREE IN 27 MONTHS

INDIANA TECHNICAL COLLEGE

528 E. Washington Blvd., Fort Wayne 2, Indiana

Catalog.

Please send for free information on B.S. ENGINEERING DEGREE IN 27 MONTHS.

Available at all leading parts distributors.

C.B.C. ELECTRONICS CO., INC.

2401 NORTH HOWARD ST.

PHILADELPHIA 32, PENNA.

**NOW $6.75 net**

THE MULTIPLE OUTLET BOX YOU'VE ALWAYS WANTED.

Features included plug, pilot light, control switch, six steady outlets, heavy-duty line cord. Attracive brown hammer tone metal case.
NOW ENJOY... House hold Electricily Anywhere!... Anytime!... in your own CAR, Boat or Plane!

NO INSTALLATION!... MOST MODELS JUST PLUG INTO CIGARETTE LIGHTER RECEPTACLE!

**A** Battery ELIMINATOR
For demonstrating and testing Auto Radios, TRANSISTOR or VIBRATOR OPERATED!

**A** Battery ELIMINATOR

**Plug-in-Type Portable INVERTERS**
Operates Standard A.C. BATTERY MACHINES.
Small-Record Players, Record Changers, etc.

**Universal INVERTERS**
Operates Standard A.C. BATTERY MACHINES.
Small-Record Players, Record Changers, etc.

**Plug-in-Type Portable MIGHTY MIDGET INVERTERS**
Operates Standard A.C. BATTERY MACHINES.
Small-Record Players, Record Changers, etc.

**Auto-Radio VIBRATORS**
Operates Standard A.C. BATTERY MACHINES.
Small-Record Players, Record Changers, etc.

**ATR**
Electronic Tube PROTECTORS
for both Auto Radio and two-way communication receiving sets; featuring Ceramic Stack Spacers for long-lasting life.

**Portable BATTERY CHARGERS**
for keeping the storage battery fully charged right in your Car, Truck, Boat, or Planet! A storage battery necessity—makes motor starting easy!

**ORDER TODAY!**
For the name of your nearest ATR ELECTRONIC PARTS DISTRIBUTOR, please communicate with your nearest ATR REPRESENTATIVE LISTED BELOW.

**AMERICAN TELEVISION & RADIO CO.**
Quality Products Since 1923
SAINT PAUL 1, MINNESOTA—U. S. A.

**American Television & Radio Co.**
300 E. 4th St., St. Paul, Minn.

**Gentlemen:**
The name and address of your nearest electronic parts distributor is...

**NOTE:** If distributor cannot supply you, feel free to order direct from factory, or ATR representative nearest you, as listed to the left!

**Send additional literature and price list on...**

**NAME: **...

**ADDRESS: **...

**CITY: **...

**ZONE: **...

**STATE: **...
Spot Radio News  
(Continued from page 18)

The military version of the Sikorsky S-58, equipped with a mass of instrumentation including high-frequency, very-high frequency, and ultra-high-frequency communications, tacan, omni-range and distance-measuring equipment, instrument landing system receivers, and automatic direction finders.

A PORTABLE, battery-powered, 50-cps to 100-icc transistorized micrometer, with a 200-micrometer (full scale), has been developed by the Bureau of Standards. Current pickup is a miniature split-core transformer that can be clamped onto a wire, making it unnecessary to open the circuit to make a measurement.

For many years, it has been common practice to extend the range of current-indicating instruments by using current transformers. For convenience, the transformer often consists of a secondary winding on a split core that can be clamped around the conductor carrying the current to be measured. This technique suggested a similar device for measuring small currents at audio and radio frequencies; an instrument consisting of a small clamp-type magnetic probe and a suitable means for amplifying the probe output to operate an indicating meter. Such an instrument would be complementary to the vacuum-tube voltmeter found in laboratories. The Bureau's device is not only based on the probe-amplifier-meter concept, but it is transistorized for long life and modest power requirements.

The circuit features a preamplifier consisting of two transistors and a feedback network. Gain in this stage is sacrificed to provide frequency equalization and to reduce phase shift at the higher frequencies. A pair of transistors are used in two intermediate stages, using direct coupling. A feedback network, from the emitter of the second transistor to the base input of the first, stabilizes the direct-current operating point for each pair and reduces the over-all current gain of each stage to about 20. The a.c. feedback factor at low frequency for each stage is the same, so a low-frequency current gain is thus stabilized against transistor and battery aging and the frequency range for constant response is extended beyond that available without feedback.

THOUGH U.H.F. has been shunned by many, one enterprising operator in the New England states has found the higher channels to his liking. WWLP in Springfield, Massachusetts, operating on channel 22, is using low-powered translators effectively to fill in shadow areas and provide service to over a million in the Connecticut River valley.

AS WE WENT to press, the stations listed on page 14 of this issue received authorization to go on the air.

THE ELECTRON microscope is now being used as a research tool to study wood technology.

A new powerful model, which can detect particles smaller than one ten-millionth of an inch, magnify them 50,000 times, and produce electron images so graphically sharp and detailed that they can be enlarged more than 300,000 times, has been installed in the College of Forestry of the State University of New York. At this enlargement scale, a quarter-inch wood splinter would appear as an object nearly two miles long.

IN ANOTHER UNUSUAL application of advanced electronic techniques, 40-megacycle signals, bounced from meteor trails 60 to 100 miles above the earth, have been used to transmit images of printed material over a distance of nearly 1000 miles without relays.

The test was conducted recently between a transmitting station at Havana, Illinois, operated by the Bureau of Standards and a receiver installation at Riverhead, Long Island. The novel system was developed for the Cambridge Research Center of the Air Research and Development Command.

In meteor-trail propagation, when a meteor enters the thin upper atmosphere of the earth, the high velocity of its passage causes the air particles to break down into positive and negative ions. This trail of ionized air, which may persist during a time interval ranging from one-tenth of a second up to several minutes after the passage of the meteor, acts as a reflector of radio signals which would otherwise radiate out into space. Along a transmission path of the type used in the experimental facsimile system, ionized meteor trails appear on an average of several times a minute to close the circuit between the transmitter and the receiver.

In the present system, material to be transmitted is recorded on 35-millimeter film, which is scanned to produce a signal in a manner similar to the techniques used in TV-film transmission. The resulting signal is sent out from the transmitter through a highly directive antenna aimed in the direction of the distant receiver. At the receiver, the signal is picked up by another directive antenna each time it is reflected during the brief life of an ionized meteor trail and the information is fed to a cathode-ray tube for display on a viewing screen. The scanner and the transmitter are run continuously, sending copies of a picture over and over at a rate of two complete scans each second.

Once more electronics has demonstrated its spectacular properties as a tool of the scientist—to mold a brighter future for mankind.
Leakage from other terminals at the CRT, leakage of the video coupling capacitor, etc., may cause this condition.

Lines with Dark Pix
Where the blanking pulse is applied to the cathode of the picture tube, leakage to the tube through the blanking network, instead of causing retrace lines with brighter-than-average images, can cause retrace lines to appear with a relatively dark picture. As in the preceding case, test to see whether the blanking network is at fault by disconnecting it. If the darkening clears up, the trouble is probably in the blanking network. If it persists, check for leakage at other points already suggested in the preceding example.

Blanking Amplifiers
Sometimes the blanking pulse is amplified before it is applied to the CRT. Such a vertical-blanking amplifier is shown in Fig. 6. Where difficulties arise in such a configuration, of course, the tube itself is an early suspect. As with any amplifier, voltage and resistance readings in the stage may also be helpful. Of course, one may also check for presence of the pulses at the appropriate points. Waveform $A$ should be found at point $A$; waveform $B$ should be found at point $B$ and again, amplified and inverted, at point $C$.

When a blanking pulse is to be applied to the first anode or focus electrode of the CRT, we are dealing with electrodes where the voltage is much higher than it is on either control grid or cathode. Accordingly, any blanking pulse that is to be applied at such electrodes must also be of considerably greater amplitude to be effective. It is for this reason that a blanking amplifier like that in Fig. 6 must be used.

Voltages at the grid and cathode of such a stage tend to be critical. Here they are set by a voltage divider consisting of $R_{101}$ and $R_{100}$. Any appreciable discrepancy should be adjusted by using resistors of close tolerance (5%). The plate circuit is also somewhat critical, but less so. Adjustment of resistors within 10% is acceptable.

The remaining components perform more or less the same functions as in the more simple circuits. Their tolerances are not too critical, but 10% replacements are advisable.

Note that the "B-*" supply is from the "B boost" in the horizontal circuit. It must be delivering the correct value or the blanking circuit can be upset. Also, in this case, the vertical-oscillator is supplied from the same source through a common resistor, as is the case here. A gassy vertical-oscillator tube can cause retrace-blanking failure by dragging down the applied "B-*" to the cathode circuit. The fault shown as low "B-*" at the vertical oscillator as well as the blanking circuit. --

Retrace Blanking Troubles
(Continued from page 67)
Sylvania Booklets
Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., has announced publication of two new booklets of interest to the industry.

Entitled "Industrial Tubes" and "Guide to Replacement," the new publications are designed as source material for distributors and users of industrial electron tubes. The first booklet describes the general characteristics of vacuum power tubes, beam power tubes, rectifiers, thyratrons, magnetrons, mercury vapor rectifiers, and ignitrons. It also lists the maximum ratings of these types. In addition, there are sections devoted to reliable and ruggedized tubes.

The second booklet lists the basic designation, tube class, and various manufacturers' type numbers for over one hundred tubes in Sylvania's industrial line.

Either or both of these booklets are available from the manufacturer without charge on request.

"Viking" Ham Equipment
E. F. Johnson Company of Waseca, Minn., has issued a new 28-page catalogue featuring photos, schematic drawings, and detailed descriptive data on its "Viking" line of amateur equipment and accessories.

Free copies of Catalogue #957 are available by writing William E. Browning, W9ZSO, advertising and sales promotion manager of the company.

Panel Meter Data
Ideal Precision Meter Co., Inc., 126 Greenpoint Ave., Brooklyn 22, N. Y., has released a new 4-page catalogue covering its latest styles and ranges of panel meters in sizes from 2-½" to 7-¼".

Catalogue C-22 carries complete specifications on all d.c. types and includes dimensional drawings, typical scales, and data charts. Featured are three new modern clear plastic models, the 212P, the 250P, and the 725P. Photographs are lavishly used in the publication.

For a copy of Catalogue C-22, write on your company letterhead direct to the manufacturer.

Resistor Color Coder
General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill., has issued a carbon resistor color coder which will be of help to service technicians, students, and hobbyists.

The handy gadget will allow anyone to read resistor color codes immediately. It works on the slide rule principle where the indicators on the slide are set opposite the colors in their order. The value of the resistor is read through associated windows in the center of the card.

The color coder measures 3-½" x 3-¾" and is sturdy and constructed. Colors are printed on a white background for easy identification and the printed portion is extremely easy to read.

The unit, catalogued as No. 5230, carries a list price of 25 cents and is available from parts jobbers.

Two New EIA Standards
Electronics Industries Association (formerly RETMA) has released two new standards of interest to the industry.

RS-196 covers fixed film resistors of high stability while RS-197 lists standardized specifications for power filter inductors for electronic equipment. The first publication, a 6-page pamphlet, is priced at 60 cents while the second, also a 6-page booklet, is listed at 50 cents a copy.

Either or both of these new standards may be ordered from the Association's Engineering Office at 11 West 42nd Street, New York 36, N. Y. Payment should accompany orders.

Centralab "Pec" Guide
Centralab, a division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis., has just issued a new 12-page guide which contains schematics and specifications on all 96 of the firm's "Pec" units.

The guide contains a complete cross-reference section which lists the manufacturer's part number of all packaged circuits used by 136 radio and TV manufacturers since 1949 and the corresponding Centralab replacement. There is also a section containing the proper test procedure for checking all of these packaged electronic circuits.

Guide No. 4 is available from the company's distributors or by writing the manufacturer direct.

"Profit Builders" Catalogue
The Advertising and Sales Promotion Department of RCA's Electron Tube Division, Harrison, N. J., has issued a colorful new "Profit Builders" catalogue which lists the company's sales promotion aids for radio-TV service dealers and technicians.

The 24-page catalogue, which is available from the firm's distributors, describes and illustrates more than 130 sales promotion, business, and technical aids for the use of service dealers and technicians in building prestige and profits.

Items in the catalogue range from a
OVER 17,000 HI-FI CUSTOMERS IN 1957
BOUGHT REALISTIC® EQUIPMENT BY MAIL *

*BECAUSE REALISTIC® PRICES ARE LOWER, OFTEN BY 50% OR MORE!
*BECAUSE REALISTIC® QUALITY IS THE TALK OF THE HI-FI WORLD!

REALISTIC® 12"-16" Arms

- Silicon Oil VISCOSUS Damaged!
- Exclusive PLUG-IN Heads (12)
- Licensed under CBS Patent Number 2676806
- 4 Separate Balance Weights for Latest Model Pickups!

16" ARM: Value $39.95* Sale $19.50
12" ARM: Value $29.95* Sale $14.95
*Suggested Audiophile Net

REALISTIC® Hysteresis Mk VII Turntable

- Hysteresis-Synchronous Motor!
- Made to sell for $84.50
- 3 Speeds: 33 1/3, 45, 78
- Meets NAB Broadcast Specs!

$6 Down,
$5.60 Monthly

$64.50

COMPLETE SYSTEM: includes turntable, 16" viscous-damped arm, unfinished rock-maple base pre-cut for table, and new G-E VR111 diamond-sapphire cartridge. Reg. value $122.95.

REALISTIC® 10W Amplifier

5 Tubes, Big Transformers!

BUILT TO SELL FOR $44.95, this 10-watt amplifier is the best-selling basic control center in hi-fi today. 18 watts peak, 20-20,000 cps ± 1 db @ 3%.

$29.95

NEW MODEL of the FM tuner that received rave reviews in top audio magazine and reports! Attach to any amplifier, console or TV set. Compact 9½ x 4½ x 6½" size. 20-20,000 cps response, Armstrong-type FM

$5 Down,
$5 Monthly

$47.50

Introductory Sale!

REALISTIC® Speakers

$19.95

2 FOR STEREO
Sale, 2 for $37.50

14½ x 11 x 10½" In Cabinet!

Fabulous "Solo"! a compact dual-cone speaker completely and installed in its solidly-built mirror-finished mahogany case! Finished on FOUR sides. Includes rubber feet. Tuned, vented duct-type Helmholtz resonator. 50-4,000 cps, march 4-8 ohms. Made to sell for $37.50.

REALISTIC® Tape is GSF*

*Guaranteed Splice Free

1200' Guaranteed Splice Free Tape


$1.79

1800' Guaranteed Splice Free Tape

7" reel, as above except 50% MORE playing time due to 1 mil. thickness. Regularly $4.98.

$2.69

Mail Coupon NOW!

Radio Shack Corporation

Please send me:

☐ Speaker $19.95 R-9006-2 12 lbs.
☐ "16" Arm $19.50 R-9006-2 4 lbs.
☐ "12" Arm $19.50 R-6002 5 lbs.
☐ Amplifier $29.95 R-9140 4 lbs.
☐ FM Tuner $47.50 R-36-806 10 lbs.
☐ Tunable $64.50 R-7903 16 lbs.
☐ " System $97.50 R-7903SYF 30 lbs.
☐ 1200' Tape $1.79 R-9212 1½ lbs.
☐ 1800' Tape $2.69 R-9118 1½ lbs.

More data on:__________________________

FREE 64-page Hi-Fi Buying Guide 259-R

*Introductory sales prices for limited time

My Name_________________________

Street_________________________

Town _______ Zone _______ State_____

February, 1958
Quick, Easy Access to Your MINIATURE CHASSIS With XCELITE’S Handy Pocket NUTDRIVERS!

Today’s Increasing Miniaturization prompted XCELITE to bring you these Super Handy Pocket Nutdrivers with the convenient pocket clip.

You’ll want to keep all four of these “just-right-hex-size” XCELITE Pocket Nutdrivers clipped in your shirt or coat pocket. They’re ideal to reach those “hard-to-get-at” places in the new miniature and subminiature sets.

Fact is, XCELITE Pocket Nutdrivers are just like all the other quality band tools.

XCELITE, INCORPORATED
Dept. E, Orchard Park, N. Y.
In Canada—Charles W. Polleton, Ltd., 6 Alico Ave., Toronto, Ont.

SPELLMAN HIGH VOLTAGE STEP-UP COILS FOR EXPERIMENTERS • ENGINEERS RESEARCH LABORATORIES for construction of RF type High Voltage DC POWER SUPPLIES

Coils are furnished with schematic diagrams showing various circuits, regulated and unregulated, of DC power supplies from 5KV to 90KV.

35 KV COIL
35 KV ........................ $ 7.00
10-15 KV ........................ 12.00
25 KV ........................ 36.00
35 KV ........................ 42.00
70 KV ........................ 75.00
Filament Transformers ...... $1.50
All prices are Net
SEND FOR COMPLETE CATALOG RT OF POWER SUPPLIES AND COILS

SPELLMAN TELEVISION CO., INC.
3029 WEBSTER AVENUE
N. Y. 67, N. Y.
Kingsbridge 7-8306

DATA ON SERVICE PARTS
Workman TV Inc., 309 Queen Anne Road, Teaneck, N. J., has issued two new data sheets of interest to the service field.

One sheet covers exact replacement resistors for use in transistorized auto radio output circuits, while the second provides full specifications on the firm’s Model # D1 “Adapt-it” for use with the new RCA type 110-degree TV picture tubes. The adapter converts the base of the 110-degree tube to that of the standard duo-decal type so that all existing harnesses and test equipment for standard duo-decal picture tubes can be used.

Write the company direct for either or both of these data sheets.

NEDA SPEAKER ROSTER
The national office of the National Electronic Distributors Association, 343 S. Dearborn St., Chicago 4, Ill., has issued a directory of speakers on electronic subjects for use by NEDA chapters and educational seminars.

Designed to be of help in making up programs, the directory lists speakers by company affiliation, subjects, geographical areas preferred, advance notice required, and minimum audience. This project is designed to serve as a bridge between manufacturers’ personnel who have something worthwhile to say and the audience they are trying to reach. Revision of the directory will be a continuing process and manufacturers are urged to furnish names of speakers for inclusion in future editions.

FREE LAMP CHART
A special industry-wide chart on panel and flashlight lamps has been compiled by United Catalog Publishers, Inc., 60 Madison Ave., Hempstead, N. Y., and is being offered free to interested industry personnel.

The new chart is a composite listing, arranged numerically, of all panel and flashlight lamps manufactured by Chi-co, Miniature, Caucasian, R.C.A., Raytheon, Wang-Sol, and Westinghouse. Simply by checking the lamp number the user can determine at a glance the respective manufacturer, bulb type, base, volts, amps, and bead color. All bulb types are illustrated with physical dimensions.

The company is publisher of “The Radio-Electronic Master,” the 1958 edition of which has just been released.

"PETTI-SEL" RECTIFIERS
Radio Receptor Company, Inc., 240 Wythe Ave., Brooklyn 11, N. Y. has issued a new bulletin giving ratings and dimensions for its new high-cur-
rent-density "Petti-Sel" industrial type selenium rectifiers. The bulletin also has data on upgrading the rectifiers when cooled by forced air.

A life of at least 100,000 hours is claimed for the industrial type "Petti-Sels" used according to the ratings indicated in Bulletin No. 248A, a copy of which is available without charge.

INDICATOR LINE
Eldema Corp., 1805 Belcroft Ave., El Monte, Calif. has just published a new brochure which covers a complete line of miniature indicator lights and special-function indicators for aircraft, computers, and industrial and laboratory instruments.

A transistor circuit indicator containing a diode network which adapts transistor voltages to fire a neon lamp is one of the featured items of this publication. The 6-page, two-color brochure includes photos, descriptions, and dimension drawings plus a sectional drawing showing general construction.

RACKS AND CABINETS
Par-Metal Products Corp., 32-62 49th Street, Long Island City 3, N. Y. is now offering copies of its new product catalogue which contains illustrations, descriptions, technical specifications, and prices on an extensive line of universal cabinet racks and utility desk assemblies.

Catalogue 58 also lists accessories and fittings used in conjunction with the basic housings. This 28-page catalogue will be supplied without charge on request.

OLSON FLYER
Olson Radio Warehouse, 260 S. Forge St., Akron 8, Ohio is now mailing out copies of its 28-page flyer which lists literally hundreds of unusual values in all types of electronic equipment.

Included are speakers, record changers, tools, timers, radio receivers, tape recorders, service parts, tuners, preamps, amplifiers, audio accessories, test equipment in factory assembled and kit form, motors, TV accessories, shop supplies, tubes, wire, etc. The flyer also lists premiums which buyers can obtain by saving the coupons which are given with purchases from the company.

Those who haven’t received a copy of the flyer may write the company for one. It is available without charge.

1958 RCA POCKET BOOK
The 1958 edition of the RCA Reference Book is now available from the company’s distributors.

Published annually since 1931, this pocket-size book contains 216 pages of up-to-date information on RCA electron tubes, test equipment, batteries, transistors, and semiconductor diodes. The data has been carefully selected to be useful to design engineers, service technicians, and purchasing agents.

The book has interchangeability directory for tubes, transistors, and batteries. It also contains a daily reminder calendar and 16 pages of world maps in color.

FREE—a new 100 page TV Replacement Guide with a brand-new format. Locates the replacement immediately—with or without the original part number. Models listed individually in numerical order. See your distributor or write us for your free copy.

CHICAGO STANDARD TRANSFORMER CORPORATION
3505 Addison Street • Chicago 18, Illinois

Export Sales: Roburn Agencies, Inc. • 431 Greenwich Street • New York 13, N. Y.

YOUR COPIES OF RADIO & TV NEWS ARE VALUABLE!

Now you can keep a year’s copies of RADIO & TV NEWS in a rich-looking leatherette file that makes it easy to locate any issue for ready reference. Specially designed for RADIO & TV NEWS, this handy file—with its distinctive, washable Kivar cover and 16-}

-130-
Here's how to GET MORE WORK OUT OF YOUR Oscilloscope!

A Complete, easily understood guide to using the best service instrument of them all

MODERN OSCILLOSCOPES AND THEIR USES

By Jacob H. Ruiter, Jr.

**Enlarged 2nd Edition**

- ...contains the latest data you need to know about 'scopes!
- MORE THAN 30 NEW PICTURES
- plus 50 more pages on use of 'scopes in Color TV servicing... Industrial Electronics... Teaching... even in Atomic Energy work.

Oscilloscopes are gold mines for servicemen who learn to use them fast, easily, and accurately on all types of work—and here is a new, enlarged 2nd edition of THE BOOK THAT REALLY SHOWS YOU HOW.

In clear, easily understood terms, it teaches you when, where and exactly how to use the oscilloscope... how to interpret patterns... how to use your 'scope to handle tough jobs easier, faster, and better.

It contains no involved mathematics—no complicated discussions. Instead, it gets right down to "tricks of the trade" in explaining how oscilloscopes operate. Then you learn exactly what is going on in lab work and on all types of A.M. F.M. and television service—from locating troubles to handling tough readout jobs.

'SCOPES ARE "GOLD MINES"... With them you can Use Them Right!

Each operation is explained step by step. You learn to determine just where and how to use the 'scope on specific jobs; how to make connections and adjust circuit components; how to set the controls; and how to analyze oscilloscope patterns fast and right.

274 illustrations, leading dozens of pattern photos make things doubly clear.

No other type of specific servicing book can mean so much to you in boosting your efficiency and earning power! Send coupon NOW for 10-day examination!

**PRACTICE 10 DAYS—FREE!**

PINCHART & CO. INC.

36 W. 42nd St. 

Send modern oscilloscopes and their uses for 10-day free examination. If led to satisfaction, I will then send you $6.00 color copy. Photographs and illustrations in full color. If not, I will return both. Offer good while stocks last. (You may save $6.00 with order and we pay postage. Same 10-day return privilege with money refunded.)

NAME...

ADDRESS...

CITY, ZONE, STATE...

OUTLINE B.A. stores each only. Write me if you return book within 10 days.

JFD "SELL-A-BRATION"

JFD Electronics Corp., 6101 16th Ave., Brooklyn 4, N.Y. has a large-scale "Sell-A-Bration" sweepstakes program underway which will continue until March 31st. Each service-dealer will receive certificates good for brand-name merchandise with the company's "Color-tennas." The selection of prizes embraces over 1000 gifts as well as pleasure trips. Grand prizes are to be awarded, over and above these incentives, consisting of four-expenses-paid trips for two to Paris, Bermuda, and the Waldorf-Astoria Hotel in New York, to the three service dealers earning the highest number of certificates. The winners will be announced May 19 at the Electronic Parts Show in Chicago.

Information on the "Sell-A-Bration" promotion is available from the company.

""3-D" WELLER SIGN

Weller Electric Corporation of Easton, Pa. has developed a multi-use, three-dimensional sign in four vivid colors to help electronic distributors merchandise its professional model soldering guns.

The display may be mounted for framing, to give added size to the sign in large display areas; hung on a wall by using tacks or nails in side tabs with holes; set up on counters; or attached to display cases.

The plastic sign, which is red, yellow, white, and black, features a soldering gun and appropriate selling copy. The sign measures 22" long, 17" high, and less than 2" thick. It is available to distributors without charge.

**SELF-SERVICE CAPACITORS**

Designed for easy self-service and maximum display value, the new floor racks for distributor establishments offered by Cornell-Dubilier Electric Corp., South Plainfield, N.J. are proving exceptionally effective in merchandising the firm's "preferred-type" twist-prong electrolytics.

Each single-section rack with canopy holds 360 cartons or 720 capacitors for the dual-section unit. Finished in blue and yellow, the rack features a lighted canopy, illuminated stocks, slanted shelves for easy reading and selection of types, convenient front re-loading, and no "blind stock," making self-inventory a simple matter.

**PENTRON STEREO DISPLAY**

A new demonstration center display for stereo and monaural tape components is now available from Pentron Corporation, 777 S. Tripp Ave., Chicago 24, Ill.

The display is made of ¾" plywood and the natural finish of the wood is lacquered and silk-screened. The dealer may use the display as offered or it can be painted any color to match the store decor.

The unit accommodates a tape mechanism and three flush-mounted tape preamplifiers. The customer can easily select the stereo and hi-fi units he desires since all units are operative in the display.

**WIRE PROCESSING FILM**

Eubanks Engineering Company, 260 N. Allen Ave., Pasadena, Calif. has produced a 15-minute 16 mm. color motion picture on its new automatic wire cutter and stripper which is being made available to interested groups on a loan basis.

Entitled "Modern Wire Processing," the film shows in detail the action and operation of the machine which will cut and strip 12 to 32 gauge insulated wire in lengths from 1 inch to 300 feet at speeds up to 8000 pieces an hour.

"CONTROL-MASTER" TESTER

Packard-Bell Electronics Corp. of Los Angeles has come up with a unique "shopper stopper" which enables customers to test its new "Control-Master" television remote control unit.

With the unit mounted on a display, the shopper may change channels on a nearby television set, turn the set on or off, adjust picture brightness, fine tuning, and volume control. In addition, the customer can switch the sound from the set to the self-contained speaker in the control unit for personal listening.

**STOP THIS**

Stainless steel TV Tuning

RADIO & TV NEWS
**TERIFFIC BUY! RADIO DYNAMOTOR**

Type: DY-35/XT-2

**Input:**

V.D.C. @ 25 A

**Output:**

V.D.C. @ 225 A

125 V.D.C. @ 505 A

9.5 V.D.C. @ 15 A

18.5 V.A.C. @ 3.7 A

Complete with mounting hardware: **BRAND NEW in original package** $7.95

Weight 2 lbs.

**BC-645 XMTR RECEIVER**

15 Tubes 435 To 500 MC

Can be modified for 2-way communication (code, a.m., n.m., hi-fi). F.M., on band 120-150 mc, citizens radio 160-190 mc, fixed and mobile 10-14 mc. Rearanger circuit. Tubes: Brand New. Excellent. **Complete Set of 10 Tubes** NEW $7.95

**PE-101C DYNAMOTOR**

DC-645 input (easy to convert for 6V battery operation). **Complete Set** $29.50

**UCF-28 RECEPTOR**

Radio Receiver: 100 to 156 mc in 100 kh. Brand New $20.45

**ARC-5/T-2 TRANSMITTER**

UHF Antenna Assembly: **BRAND NEW** $2.45

**ARC-5 GIRNE TRANSMITTER/RECEIVER**

NAVY Type Command, 1.5 to 5 kh BRAND NEW: $16.95

**BC-659 TRANSMITTER & RECEIVER**

Complete set with all tubes and crystals, **BRAND NEW** $29.50

**TC-32A-1 TRANSMITTER**

10-channel push button tuning or continuous tuning. 10-20 Mc. **BRAND NEW** $19.95

**BC-683**

Complete set with all tubes and crystals, **BRAND NEW** $29.50

**RECEIVER NAVY TYPE RAY-3**

Model AN-PR26 is for IS 140 DC operation. **BRAND NEW** $24.95

**AIR NAVY RECEIVER-TRANSMITTER**

**AN-22R, BRAND NEW**, tube includes: 1.25 Mc band receiver. Complete with speaker, tubes. **BRAND NEW** $11.95

**POWER SUPPLY**

77-45A, 505 V tubes $12.45

**BC-603 FM RECEIVER**

10-channel push button tuning or continuous tuning, 10-20 Mc. **BRAND NEW** $19.95

**DYNAMIC HEADPHONE, with "Press-to-talk" Switch, cord and plug—** **BRAND NEW only** $2.95

**DYNAMIC HEADPHONES**

With large earphone cushions, cord and phone only **BRAND NEW** $4.95

**Hi-Fi IMPEDANCE MATCHING TRANSFORMER**

For headphones 600 ohms or 8000 ohms. With plug and jack. **BRAND NEW** $9.95

**Hi-Fi DYNAMIC HEADSET with Cushions**

**BRAND NEW** $9.95

**MICSOPHONES**

EXCELLENT BRAND NEW

**T-17** Carbon Hand Mike... $5.95

**T-29**... $4.95

**T-45**... $4.95

**T-9** Handset... $4.95

**HEADPHONES**

**Model**

**Description**

**Hi-Fi**

**T-43** High Impedance... $2.25

**T-45**... $5.95

**T-49** Low Imp (feathered)... $1.95

**CD-3043** Cords with PL05 plug $7.75

SCHEMATIC DIAGRAM on this page, each $0.95

**FL-5 FILTER**

**FL-5 FILTER** $2.50

**G & G Radio Supply Co.**

Telephone: CO 7-4405

51 Vesty St., New York, 7, N. Y.

**SC-242 MINE DETECTOR**

Locates buried metal objects up to 8" or more. Target by means of sound. Operating wt. 15 lbs. Shipping wt. 10 lbs. **Completely Assembled BRAND NEW** $29.50

**MN26Y BENDIX DIRECTION FINDER**

150-1525 kc 325-685 kc 3.4-7 Mc. Complete with cables, **BRAND NEW** $26.95

**BENDIX DIRECTION FINDER**

Will find location of ships and planes. Complete installation includes:

**MN-26C**

Tubes, 12 tubes...

**MN-26E**

Complete, 12 tubes, **BRAND NEW**...

**MN-26-5 Rotatable Loop**...

**MN-52 Ammeter Control Box**...

All necessary accessories for above in stock.

**ASB-5 SCPE INDICATOR**

**BRAND NEW**, including all parts together with 5 BP Electroscopes. **BRAND NEW** $86.50

**NAVY HANDY-TALKY TRANSMITTER**

Brand new, complete with phone jack, **BRAND NEW** $65.00

**LORAN APN-4**

**FINE QUALITY NAVIGATION EQUIPMENT**

**BRAND NEW** only $48.49

**LORAN APN-4**

**NAVIGATION KIT**

**FOR NAVY** $215.00

**BRAND NEW** only $19.95

**BC-221 FREQUENCY METER**

Special Buy! Complete with operating manual. **BRAND NEW**...

**BC-221 FREQUENCY METER CASE**

**BRAND NEW** only $48.49

**LM FREQUENCY METER**

Crystal calibrated modulated. Heterodyne 125 kHz to 500 kHz. With Calibrator and Test. **BRAND NEW**...

**GOLD PLATED SPECIAL**

**T-31/AR-1 TEST OSCILLATOR**

Portable 15 mc to 90 mc. **BRAND NEW**, in metal housing 9% x 7% x 1", **BRAND NEW**...

**G & G SPECIAL PURPOSE TUBES**

In Original Individual Packages

**BC-422 METER**

$4.50

**BC-424**

$5.25

**BC-435**

$6.95

**BC-455**

$10.95

**SMALL WATT VOLT BATTERY**

3 Amp. Hour. **BRAND NEW**, 9% x 1% x 1%...

**2 VOLT BATTERY "PACKAGE"**

1-2V, 20 Amp. **BRAND NEW**...

**WILLIAM 60 VOLT MIDGET**

3 Amp. Hour. **BRAND NEW**...

February, 1958
Service Dealers and Sales (Continued from page 58)
sell service as a commodity at a price that will give us a profit. This will keep us exposed to the cut-rate, set-business that has been falling in the laps of the specializing service shops."

Obviously, all TV set retailers eventually will have to re-appraise the service phases of their businesses. The continuing shortage of competent service technicians will make it necessary for dealers to pay competitive wages to get and keep good men. The recent action of department and specialty stores in San Francisco in accepting a three-dollar-per-hour rate of pay for TV technicians indicates the determination of dealers to maintain their positions in the service market. To operate a service department profitably when technicians are paid at that rate requires a minimum charge for home service calls of six dollars and twenty-five cents. The operation of dealer service departments on a profit-producing basis will have an important influence on creating a healthier business atmosphere for the entire TV service industry.

Another factor that will influence the thinking of retailers about developing their service departments more aggressively is the steady trend among part-time technicians to charge as much for their services as the full-time service dealers. Actually, many part-timers are reaching the conclusion that they provide a premium type of service, since they are available to repair sets during the hours when TV service shops may be closed. The result is that, except for the sharpies who advertise sub-standard charges as a gimmick to hook suckers, the public is being steadily educated in the wisdom of paying reasonable rates for TV service.

From a selling standpoint, it will become increasingly necessary for TV-appliance retailers to promote their service facilities and to make their service departments profit-producing facets of their businesses. Barriring a revolutionary change in TV reception methods, neither cabinet design, nor appearance, nor circuit improvements will inspire the public to trade in operating old sets for new models. TV sets are bought for their utility as media of entertainment. Owners will use old sets until they are faced with the prospect of paying a big repair bill for a major overhaul job. The service technician on the job when the owner realizes the old set should be replaced is the key spot to sell him a new set.

Thousands of service dealers have already become firmly entrenched in retailing TV sets. But they still promote service as the primary function of their businesses. While good service is the key to sales, the service requirements of TV make it imperative that service time, knowledge, and skill be sold at a profit.

EARN TOP SALARIES! BUILD AN EXCITING FUTURE! READ:

YOUR CAREER IN ELECTRONICS
A NEW ZIFF-DAVIS PUBLICATION

This fact-filled volume prepared by the combined staffs of RADIO & TV NEWS and POPULAR ELECTRONICS is written for men who have a stake in the fastest-growing industry in the world—electronics! If you’re eager and ready to move into a more advanced, higher-paying electronics specialty or want to begin an electronics career, don’t miss this informative 132-page publication.

IT TELLS YOU
- what job opportunities are available in electronics
- how to prepare for a job in electronics
- how to get a job in electronics

CONTENTS


CAREERS IN PROGRESS—I am an Atomic Engineer . . . I Ride the Satellites and Rockets . . . I Make Electronic Brains . . . Thank Me for Safe Air Travel . . . We Make Color TV . . . We’re Looking for Tomorrow

SURVEY OF THE JOB MARKET—Personnel requirements of the largest electronic manufacturing firms—number of technicians, engineers needed, kind of background required, salaries offered, training given and opportunities for advancement.


BASIC ELECTRONICS—A brief course in the fundamentals of electronics. It gives the beginner a knowledge of terminology and some familiarity with the electronics field.

Buy a Copy of YOUR CAREER IN ELECTRONICS ON SALE NOW AT ALL NEWSSTANDS—only 75c
DURING recent months, a comparatively new advertising technique has been receiving considerable publicity. This technique uses the principle of "subliminal perception." The term, borrowed from psychology, refers to the fact that we are able to perceive or apprehend something even though we are not actually conscious of it through our physical senses. Hence, we are made aware of some bit of information by an appeal directly to our subconscious minds, without our being aware of seeing, hearing, or feeling the information itself. The method has already been tried with some success in the movies, where a special projector is used to flash a brief commercial on the screen for only 1/100th of a second.

Since such brief exposures are not practical for TV, two other methods have been tried. In one of these the commercial is superimposed on the received program for as long as several minutes, but the brightness level is kept high, so the viewer is not conscious of it. This method has been tried only on closed-circuit TV, where its proponents have claimed some success. In a second method that has been tried over the air by an independent TV station, the subliminal ad is put on one frame out of 250 frames in a film loop. The commercial is sent out once every 11 seconds more or less steadily on some of the station's programs. Here again the ad is superimposed on the regular program. Results of this test have been inconclusive.

As a result of the public clamor and interest, the major TV networks as well as the National Association of Radio and Television Broadcasters, have made statements on the subject of subliminal ads. In essence, the networks have forbidden the use of such techniques while the NARTB stated that the process should not be permitted on the television broadcast medium.

Because of Congressional protests, the FCC has undertaken a study of the technique as expeditiously as possible. Upon the completion of this study, the Commission proposes "to take such action as may be warranted under the circumstances." The Commission has further indicated that the problem is such that the public interest is not in immediate danger of being adversely affected. They feel that the subliminal prove has been given of the recognition on the television licensees of their responsibilities and obligation to operate their stations in the public interest.

---

February, 1958
**Radio Communication Terminal Carried by Air**

Signal Corps evaluates new air-transportable radio terminal providing high-mobility "transhorizon" link.

A COMPACT, air-transportable radio communication terminal with an antenna that inflates like a balloon, is being evaluated by the U. S. Army Signal Corps. The terminal was designed and built for the Army by Collis Radio Co. of Cedar Rapids.

Capable of being completely packed in two metal "huts" that serve as shelters when the station is erected, this terminal provides the greatest mobility available today for radio communication called "transhorizon." The two huts may be carried by transport aircraft or by motor vehicles.

The transhorizon method, based on the scattering effect of radio waves, provides reliable communication for 50-150 miles without relays. Up to 12 voice or 96 teletypewriter messages can be handled at a single station, which operates in the u.h.f. range.

Two dish-shaped antennas, 15 feet in diameter, are used. The inflatable portion of the antenna consists of two pieces of plastic fabric clamped together to form an enclosed envelope. The rear piece of fabric is coated with aluminum to reflect the radio energy. A motor-driven blower inflates the antenna to the desired pressure and maintains this pressure.

The complete antenna assembly, including tower, weighs only 400 pounds, compared to 1350 pounds for equivalent conventional metal antenna and tower. The complete antenna assembly can be dismantled and stored in a space about 3 feet x 2 feet x 7 1/2 feet, while the major part of a 24-foot trailer is required for only two conventional metal antenna assemblies.

The air-inflated antenna, which is considerably lighter than conventional metal antennas, may be easily erected or dismantled at the station site by a few men.
Olson's new big warehouse is completely mechanized and can fill 300 orders per hour. Order from Olson with confidence. Get fast service and big discounts on nationally famous products.

**ORDER FROM... Olson's Big New Warehouse**

**2½" De Luxe Hard Cone TWEETER**
- Stock No. 5-287
- $3.11
- Use with Dual Turnover Crystal Cartridge
- Foot #1 for $5.00
- Sound absorbing sponge rubber padding for lining Hi-Fi speaker enclosures. Easily cut to any size cabinet.

**NEW WEBCOR 4-SPEED AUTOMATIC RECORD CHANGER**
- With Dual Turnover Crystal Cartridge
- Stock No. RP-45
- $25.87
- Plays 78, 33½, 45 and 7½ RPM. Three speeds change automatically, heavy 3 1/2 lb. tone arm with rubber cap. 1 1/2" knob can be turned for automatic play. Overall size 12" x 13½" x 9½". 5½" "Hand" hemimetall finish. 110-120 Volts 60 Hz. Shipping weight 15 lbs.

**ACOUSTIC FOAM**
- Stock No. CA-62
- $3.02
- Roll size 72" x 18" x ½". Use in Transistor tape. At Aristol-Bitt sliding drawer at set price.

**“B” Battery Eliminator & Charger**
- Size ⅜" x ⅜" x 1½".
- Stock No. RA-39
- $2.88
- Use with Dual Turnover Crystal Cartridge.

**JENSEN 12" SPEAKER WITH WHIZZER CONE**
- Stock No. S-369
- $7.03
- With battery eliminator, amplifier and speakers. Operates 25 watts.

**GERMANIUM RADIO**
- Complete with Crystal Earphone
- Stock No. RA-277
- $36.33
- A completely assembled radio featuring germanium diode detectors, 3 tubes, 9 volt battery, complete with earphone and manual.

**NEW 4-SPD PLAYERS**
- Stock No. MO-6
- $6.73
- Genuine oliphine 4-speed motor and turntable. Self-lubricating, only one drive, 16½, 33½, 45 and 7½ RPM. 45 RPM built-in record adapter plus In-Store plan. 110 V. AC. 60 cy. Shipping weight 1 lb.

**OLSON BARGAIN STORES IN:**
- CHICAGO—423 W. Randolph St.
- CHICAGO—123 N. Western Ave.
- CLEVELAND—2020 Euclid Ave.
- PITTSBURGH—5196 Penn Ave.
- MILWAUKEE—423 W. Michigan
- BUFFALO—711 Main Street

**IT'S EASY TO ORDER FROM OLSON'S**

Send Orders to Akron, Ohio

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description, and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship COD and you may pay mail or expression for merchandise and postage.

**MONEY BACK GUARANTEE:** Everything you order from Olson is guaranteed as advertised. If you are not more satisfied, you may return merchandise for cash refund.

<table>
<thead>
<tr>
<th>Quan.</th>
<th>Stock Number</th>
<th>DESCRIPTION</th>
<th>Price</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SHIP 1-28**

- **NAME:**
- **ADDRESS:**
- **CITY:**
- **ADD POSTAGE:**
- **TOTAL AMOUNT:**
- **ZONE:**
- **STATE:**

- **T-28 FORGE ST.**
- **AKRON 8, OHIO**

February, 1958

145
high premium in terms of amplifier watts, which cost money and involve bulky equipment.

We have ourselves often been astonished at the small increase in sound level in a concert hall which results from doubling the power. Using four 15-watt amplifiers, each 15 ohms output, in parallel, gives 60 watts when four 15-ohm speakers are switched on, also in parallel. With one speaker in circuit the available power is only 15 watts due to mismatch. Under these conditions, two speakers are better than one and four are better than two, but the total difference never sounds like 45 watts. The same argument applies in reverse under domestic conditions, where we can drop from 30 watts to 15 watts in amplifier output with little apparent sacrifice in sound. (The reader will notice I am careful to say "we can drop . . ." rather than you, because this viewpoint is more popular here than in the States!)

I admit that the margin of safety on the peaks shown in Fig. 35 is greater with a 30-watt amplifier than with a 15 wattter, but I am assuming that the domestic levels of 3-5 watts on full orchestral (previously stated as adequate)—will not touch 15 watts on transient peaks with drums and cymbals.

**Measurement of Efficiency**

This is even more difficult than rating power handling capacity. When I see it stated that the efficiency of horn-loaded speakers is 40% compared with 8% for reflex enclosures, and even as low as 2% for small infinite baffles, I can only conclude that the conditions of test do not even approximate the conditions of use, so the findings are of doubtful value to the average listener.

The question of where a test is made is of vital importance. For instance, if you work under free-field conditions and measure the output at the mouth of a horn you will obtain a maximum reading, but if an open baffle is used the reading in front of the cone represents only half the output which would be available in a live room. The reverberation time of the listening room also affects results—the longer it is, the greater the build up of sound, but this would not necessarily affect all speakers to the same extent.

The strongly directional properties of horn loading are too well known to need further emphasis, but if efficiency tests are made on-axis they do not apply if you listen 30° off-axis. In other words, directional properties have a lot to do with the question, and an omni-directional speaker system rated officially as 8% efficient might give an average sound level in a normal listening room almost equal to horn-loaded types rated much higher. Part 9 of this series will deal with speaker mounting and response curves will

**ALL ABOUT AUDIO**

(Continued from page 37)

(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.**

**HI-FI ANNUAL**

Partial Contents

* Why’s and wherefore’s of room acoustics, speakers, enclosures.
* How to buy and install preamps, equalizers, tone controls.
* Do’s and don’ts of amplifiers.
* Latest techniques and ideas on stereophonic sound.
* Tape recording ideas and recorder guidance.
* Transistor hi-fi.
* All about speakers and enclosures.
* Building, servicing and improving hi-fi systems.

**HI-FI ANNUAL**

Now on Sale Everywhere

**Only $1.00**
show that these differences are not as great as one might expect, although it is clear that the totally enclosed cabinet filled with sound absorbents mops up half the sound produced by the cone, and reflex enclosures absorb much of the middle and upper registers.

**Amplifier Output**

The relationship between speaker efficiency and amplifier watts was clearly explained in the August 1957 issue of this magazine by N. H. Crowhurst in his excellent article on "High Power vs Low Power Amplifiers." The following quotation sums up the position very neatly:

"Take a 2% efficiency speaker in comparison with a 10% efficient speaker. Obviously, a 10-watt amplifier with a 10% efficient speaker will produce the same acoustic output into the room as will a 50-watt amplifier with a 2% efficient speaker. Both will give a maximum of just 1 watt into the room."

Mr. Crowhurst also said that the actual sound energy you need in the living room is only a matter of hundreds of milliwatts at the peak. I agree.

**Load Matching**

It is, I think, necessary here to repeat the warning that we only get 10 watts out of a 10-watt amplifier when it is correctly loaded. Amplifier makers belong to the more fortunate members of the audio industry; they provide a 15-ohm output and then make all their tests with a 15-ohm resistor across the terminals. No wonder they produce such wonderful results! I ask you, how many loudspeakers look like a pure resistance?

Mr. Cooke has already expatiated in Part 6 on the difficulty of matching electrostatic speakers to an amplifier and translating watts into sound without hidden losses. Many moving coil systems show a steep rise in impedance below 100 and above 2000 cps. It is easy to remember that a rise from 15 ohms to 30 ohms reduces 10 watts to 5 watts; nevertheless this is often forgotten. The virtue of a level impedance curve cannot be over-emphasized.

*(To be concluded)*
Video Color Converter 
"Previewed" by Long Distance Phone

New Ampex video color converter revealed to TV stations

Ampex gave the entire TV station network of the United States, Hawaii, and Puerto Rico a preview of the delivery and production plans on its video tape recorder recently in a series of long distance telephone calls.

President George I. Long of Ampex Corporation set a record for long distance telephoning by talking to 510 persons in 48 states and overseas.

The persons to whom Mr. Long talked were, for the most part, owners or managers of America's television stations. Radio & TV News also received a call from Mr. Long so that he could break the news to our readers. The calls were to announce Ampex' new tape recording equipment which will record and playback color television programs. The new gear is expected to be in production by June of this year.

"Conference" Calls Used

Long's call actually was a series of 22 "conference" calls during which he was heard by 24 persons at a time. His words were recorded on a tape recorder and played back into the telephone each time that another 24 listeners were connected by telephone operators across the country. Each call lasted approximately five minutes.

Starting at 7:30 a.m., with 10-minute intervals between calls, the telephone operation required about 5 hours to complete.

Long talked first to cities in the eastern time zone and last to Pacific Coast cities and Hawaii. Pacific Telephone & Telegraph Co. said it was the most extensive use of its conference call service ever made by one person in one day.

New Color Adapter

Engineering on the new color adapter, which has been priced at $29,000 each, is being completed now. Two units have been promised to CBS for May, 1958 delivery. A segment of the industry is expected to wait until every field tests have been conducted before ordering, but others are hastening to get their orders in to assure early delivery.

The new color converter will fit in a standard 19-inch rack mount. One section of the black-and-white electronics will be removed from the VTR and replaced by color conversion equipment. The balance of the equipment is designed to stand alongside the VTR in a single rack panel.

Ampex field engineers will assist TV station personnel in making the switch over from black-and-white to color. The company's officials claim conversion can be done in one week by station engineers. Complete instructions are included in a manual which accompanies the equipment.

Basically, the color converter records the entire color signal (which is different from the black-and-white signal) on a single channel continuous recording. The same head as used for black-and-white picture recording will be used for the color picture. The head will turn the same number of revolutions, but there will be a slight modification in the heads, for technical reasons.

"We will put strob marks on the rotating heads," explained Jack Hauser, company executive. "There will be a photo-sensitive device to synchronize the mechanical timing."

The Ampex videotape development, which may sound the death knell of kinescope film records, was first announced in April, 1956. More than 100 stations placed orders for the units at $45,000 each. Prototype models were put into active use by major TV networks the following November. KING-TV, Seattle, was the first television station to receive delivery of a production model.

Videotape is practically the same tape as is used in the average home recorder. Produced under exacting laboratory standards, the tape can be used approximately 50 times before quality deteriorates. Just as standard magnetic tape, used for audio or instrumentation recording, puts electrical signals on tape for later reproduction, VTR does the same.

It records the same kind of signal in much the same way, although the TV signal is made up of millions of separate bits of information per second.

With the recent agreement between Ampex and RCA to exchange patent rights on videotape recorders, standardization of equipment is assured. (Ampex and RCA are alone in the field at the present time).
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

FREE RCA "CHEATER" CORD GIVEN WITH
ANY TUBE ORDER OF $7.00 OR MORE!!

SEND for our FREE complete
TUBE & PARTS LIST and order blank.

FREE BONUS AN-
TENNA GIVEN
WITH ANY TV SET
ORDER!!

FREE POSTAGE in U.S.A. and Terri-
tories on orders over $5.00. 25¢ han-
dling 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.

Brand New Factory
Seconds! Electrically
Perfect Factory
Seconds! Used Tube!
New and Used
Jon Surplus Tube!

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED

WE HAVE OVER 1000
USED TV SETS
FOR ANY TUBE
$37.00 PER HUNDRED
Mac's Service Shop
(Continued from page 68)

“Open output filter capacitor,” Barney guessed.

“Right. With the current-storing or bypassing action of this capacitor removed—whichever way you like to think of it—the plate circuit of the output tube could not get the strong pulses of current it demanded to supply power to a load. The whole thing acted like a transformer whose primary was being fed from a voltage source with poor regulation. When the secondary demand load increased, the voltage dropped.

“When this capacitor was replaced, everything worked fine; but I’ve been brooding ever since about how easy it is for a technician to forget what he knows especially when something or somebody gives his mind a push in the wrong direction.”

“You know something?” Barney asked with a quizzical smile. “It makes me feel good all over when you make a mistake. What with you showing me up all day long here at the shop and then going home and watching those ‘brains’ on TV quiz programs coming up with answers that no one has any business knowing. I feel pretty stupid most of the time. It helps a lot when you pull a boo-boo.”

“OK; so then I’ll be big-hearted and pull some more.” Mac promised with an understanding grin. “But I’ve been meaning to ask you if you are running into any unusual problems since channel 13 came on the air with that fine signal they’re putting out?”

“Nothing too unusual. I’m pretty well convinced that everyone in this area should be getting over 8. On our own field-strength tests, 13 is putting out more than twice as much signal; so-o-o-o, when I hear someone say they are not getting it well, I work on the theory something is wrong in their set or installation, and there usually is.”

“What’s the most common difficulty?”

“Simply that the oscillator is not adjusted properly on channel 13. In many cases this channel was never set up in the beginning, since channel 13 was blank in this area for years; and in other cases the oscillator has just drifted off. At any rate, a simple twist with an alignment tool takes care of it.”

“There must be other cases not so easily disposed of. At least you’re away from the shop long enough.”

“Oh there are!” Barney said hastily. “For instance, I’ve found a lot of those people who insist on leaving a coil of surplus lead-in piled up on the floor behind the set may have been getting away with it after a fashion on channels 6 and 8, but channel 13 is another story. I do my best to get them to insist on having it available so they can move the set around. I fix them up with a lead-in extension with connectors all...
around so that it can be spliced into the line when needed or left out when not.

"Another thing I run across fairly often is those line-tuning gimmicks made of a piece of tinfoil wrapped around the line. This was adjusted so that 6 and 8 came in OK, but very often it cuts channel 13 way down. Usually I just take it off and throw it away. If the customer is the bulbheaded type, I show him that it will have to be shifted up or down the line to get good reception on 13."

"Have you had any trouble from too much signal?"

"I was just coming to that. In quite a few instances the customer complains of picture pulling on channel 13 only. In most cases this is simply the result of overloading because the a.g.c. control is not properly set. Most of the sets in this ultra-fringe area are running nearly wide open most of the time. Re-adjusting the a.g.c. control normally sets things straight unless, of course, there's something wrong with the a.g.c. circuit itself."

"Well, you can say this for radio and TV servicing," Mac observed philosophically: "it is often a headachy, frustrating, maddening business, but it's never dull or boring. There's always something new coming up!"

---

**CALENDAR of EVENTS**

**FEBRUARY 8-11**

**FEBRUARY 14-16**
1958 San Francisco High Fidelity Show. Sponsored by Institute of High Fidelity Manufacturers, Inc. and Audio Shows, Inc. Whitecomb Hotel, San Francisco.

**FEBRUARY 20**
Seminar "Practices of Tape and Disc Recording." Sponsored by Audio Engineer- ing Society. Sessions to be held weekly for 15 weeks, Thursdays at 7:15 at RCA Institute Auditorium, 350 W. Fourth St., New York City. Fee $35.00 for full course or $3.00 per lecture. Contact Sumner Hall at Amityville, N. Y., or McFt J-7080 for full details or reservations.

**FEBRUARY 26-MARCH 2**
Audio Show. Sponsored by Institute of High Fidelity Manufacturers, Inc. Bilt- more Hotel, Los Angeles, Calif. Additional details from Edwin Cornfield, Executive Secretary, 125 E. 23rd Street, New York 10, N. Y.

**MARCH 24-27**

---

**HANDLE THE TOUGH SERVICE JOBS**

**AS SLICK AS YOU DO THE EASY ONES...**

These two giant how-to-do-it Ghirardi manuals make it easy for you to be an expert on all 10 types of TV receiver service; cut your time-saving costs 50% or more; make more after taxes... and save 25% or more on parts and supplies.

1. **COMPLETE Professional TRAINING in MODERN SERVICE METHODS**

Radio and Television TROUBLESHOOTING AND REPAIR gets right down to earth in guiding you through each service procedure... from locating troubles quickly to fixing them fast and right.

For beginners, this famous 822-page book is an absolutely complete training course in professional methods. For experienced servicemen, it is the ideal way to develop better troubleshooting methods and shortcuts... to find quick answers to puzzling problems and to handle tough jobs faster.

Black diagrams of circuit configuration, response curves and other features speed your work... make each step doubly clear. Handy troubleshoot- ing charts cover practically every type of job from troubleshooting television to AM and FM realignment, IF and Detector sections, car radios and many more.

Here are a few of the subjects covered in Radio and TV Troubleshooting and Repair: Component Troubles, Basic Troubleshooting Methods, Shortcuts, Tips and Ideas; Complete Guide to TV Servicing; Realignment Made Easy; FM, Communication Receivers, Record Players, etc.; Auto Radio; Loudspeakers; Tuner and Switching Mechanisms; and dozens more. 417 clear illustrations. Price only $7.50 separately. See MONEY-SAVING OFFER in coupon.

2. **Learn all about circuits... AND WATCH SERVICE HEADACHES DISAPPEAR!**

You can repair any radio or TV set... even special electronic equipment faster and faster when you know all about its circuits! That's where this 669-page Radio & TV CIRCUITRY AND OPERATION is worth its weight in gold.

You locate troubles in far less time... because circuits - "wound-up" - teaches you exactly what to look for and where. You make repairs faster and better... because you eliminate needless testing and guesswork.

Radio & TV CIRCUITRY AND OPERATION deals fully with practically every circuit and circuit variation used in modern receivers. It teaches you their peculiarities and likely trouble spots.

Over 110 pages explains Television... from scanning to signal to every circuit detail of each of the receiver sections.

Includes: AM, FM, R-F Amplifiers and TRF, AM Superhet, AM Detector and AVC Systems, A-F Amplifiers, Power Supplies, Television, Antenna Systems, Pickups and Record Players, Speakers, Audio's, Mechanical Construction of Receivers... and lots more.

Throughout, this great book equips you with the kind of above-average service training that really pays off! Price only $6.75... or see MONEY-SAVING OFFER in coupon.

---

**PRACTICE 10 DAYS FREE!**

Dept. RN-28, RINEHART AND COMPANY, 232 Madison Ave., NEW YORK 16, N. Y.

**MONEY-SAVING COMBINATION**

Both books only $13.00... you save $1.25. Payable at rate of $4 (plus postage) after 10 days and $3 a month thereafter until $13.00 has been paid.

Name...
Address...
City, Zone, State...

OUTSIDE U.S.A.—$8.00 for TROUBLESHOOTING AND REPAIR; $7.25 for CIRCUITRY AND OPERATION: $14.00 for both. Cash with order only. Money refunded if return postmarked within 30 days of purchase. Reprints not available.
ABOUT the time the stereo disc was announced at the Audio Show, a sampling of opinions among the tape manufacturers present was that stereo disc would help, not hinder the stereo tape market and as far as they could see, it would be a peaceful co-existence. While for the most part this is probably true, only the most naive would fail to see the beginnings of strife. By this I mean that the parties involved are not going to sit around complacently waiting for a stereo disc to upset the tape market. Co-existence is possible...yes but only as long as both media continue to sell strongly.

Tape is at an obvious disadvantage at the present time, due to the great price disparity. Even with an anticipated $4.98 to $5.95 tag on a stereo disc, the tape still can't compete price-wise. The tape boys are well aware of this and this fact has spurred activity in a field which had become almost static...the process of tape duplication.

Get the cost of duplicating tapes down to a comparable level with discs and then go after the raw tape manufacturer. Show him how the new duplicating process can make recorded tape really a mass market item and the raw tape price will come down in a hurry.

As you probably know, most tape is duplicated today by multi-speed slave recorders or by the common mandrel system. These do a remarkably good job and they are constantly being improved upon, but still the process leaves something to be desired. Some years ago, pioneer work was done on a method of duplicating tape by a process analogous to photographic contact printing. A steel tape was used as the master and layers of raw tape were laid down over this master. Then a current would be applied to the master and bingo!...out comes “prints” of the master. If I remember correctly, fairly good results were obtained up to about 20 layers of tape and then it fizzled. Of course there were bugs, so many that the idea was abandoned. This is but one avenue of experiment, and there are undoubtedly others.

One thing is fairly certain...nobody is going to sit on their hands and you can bet that wheels are churning now, slowly to be sure, but in time all this activity is sure to result in cheaper tape and a stable market.

BRAHMS SYMPHONY #1
Boston Symphony Orchestra conducted by Charles Munch. Victor GCS-42. Price $18.95.

Yes. I know. Anent the above discussion, this is a staggering price to pay for a stereophonic tape. Yet that is what the companies feel they must get at present. Is it worth it? That depends on how badly you want Brahms 1st symphony in stereo. From the musical and technical standpoints the recording is certainly splendid. This is a massive work which makes strong demands on a large orchestra. Heard monaurally, the work is of heroic proportion, with a granitic solidity to its orchestration. Heard in the glories of stereo, the piece becomes almost overpowering. For lover of the “big sound,” here is orchestral weight that will certainly please. From the relentless opening tympani beats, the work builds tower on tower, creating a monumental musical edifice. With the huge orchestra spread across the end of your room, the full impact of stereo hits you.

Munch is not the best of conductors for this work...he interjects too many fussy mannerisms. But his tempi are fairly straightforward, he has a fine sense of balance and proportion, and all-in-all his reading is acceptable. The recording was mixed fairly close, but the magnificent Boston Symphony Hall acoustics allowed for this high detail by clothing it in spacious reverb. This is a very full sound, with good directionality and good center fill. The illusion of depth was very strong and instrumental delineation exceptional. My only quibble with this, is as odd one for stereo...the first strings were a mite on the strident side. As you know, one of stereo’s most charming aspects is its ability to smooth out string tone. Most of the stridenecy occurs in the first few minutes, so it is not too objectionable. In summation...if you like Brahms, you will find this a terrific experience.

BACH, J. S.
PRELUDE AND FIGUE IN A MINOR
PRELUDE AND FIGUE IN E MINOR
TRIO SONATA #4
“WACHER AUF, RUFT UNS DIE STIMME”

This is another tape in the magnificent series Boxotape is devoting the organ music of J. S. Bach. This is one of the finest yet produced and the opening “Prelude and Fugue in A Minor” is breathtaking in its sonic
realism. The directionality was exceptional for an organ and the intricate pedal work, which is a feature of this work, is easily "seen" and heard to the left.

The other works are equally well recorded and well-played. Weinrich is simply fabulous in this recording, easily doing the best work of the series so far. As always, his phrasing and tempi geared to the acoustics of the church is a marvel and his choice of registration ever tasteful. This is very bright sound, rich in detail yet lovely in the rounded fullness of the wonderful acoustics. Solo pipes and mixtures were produced with equal clarity. The sense of depth here was startling . . . and added to the general impression of on-the-spot "presence."

OFFENBACH
TALES OF HOFFMAN (EXCERPTS)
ORPHEUS IN HADES OVERTURE

This is one of the most sensational stereo tapes yet produced by Victor! I know, you are wondering what could be so hot about this kind of repertoire. Don't let this stereo fool you, friends . . . it can make a seemingly innocuous piece of music into a highly exciting work. This has all the stereo virtues in spades. Directionality? In the famous "Barcarolle" you will hear the most intriguing interplay between first and second strings and the celli. Depth? Really amazing on this score. Boston Hall acoustics taking a bow again. Instrumental separation? Every instrument is limned and yet is a cohesive part of the orchestra.

Fiedler does a perfect job of conducting these light confections and the Boston men play with wondrous precision and elan. There was excellent center fill on this tape, wide dynamics, good signal-to-noise-ratio. The over-all presence has to be heard to be believed. If you want to impress some friends with the quieter virtues of stereo, just play this "Barcarolle" for them and watch them melt!

500 MILES TO GLORY

How is this for something different? This was actually recorded at the Indianapolis Speedway employing four stereo recorders and 12 microphones. There is a running commentary on the race itself, but need I say that the cars are the stars. It is also needless to say I'm sure, that directionality in stereo being what it is, you will have race cars zooming through your room. The first time you hear the whine and roar of the big Offenhausers is quite a thrill, but unhappily since all the cars in the race are of the same breed and there is no up and downshifting as with sports cars, the sound soon pall.

Worth the price of the tape, however, are the fantastic sounds of several crashes. This may be is carrying stereo realism a little too far! It's a
**Genalex**

**THE ORIGINAL**

**KT66**

The name GENALEX on the tube and carton is your guarantee that you are buying the original KT66...world-famous pentode, often referred to as the finest audio tube ever made! The GENALEX KT66 is the hallmark of the finest amplifiers. It is original equipment in the famous HEATH ULTRA LINEAR AMPLIFIER KIT.

No. W-5M. Identical pins and connections as 6L6 tubes. Unit $3.50 each.

For complimentary fact sheet, write Dept. XB8

---

**BRITISH INDUSTRIES CORPORATION**

Port Washington • New York

---

**CENTER ELECTRONICS**

**POST-HOLIDAY SPECIALS**

**PRICES ON THE HI FI UNITS LISTED BELOW ON REQUEST**

**STEPSHENS**

Trusonic 206/AAA 13" Two voice con box loud speaker, frequency range 20-20,000, voice coil 1 3/8 x 1 3/4 x 3/16 lbs. Akroon 1 magnet. Shpg. wt. 1 lb.

**FISHER**

FM-40 Custom FM Tuner, Center-of-channel tuning meter, 3 microvolts for 20 db quieting, self-powered, shielded construction, shock-mounted chassis. Cabinet available in mahogany or blonde, extra.

**BELL**

Stepphenics 3 D70 2-Channel Amplifier 24 watts, 12 watts each channel, complete power and pre-amplification on each channel, best for monaural, too.

**GENERAL ELECTRIC**

Vox Antique Play Golden Treasure Cartridge 1 mil. diamond, 3 mil. sapphire "lip-in-lip" stylus assembly, 20 to 20,000 cps.

---

MAIL ORDER 15% DEPOSIT, BALANCE C.O.D.

**BASIC AMPLIFIERS** • **TUNER AMPLIFIERS** • **PRO-amps** • **PIERPS** • **SPEAKERS** • **RECORD ENCODERS** • **RECORD CAMERAS** • **TAPES** • **ENCLOSURES** • **CARTRIDGES** • **TURNTABLES** • **Etc.**

GET OUR SPECIAL PRICES.

**CENTER ELECTRONICS CO., Inc.**

Dept. NS, 72 Cortlandt Street, New York 7-149 7-6474

---

**JAZZ AT STEREOPHONIVL**

Casie Williams, trumpet; Rex Stewart, cornet; Bud Freeman and Coleman Hawkins, tenor sax; Lawrence Brown and J. C. Higgenbottom, trombones. Concert Hall 550, Price $11.95.

Jazz has been fairly well served on stereo tape, but never with the success this tape affords. This is, without a doubt, the most exciting and effective jazz stereophonic tape I have heard. The fidelity of the recording and the high degree of musicianship make this one of the memorable experiences in many years of jazz listening.

A glance at the personnel involved and it's not hard to understand why. The musicians are among the all-time greats on their respective instruments. This recording makes use of an old and familiar device. Remember the "battles of music" and "battles of the bands"? The recordist or group of players would be pitted against a similar set-up, either in the same orchestra or in a rival orchestra.
SPRAY it or DROP it

the NEW QUIETROLE Spray-Pack
or the QUIETROLE Bottle with the Eye Dropper Cap

Now QUIETROLE offers you both types of containers. Either way assures you of the same unfilling; suits that QUIETROLE is known for.

Make your next purchase of QUIETROLE, get down to its action and the answer between quality and poor substitutes. QUIETROLE is the original product of its kind, it is a FIRST of the industry and you can depend on it to end your noisy control and switch troubles.

In various improvisatory rides and riffs, each group would try to outdo the other. The same ideal is worked here. With the directionality afforded by stereo there is no doubt as to where the various players are located. On the left channel we have Rex, Bud, and J. C. and on the right channel Cootie, The Hawk, and Larry. A solid rhythm section made up of Billy Bauer on guitar, Hank Jones on piano, Milt Hinton on bass, and Gus Johnson on the skins provides a solid beat for the boys on the horns. The tremendous drive of this group and their very expressive and determined passages has to be heard to be believed.

The first number on the tape is "I'm Beginning to See the Light" and in their unrestrained free-swinging style both sides have a go at each other. In the famous old "Do Nothing 'Til You Hear From Me," this is mostly the guty, very "dirty" trumpet of Cootie on the right channel backed up by very nice ensemble work. The final number, "Alphonse and Gaston," gives the rhythm section a break to show the players off the opening bars. Then, as the name implies, the battle of the players resumes. All do great work, but I was most impressed by the trombone duel between Higgenbottom and Brown which occurs just after the rhythm introduction.

Soundwise this is fabulous. The directionality has probably been a little exaggerated, but there is no doubt as to its effectiveness. Each player is highlighted as to position, yet there is no overpowering sense of left and right, when the rhythm section fills in. The recording was made very close-up and employed a fairly spacious acoustic perspective. The result is great instrumental detail, wherein you can hear the sharp brazenness of the trumpets, the breathy redness of the saxos, and the growls and gutturals of the trombones and yet the acoustic treatment wraps everything in an impressive liveness.

I can most certainly recommend this tape to anyone interested in hearing what solid, honest jazz sounds like in the stereo medium. For jazz buffs this tape is an absolute must!

LOCOMOTION

Joe Loco and his Latin American Rhythms, Mercury MBS-210. Price $10.95.

This could conceivably be used as dance music, but the dancers would sure have to be flexible on their feet and most athletic! Joe Loco sees crazy name senor, an he mek crazy music! All kidding aside this is a fabulous recording and is just about the best Latin-American stereo I have heard. The topics are all imminginous to the warm and lazy Caribbean.

Directionality here is high perfect even if contrived and center fill is there aplenty. A very bright and high level recording, this tape with judicious reverber lengthy life to the highly detailed sound. The frequency and dynamic range was most impressive and tape hiss was not obtrusive.

The current Hi-Fi Annual (Ziff-Davis) contains reprints of "A Tape System You Can Build," originally published in RTN. This has resulted in a new flood of inquiries to Viking regarding the special power transformer, erase-bias circuitry, transistor and other components peculiar to the Viking RP61 Recording Amplifier described in those articles.

The original RP61 circuit has been constantly improved during the two years since initial publication. Circuit refinements include increased signal-to-noise ratio, elimination of need for a DC filament supply, a hum cancellation control, a circuit change to reduce head magnetism in recorded type, a bias oscillator balance adjustment and means for synchronizing the erase-bias oscillators of two conductor pairs.

Decks, too, have undergone some change. Interim developments have made possible the double gap erase head now used by Viking. This makes possible clean, dead quiet erase, even at the very high erase-bias frequencies which Viking employs. (A high bias frequency is absolutely essential for clean recording of high frequencies.) Double winding (hum bucking) record/playback heads add at least 6db to the original signal-to-noise ratio, even in physically "tight" installations. The present overall signal-to-noise ratio of 55db places Viking components second only to the finest of professional recorders.

One of the major deterrents to progress of stereo has been the physical size of the required speakers. One six to twelve cubic foot box is perhaps acceptable in the average living room. The second is usually endurable or as a necessary good stereo sound. There is also the problem that most sources provide for more realistic sound.

It is with considerable confidence and satisfaction that Viking is currently announcing a completely new concept in loudspeaker enclosure design — the "Viking 88." This new speaker is end table size, utilizes an 8-inch driver and provides full frequency, balanced response from 30 to 12,000 cycles. It is a high efficiency speaker. It will handle unbelievable power levels without distortion.

A speaker system, admittedly, must be purchased on the basis of purely personal preferences as to styling, impressiveness and the apparent flatness, or accented areas of response. Viking dealers are now getting their first samples of this new and style-setting speaker. See it, and hear it at your Viking dealer's. Judge it for yourself. A free "88" brochure is available from Viking's Customer Service Department.

YOURS FOR BETTER TAPES

February, 1958
Which Way to Hi-Fi?

(Continued from page 46)

Another development on which some research has been done and we expect to see new products appear within the next year or so will help in this problem of amplifier-to-loudspeaker matching discussed earlier. This will take the form of switching in the amplifier circuit.

Careful experimentation has shown that different phase compensating arrangements, as well as varied combinations of feedback to achieve different damping factors, will produce the best overall performance into different types of loudspeaker loads; for example dynamic type loudspeakers which with their crossovers, require varying damping factors to get the best performance; also a dynamic woofer with an integrated wide-range electrostatic.

A few components, skillfully chosen, with a selector switch, to choose the best combination for any individual speaker system, should make a high-quality amplifier perform almost as well as a loudspeaker as it does into that "dummy" resistance load.

Package vs Components

Going back to this question, the foregoing discussion suggests that the future may offer a three-way rather than a two-way choice. A new approach, using what may be called "integrated component systems" is being used by a few manufacturers.

It is well known that the loudspeaker unit should be integrated with the enclosure design. In this case the do-it-yourself hobbyist can buy the wood or a kit, and make the enclosure to the loudspeaker manufacturer's specification for the units used. Several loudspeaker manufacturers have made these facilities available.

High-fidelity at present has reached a very high order. Undoubtedly further improvements will be made—many of them. But the present quality is certainly one with which it is possible to be satisfied for some time to come. This makes the choice of approach to high-fidelity depend on what you want of high-fidelity.

The package manufacturer can put together components designed to work together, without having to allow for the complicating problems discussed; he can provide a suitable cabinet for housing the system; and he can also cut costs because the whole system is built in an integrated production schedule. What is more, the package manufacturers certainly do not lack top-notch audio engineering talent. But most of the "high-fidelity" sold by a good many package manufacturers does not qualify for the name at all. This is particularly true of a great number of the less expensive units that are available.

Recently a friend called me up and announced "I now have a high-fidelity." When asked what and how much, the reply to the second part was "$59.50, complete—everything!" The next question from the other end of the line was, "Why do you laugh?" Anyone with a basic knowledge of what goes into a high-fidelity system knows that the raw materials for a quality system must cost more than $59.50. So no amount of cost cutting can produce a system for such a price. The quality must, of necessity, be drastically cut too.

This really is the big snag about the packaged market. Basically these manufacturers cater for the biggest possible sale at the lowest possible price, on the fact that anyone without real listening experience will never know the difference. After all "they can hear the music—what does it matter to them if it's distorted?" "Improvements" all too often consist of using three 5" loudspeaker units instead of a single 8" one, and calling it a "three-way speaker system." This makes it sound like a bargain at any price, because people in the know say that a three-way speaker system alone costs more than $59.50—as indeed a good one does!

Unfortunately, the package manufacturer, by the very market he serves, is practically forced into making a good "show" for the money, using tricks like this, rather than building real quality into his system. There are exceptions, but it takes real shopping to find them.

(Edited's Note: There are a few component manufacturers who have grouped together a number of their own units along with units made by other component manufacturers into a complete "package system" in its own cabinet. With this arrangement the quality of the system is determined by the quality of the individual components used and this may be quite high. However this system suffers from the same lack of flexibility of any packaged system.)

Using either a component system or an integrated component system—or a combination of both—you can get yourself the best system you can afford right now and also keep up with the development of better things as they become available. The simple component system has the advantage of highest versatility of combination, but you need to exercise care in making combinations, to avoid undesirable interaction.

The integrated component approach helps avoid inconsistency problems and, in some sections, may provide the best solution but you lose the advantage of versatility for trying certain variations in arrangement.

Whichever approach suits you best, don't fear your system is going to be outdated overnight—or even in a year or two. The better high-fidelity tests, the less room it has to improve. So get yourself the best system you can afford and look forward to progressing, along with your system, toward better standards, as they become available. —30—
New Converter Changes Heat to Electricity

**Direct conversion of energy achieved in experimental unit.**

DIRECT conversion of heat energy into electrical energy has been achieved in a unique electronic device developed at the General Electric Research Laboratory. The new thermionic converter, invented by Dr. Volney C. Wilson, takes advantage of the fact that electrons can be "boiled out" of a hot metal surface and used to produce an electric current directly. Experimental converters already have changed more than 8 percent of the applied heat energy into electric power, producing a power output of almost 1 watt at a voltage of 0.8 v.

Two electrodes within the tube-like device are maintained at high, but different, temperatures. New approaches to the design of the electrodes, the materials used, and the gas environment within the envelope have resulted in a more efficient flow of electrons than ever noted before. Previous methods of converting heat directly into electricity have been based on the thermocouple, with efficiencies well below 1 per-cent. Thermionic converters ultimately may be able to work at 30 per-cent efficiencies.

Operation of converter is somewhat like a rectifier tube without plate voltage.

---

**Selling**

Receivers, Transmitters, Radar, Special Purpose Tubes, Relays, Meters, Switches, Connectors, Rectifiers, Transformers, Motors & Generators, Wiring Cable, Instruments and All Electronic Components.

**Will Buy All**

New or Used
Leach Relay #5059-R
#5058
#5055
#5053-SM
#5053

Price Bros. Relay #10
Relay #5586
#5587

Antenna Switching Relay
Box #2562
#2562-AN-198
#2562-408

Tubes #53A
VT-127A VT-227A
357 357A
WL-530 15E

Highest prices paid for most all types of aircraft sparkplugs, magnetos and magneto breaker points.

**Wholesale Only**

**Radio & Electronic Surplus**

14000 Brush Street
Detroit 3, Mich. 9-3403

February, 1958
### POWER SUPPLY KIT BARGAIN

- **Primary 115V, 40 Cy. Sec. 400-0-400V @ 200 mA.**
- **6.3V @ 5 Amps, 4C. DC, 400 Ma. choke.**
- **Mounting nuts & 6 Hr. 200 Ma. choke.**
- **And two Mfd. Oil Condensers...**
- **Price $7.25**

#### STEPPING RELAY

Resettable type. 3 deck 10 position. Includes additional 1A and 1B contact at reset position. Stepping coil 48 VDC.

**Price $9.95**

#### OIL CONDENSER BARGAINS

<table>
<thead>
<tr>
<th>Mfd</th>
<th>Primary VDC</th>
<th>Secondary VDC</th>
<th>500 vdc Mfd.</th>
<th>2000 vdc Mfd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Mfd</td>
<td>600</td>
<td>500</td>
<td>0.10</td>
<td>0.06</td>
</tr>
<tr>
<td>2 Mfd</td>
<td>1000</td>
<td>1000</td>
<td>0.20</td>
<td>0.12</td>
</tr>
<tr>
<td>3 Mfd</td>
<td>1500</td>
<td>1500</td>
<td>0.30</td>
<td>0.24</td>
</tr>
<tr>
<td>4 Mfd</td>
<td>2000</td>
<td>2000</td>
<td>0.40</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Price $9.95.

#### PANEL METERS

<table>
<thead>
<tr>
<th>2&quot; Amp Meters</th>
<th>$9.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100 Micro</td>
<td>0-100</td>
</tr>
<tr>
<td>0-100 Max DC</td>
<td>0-100</td>
</tr>
<tr>
<td>0-100 Max RF</td>
<td>0-100</td>
</tr>
<tr>
<td>0-1000 Max DC</td>
<td>0-1000</td>
</tr>
<tr>
<td>0-1500 Max RF</td>
<td>0-1500</td>
</tr>
<tr>
<td>0-1500 V AC</td>
<td>0-1500</td>
</tr>
<tr>
<td>0-3000 VDC</td>
<td>0-3000</td>
</tr>
<tr>
<td>0-5000 VDC</td>
<td>0-5000</td>
</tr>
</tbody>
</table>

Price $9.95.

#### FILAMENT TRANSFORMER

- **40 WATT TRANSFORMER** 6.3V 10 Amp 115V 120V 240V.
- **Price $2.49**

#### TRANSFORMER

- **500 Volt-110V/220V.**
- **Price $15.00**

#### BIG BARGAINS IN LITTLE TYPE

- **Kit of 50 Arrester switches.**
- **Price $1.95 ea.**

#### LINE CORDS

- **Price $2.25 ea.**

#### ADVANCE ELECTRONICS

- **6 WEST BROADWAY, NEW YORK 7, N. Y.**
- **Phone 20-0170**

#### SPLINED TUNING KNOB


### POWER SUPPLY KIT BARGAIN

- **Primary 115V, 40 Cy. Sec. 400-0-400V @ 200 mA.**
- **6.3V @ 5 Amps, 4C. DC, 400 Ma. choke.**
- **Mounting nuts & 6 Hr. 200 Ma. choke.**
- **And two Mfd. Oil Condensers...**
- **Price $7.25**

#### PHILCO MODELS 7052 and 9100

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1G2</td>
<td>1.1</td>
<td>78</td>
<td>0</td>
<td>J R</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>P5</td>
<td></td>
<td>Cap-P</td>
</tr>
<tr>
<td>2BN4</td>
<td>2.0</td>
<td>76</td>
<td>21</td>
<td>J R</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>P1</td>
<td>1950</td>
<td></td>
</tr>
<tr>
<td>3RN1</td>
<td>3.0</td>
<td>76</td>
<td>21</td>
<td>J R</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>P1</td>
<td>1950</td>
<td></td>
</tr>
<tr>
<td>4A15</td>
<td>4.3</td>
<td>78</td>
<td>0</td>
<td>J R</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>P1</td>
<td></td>
<td>Diode No. 1</td>
</tr>
<tr>
<td>4AL5</td>
<td>4.3</td>
<td>78</td>
<td>0</td>
<td>J R</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>P1</td>
<td></td>
<td>Diode No. 2</td>
</tr>
<tr>
<td>4A6E</td>
<td>4.3</td>
<td>76</td>
<td>11</td>
<td>J R</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>P1</td>
<td>1810</td>
</tr>
<tr>
<td>4B6E</td>
<td>4.3</td>
<td>76</td>
<td>11</td>
<td>J R</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>P1</td>
<td>1810</td>
</tr>
<tr>
<td>4B6E</td>
<td>4.3</td>
<td>76</td>
<td>11</td>
<td>J R</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>P1</td>
<td>1950</td>
</tr>
<tr>
<td>5AL5</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B15</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
<tr>
<td>5B27</td>
<td>5.0</td>
<td>88</td>
<td>20</td>
<td>E V</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>P1</td>
<td>2000</td>
</tr>
</tbody>
</table>

#### Owners of Philco checkers: note these many new settings, as well as revisions of earlier data.
JUST PUBLISHED!

164 PAGES—
OVER 1,000 LISTINGS
WITH ILLUSTRATIONS
OF ALL HI-FI PRODUCTS
ON THE MARKET!

World's First Complete
HI-FI DIRECTORY & BUYERS' GUIDE!

Here's the one indispensable book in your hi-fi library . . . the first complete listing of all hi-fi equipment on the market, plus dollars-and-cents advice on how to pick the right unit for your needs! Call it a shopping catalog, a sourcebook of practical hi-fi ideas, an encyclopedia of hi-fi values, a treasury of practical material you'll use over and over again—the 1958 Hi-Fi Directory & Buyers' Guide is the biggest bargain on your newsstand!

ALL HI-FI EQUIPMENT COVERED...INCLUDING PRICES, MANUFACTURERS AND SPECIFICATIONS!

- Facts on preamps & amplifiers
- Buying a record changer
- Phonograph accessories
- Wise shopping for a turntable
- Complete facts on speakers
- Illustrated guide to enclosures & cabinets
- Special section on tape recorders
- Guide to speaker systems
- Records on a budget
- Choosing AM and FM tuners
- Selecting a hi-fi console

PLUS Records recommended by Eugene Ormandy . . . and a full list of hi-fi dealers in the U.S.A.—where to buy hi-fi in your community!

Pick up a copy of the 1958 Hi-Fi Directory & Buyers' Guide at your newsstand or Radio Parts Store now while supplies last. Only $1.

Ziff-Davis Publishing Company
64 E. Lake St., Chicago 1, Ill.
Wherever you go, look for the fixed and mobile antennas of commercial and public-safety 2-way radios. These equipments must have periodic, competent maintenance—which means regular income to qualified servicemen. Much of this work is done by independent shops on a term-contrast basis.

To learn about rates... typical contracts... and take-home pay... send for free booklet "HOW TO MAKE MONEY IN MOBILE-RADIO MAINTENANCE."

MAIL COUPON TODAY!
LAMPKIN LABORATORIES, INC.
MFM Division, Bradenton, Florida

At no obligation, please send me free booklet, technical data on Lampkin meters, and time-payment plan details.

Name ____________________
Address ____________________
City ____________________ State ________

160

GET INTO ONE OF THESE TOP OPPORTUNITY FIELDS
ELECTRICITY-Electronics & TELEVISION
Radio-Color TV
TRAIN IN THE GREAT SHOPS OF
COYNE OLDEST, BEST EQUIPPED SCHOOL OF ITS KIND IN U.S.
Veterans and Non-Veterans—Prepare for a better job NOW that offers a real future, too! Get practical training in TELEVISION—RADIO—ELECTRICITY—ELECTRONICS. (Refrigeration & Electric Appliance Repair can be included.) Learn on real equipment—no advanced education or previous experience needed. Lifetime employment service to graduates.

Finance Plan—enroll now, pay most of tuition later. Part-time employment help to students.

FREE BOOK—Clip coupon for Big Free Illustrated Book—the "COYNE TECHNICAL INSTITUTE OPERATED by the COYNE TECHNICAL INSTITUTE"
500 S. Paulina St., Chicago, Ill., Dept. 28-40
ELECTRICITY—TELEVISION—RADIO—REFRIGERATION—ELECTRONICS
B.W. COOKE, JR., Pres., COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Chicago 12, Ill., Dept. 29-60
Send FREE BOOK and details on:
□ TELEVISION-RADIO
□ ELECTRICITY-ELECTRONICS

NAME ____________________
ADDRESS ____________________
CITY ____________________ STATE ________

"Muscle Mouse"
(Continued from page 35)
as this is another high current spot.

The antenna windings shown in the parts list are for a typical 52-ohm or 72-ohm-fed antenna feeder. Other feeder lines (for example, 300 ohms) may require some adjustment.

The transmitter is tuned up like any other transmitter—but perhaps a few words will be of help to the newcomer. First, connect a 25-watt light bulb to a phono input plug and plug it into the antenna output receptacle. Press the key and rotate the tuning capacitor. If all is well, the neon bulb will light at some setting of the capacitor.

Note that in rotating the tuning capacitor, at one point the dial light current indicator indicates a very sharp dip. At approximately the same point, the neon bulb glows most brightly. The point for proper tune-up is that point at which the neon bulb is the brightest and the dial light is the dimmest.

Tuning up to an antenna is similar: "load" up by sliding the antenna coil down on the plate coil, until the dial light barely dips. Again, select the point at which the dial light indicates the minimum current and the neon bulb is the brightest.

A PHONO PLUG HANDLE
By M. JOHN WAGNER

THE almost standard adoption of phono pin-plugs and jacks as the method of hooking up audio components creates problems for the assemblers of such equipment. Although they are conveniently small and make good connections, these pin-plugs are difficult to withdraw from a tight-fitting receptacle unless one simply jerks on the wire. After a few jerks, the shielded lead is likely to break away from the pin-plug because the connection at this point is usually weak. This particular solder joint is an unusually awkward one to make in the first place, and it rarely looks as neat as one would like.

Here is a way to overcome the problem. When attaching legs to these pin-plugs, prepare the wire to be inserted into the plug in the usual way, but instead of drawing it through the side of the shielding, simply remove the shielding from the last inch or so of the lead. Then cut a piece of one-quarter inch copper tubing, about one or two inches long. Flare both ends of the tubing and slide the shielded lead completely through it. Solder the wire into the pin-plug as usual; then slide the tubing down the wire, firmly against the end of the pin-plug shield, and solder it there. Finally, solder the shielding to the opposite end of the tube.

This process makes a very strong connection and provides a convenient handle by which to grasp the plug when removing it from a tight receptacle.

"Handle" facilitates phono plug removal.
An "Automatic Rheostat" (Continued from page 42)

The graphs of Figs. 4 and 5 show the effect of the stepped delays with a receiver rated at 205 watts. The broken line in Fig. 4 shows current measured to the set during warm-up time before the protective device was installed. The solid line shows current after installation up to the time of stabilization. Note that final current with the automatic device is slightly greater than without it. This is accounted for by the small amount of current consumed by the delay tubes.

The broken line in the graph of Fig. 5 shows voltage available from the rectified and filtered power supply before the device was installed. The stepped increase measured after installation is shown by the solid line. At no time are the filter capacitors' working-voltage ratings exceeded.

Although the graphs are shown for a set rated at 205 watts, most recent sets are sufficiently close in power consumption so that the device, with the resistor values shown, would provide essentially the same protection. However, the values of the dropping resistors could be adjusted, if desired, to provide the same warm-up pattern for lesser or greater receiver loads.

Since the three most common troubles with electronic equipment are the failure of rectifiers, of other tubes, and of electrolytic capacitors, the automatic rheostat is a valuable addition to any set. The longer life of these parts will more than pay for the expense of the device.

Fig. 4. Input a.c. current to receiver before (broken line) and after (solid line) the delay device was installed.

Fig. 5. Broken line traces normal "B+" output of the receiver. Solid curve is the same output after delay is provided.

What Do You Know About These New Single-Groove Stereo Discs?

These amazing new stereo discs promise to revolutionize the world of high fidelity! Now being readied for release, these long-playing binaural recordings are single grooved...can be played by simple adaptation of your present hi-fi rig. Priced at no more than ordinary monaural LP's these new discs will at last make stereophonic sound possible for everyone...

And what do you know about--transistorized hi-fi amplifiers which will last forever...amazing new loudspeakers that have no cones, but "excite" the air through ionization...new inexpensive recording equipment for making stereo tapes...thin-line baffles which match the performance of many of today's bulkier enclosures.

New inventions, new improvements, techniques are making high fidelity the most exciting pastime in America today—for those who keep ahead of all the latest hi-fi developments. And now, there's one sure way to do this...

Become a Charter Subscriber to America's newest magazine for high fidelity enthusiasts!

This is your invitation to become a Charter Subscriber to HiFi & Music Review, one of the most important publishing projects in the history of high fidelity!

On sale now, this new monthly magazine will bring you a completely fresh approach to the pleasure-filled world of hi-fi music and sound.

In simple, down-to-earth language, HiFi & Music Review will show you how to select a system best suited to your home...how to place it for best acoustics...keep you up-to-date on every new development.

You'll tour the world of music. Composers and musicians, conductors and arrangers, classicalists and jazz buffs discuss their works, their new plans. A panel of experts analyzes the best of the 200 recordings and tapes released each month. You will learn how to build a fine record collection, make your own tapes.

HiFi & Music Review is big, lavish, generously illustrated...printed on the finest paper. You will cherish each issue!

No matter what interests you most...opera or blues...jazz or mood...symphonies or string quartets...whether you want to know more about fabulous stereo sound...33 1/3 records...tape...or the new 12 inch discs that play for 10 hours—you'll find it all in this elegant publication.

8 months for only $2.00

Because only a limited number of copies of HiFi & Music Review have been printed for the first edition, we urge you to accept this Special Offer NOW.

HiFi & Music Review will sell regularly for $4 a year (12 issues). By subscribing now you save a full 25%...actually get the equivalent of 2 issues free! But most important, ordering now assures you of receiving Volume I, Number 1 of this brilliant new magazine...already becoming a valued collector's item. In addition, you will receive a handsome Charter Subscription Certificate, suitable for framing.

Again, the printing of first-edition copies has been limited. So don't delay, fill out and mail in your Charter Subscription Application today.


Charter Subscription Application

Please enter my Charter Subscription to HiFi & Music Review to start with Vol. I, No. 1, at the special rate of 8 months for only $2. Also send my Charter Subscription Certificate.

☐ Payment Enclosed. ☐ Bill me.

Save us expensive billing costs and we'll add an extra issue free—making 9 issues for only $2!

Name: ____________________________
Address: ___________________________
City __________ Zone __________ State ___________

February, 1958
PLATE SUPPLY KIT

2000 VDC @ 680 Ma
2 plate transformers, 1 Rectifier Fil. tran. for
1250 VDC, and Four 1 MF D 3000 VDC Oil Condensers. (Transformers, chokes
and filters designed below.)
ALL FOR $35.00

REDMOND BLOWER

110V. 60 cycle, 2.0 Amps. 1600 Rmp. 3 1/2"
Blower wheel -- 2 1/4" Diameter,
1-3/8" Stock Trans. tubes.
Price $7.95
2 For $15.00

MISCELLANEOUS SPECIALS

162

Service Industry News

If you are a member or officer of a
service association, you will certainly
be interested in this month's edi
torial on page 8. In fact, if you are a
non-member who has ever thought
of joining such a group, provided
that one came along that suited you,
you will still want to read the edi
torial. Perhaps you can help answer
our question.

Texas Magazine

The recent release of the first is sue
of the "T.E.A. Times" as the of ficial magazine for the Texas Elec
tronics Association represented the
third publication to be started by ma
jor service associations during recent months. The "T.E.A. Times" will be
a quarterly magazine devoted to state,
national, and local association news of interest to service dealers in Texas.

In launching the new publication, Leonard R. Smith, its editor, said:
"The officers of the Texas Electronic Association felt that a regular means
of communication was necessary in order to keep the individual members of T.E.A. affiliates informed of state
wide developments in the service in
dustry. 'T.E.A. Times' will be sent to
every established service dealer in the State of Texas. It will keep them
informed on what T.E.A. is doing to raise the level of TV and related elec
tronic servicing and to improve the business climate of the entire service
industry."

"In a far-flung organization like the
Texas Electronic Association, it is im
possible for the executive mem
bers informed of the progress of association programs through personal
contact alone. This quarterly maga
zine will help us to weld our associa
tion into the kind of a cooperative force we need to establish stability in
the electronic service field."

Mr. Smith was the chairman of the
highly successful Annual Clinical and
Fair held in Fort Worth last August. Copies of the "T.E.A. Times" may be ob
ained from Leonard R. Smith, edi
tor, 1105 May Street, Fort Worth 4, Texas.

Pennsylvania House Organ

The Electronic Service Dealers As
sociation of Western Pennsylvania
published the first issue of its official
house organ during the late fall. Named the "ESDA Scanner," one thousand copies of the initial issue were printed for distribution to service
dealers in Pennsylvania and ad
joining states.

Edited by B. A. Bregenzer, who is also chairman of the Federation of
Television-Radio Service Associations of Pennsylvania, the initial issue of the "Scanner" marked the first anniversary
of the Pittsburgh Service Dealers
Association. The organization, initially formed by eleven men, has grown rap
idly during its first year of existence.

Under the leadership of Joseph S.
Doyle, its president, membership has
grown to include over 100 shops.

In his talk at the annual banquet,
Mr. Doyle said: "We believe we have
proved to the public that all television service men and dealers are not
thieves. We have corrected many evils.
We will correct many more. Standards have been set up. Those who desire to remain in the service business will, in time, be required to meet them. We will, at all times, strive
to improve on our present standards.

In the very near future the well
known axiom, 'By your actions you
shall be known,' will prevail in this
industry."

Information about the "ESDA Scan
ner" may be obtained from B. A. Breg
enzer, 1741 East Street, Pittsburgh
12, Pa.

Indiana Publication

The "Hoosier Test Probe" is the third publication launched by a major
service association in recent months. Edited jointly by Frank D. Turvey and
Robert M. Sickels, the "Test Probe" is the publication of the Indianapolis
Television Technicians Association.

In a recent issue, Editor Sickels
presented some sage advice to readers under the caption, "You and Your
Business." He said:
"Do you really run your business? Have you got a firm hand on the rudder?
Or are you drifting aimlessly from day to day?"

"A well regulated business budgets its money. Promotions are planned
far in advance, so as to get the most consistent effect from advertising. Two
to three per-cent of your annual gross sales should be plowed back into advertising which will maintain your present volume against the normal loss of customers. A 5% advertising budget, well spent,
will build business.

"Do you allow distributor salesmen to load you with too much merchandise?
A well managed business buys only its requirements and leaves the
warehousing to the supplier.

"Do you take all of your trade dis
counts? Now that the busy fall season is over, some months ahead of¯
ward, you may find it much easier to
use your cash register much more easily. NOW is the time to get on a cash basis.
NOW is the time to lay up some extra capital to see you through the slow
months ahead.

"A liquid business is always in a
better competitive position. Oppor
tunities can be seized in soft markets, if you have the ready cash on hand."
ness, start looking to your credit line now. Too many operators have found a much needed expansion program impossible because of past credit mistakes.

Copies of the "Hoosier Test Probe" may be obtained from either Frank J. Teskey, 1212 Clifton Street, Indianapolis, Ind., or Robert M. Sickels, 1859 South East Street, Indianapolis.

New Association
A group of service dealers and technicians met recently to form a service association in Terre Haute, Indiana. Organizers of the new group included W. C. Anderson of Ace Electronics; T. Bourbeaux of Commercial Radio & TV Service; C. Carrithers of Jensen TV & Appliances; Robert Easton of Midwest Radio & Appliances, and E. C. Oberholtzer of Obie's TV.

Mr. Anderson was elected temporary chairman of the organization and Mr. Bourbeaux was named temporary secretary. Information about the organization may be obtained by contacting W. C. Anderson, Ace Electronics, 1001 College Ave, Terre Haute, Indiana.

Tennessee Plaintiff
T. R. Nabor, president of the Middle Tennessee Technicians Association, took service dealers to task for their indifference in a recent issue of "MTTA News." Under the caption, "We Asked For It," Mr. Nabor said:

"One of our many great opportunities has passed us by, without the slightest recognition by most of us, because we have been lulled to sleep by our false sense of security and self-esteem.

"When television was first introduced in Nashville and middle Tennessee, we were all very enthusiastic about the opportunities in the field of TV servicing. Realizing that only trained technicians could render this valuable service, we applied for and received special training in this phase of electronics.

"Today, however, electricians, plumbers, carpenters, truck drivers, firemen, refrigeration mechanics, and many others have decided TV servicing is a good field to explore because anybody can learn to change a few tubes. If one tube doesn't cure the trouble, keep changing them until some combination does. We in the service industry know how disastrous the results have been to the general public from these 'tube changers.' It has brought us unjust and unwarranted criticism. All of the glamour and prestige of being an expert technician in the electronic field has been trampled in the mud.

"When are we, the licensed shop owners and technicians, going to stop bickering among ourselves and start fighting for what is ours? When are we going to play fair with the public and ourselves and start defending our customers and ourselves against the unethical and unlicensed Fast-Buck Boys and Quacks?"

---

FEATURING FAMOUS FACTORY

TUBES

- INDIVIDUALLY BOXED!
- GUARANTEED ONE YEAR!
- FACTORY BOXED
- FACTORY REGULARS
- NEW JAN SURPLUS
- EQUIPMENT TUBES

ALWAYS 1000 TYPES IN STOCK

We Are Not Selling Price—We Sell Only Quality
Used Tubes, Electrically Perfect Factory Seconds, Brand New Factory Seconds and New and Used Jan Surplus Tubes.


Below Is A Partial List—Send For FREE Complete List and Order Form

FEE 12" TV SET with every receiving tube order of $100.00 or more

FEE 16" TV SET with every receiving tube order of $200.00 or more

Bonus TV sets are shipped complete with cabinet and picture tube P.O.R. our warehouse. With slight adjustments and minimum labor they can be restored like new.

STANDARD LINE ELECTRIC COMPANY
432 HARRISON AVENUE, HARRISON, N. J. Phone: Humboldt 4-4997

February, 1958
Simple 3-Channel Mixer
(Continued from page 51)

The cathodes are heavily bypassed to prevent the generation of hum by a.c. break-through from the heaters. Next, the signals come to the 1-megohm interstage leveling controls. These allow for more efficient use of the mixer controls in addition to preventing unusually strong signals from overloading the second stage. It is at this stage, a 12AX7, that it is permissible to leave the cathodes unby-passed. The cathode resistors are small, raising the transconductance and permitting the use of a small amount of degeneration. This gives the 12AX7 a larger signal handling capacity in addition to lowering the distortion produced by this stage. After the 12AX7 the signals enter the mixing circuit.

The plates of the mixer tubes provide an ideal feed for a cathode follower, a good use for the remaining half 12AU7. The current amplifier is then coupled to the output Jack by a .25 µfd. capacitor, large enough to work into a load of about 50,000 ohms or more. If the load is more than 100,000 ohms, a 1 µfd. is enough.

An external power supply providing 275 volts at 10 ma. and 6.3 volts a.c. at 1.2 amps is necessary. These potentials can usually be "stolen" from a power amplifier or other associated equipment without danger of instability of any sort. The heaters are balanced through a 100-ohm potentiometer to a positive d.c. potential of about 17 volts. This voltage was taken from the power supply by installing two extra resistors in its chassis. The capacitors used for filtering were 2 triple electrolytics. Separate ground buses are used for each input to prevent ground loops. "B" is connected directly to the buses, which are connected to the chassis only at the input jacks.

Transformers were not used in the author's mixer, but the builder can install them on the chassis if they are not too close to the power supply or other a.c. fields. If this is done, a larger chassis than the 5" x 2" x 7" model used by the author is necessary. Two 5%-27 microphone connectors were used in the author's mixer, but the builder can use any type that will match those on his mike. The same holds true for the RCA-type high-level input and output jacks.

Some difficulty was encountered with a two microphone 12AX7; perhaps the premium 12AD7 would be a better choice. Four 100,000-ohm, 1-watt resistors were used in the plate circuits to minimize resistor noise; de-posit carbon units might be more effective.

The mixer makes an interesting project and a very useful piece of equipment to have around the audio workshop.
Now—See How to Save Hundreds of Dollars, Get More Fun Out of High Fidelity!

**1958 Edition HI-FI GUIDE AND YEARBOOK**


**Actually 3 Books in 1**

1. **IMPROVING YOUR HI-FI.** How to use tone controls. How crossovers work. Ways to boost speaker performance. Why you need loudness controls, how to add them. How to add extra speakers to your rig. How to add a spotlight with presence control . . . tricks of accenting a vocalist or soloist by accenting the middle sound frequencies. Effects of variable damping in amplifiers. How to check your phono's pickup and keep it working at peak efficiency. Ways to check a stylus.

2. **TAPE TECHNIQUES.** How to get the most out of tape. How to keep tape in top shape. How to tape programs directly off the air . . . step-by-step instructions and pictures. Expert hints and shortcuts on making good tape recordings. How to check a tape recording head to ascertain alignment. Complete guide to tape splicing for interesting effects.

3. **GETTING INTO STEREO.** What stereo is. Latest advances. What the different stereo systems are. What stereo equipment is available. How to add stereo to your present rig. Merits and drawback of different systems. What they cost. Tricks of the trade.

**A RICH SOURCE OF PRACTICAL INFORMATION**

Many thousands of hi-fi fans knew a good thing when they saw the first edition of the Hi-Fi Guide and Yearbook. Newsstands were cleaned out in a matter of days and the book became a collector's item.

The new 1958 Edition of the Hi-Fi Guide and Yearbook will go on sale soon. It contains completely new material on every facet of high fidelity . . . from an advance report on 16-⅔ rpm ("The Fourth Speed"), to guidance on adding stereophonic sound to your present set-up.

This new Hi-Fi Guide and Yearbook will return many times the $1 you pay for it . . . by showing how to shop wisely for equipment, how to save on repairs, which records are best, and money-saving techniques and ideas available nowhere else.

It will be a continually entertaining companion . . . providing you with fascinating, useful lore, showing you how to get more pleasure out of hi-fi, helping you explore the different worlds of high fidelity and music.

Reserve your copy today. This new edition will sell fast! A word to your newsdealer now will assure you of your copy of this handsome, practical book.

COMING SOON—Reserve Your Copy Today at Your Newsstand ☆ Only $1

Ziff-Davis Publishing Co., 64 E. Lake Street, Chicago 1, Ill.
Radio Astronomy
(Continued from page 38)

moon. The problem cannot be appreciably
avoided by increasing the length of the
transmitter pulse with appropriate
decree of the receiver bandwidth,
because of the Doppler spread intro-
duced by the rotation of the planet.
The rotation period of Venus is un-
known (this would, in fact, be one of
the main scientific results to be
expected from the experiment), but on
the basis of current estimates of the
rotation period, the Doppler spread
would probably limit the useful pulse
width to about 40 milliseconds, which
is only somewhat longer than that
used in the lunar investigations.
The main factor must therefore be
achieved in the gain of the aerial, by increasing
the transmitter power, and possibly by integration of successive echoes.

**Attempt to Secure Planetary Echoes:**

This problem has been carefully
considered at Jodrell Bank in relation to
the very great gain of the new
telescope, and an attempt to obtain
planetary echoes will be made early in
the year. The complete return journey of the earth-
Venus radio signal will take 4 minutes,
and success in detecting such a radio
would be a spectacular technical
accomplishment. Nevertheless, the
experiment cannot be justified on this
basis, and it is hoped that with the
radio a systematic program will be
possible, in which the rotation period
can be determined and information
obtained about the Venusian
system.

A further interest in this planetary
work is the possibility of measuring
the range of the planet with sufficient
accuracy to improve our knowledge of the
period of the solar parallax. The present
position is that the two most accurate
optical measurements should be
wrong in 1 part in 1,000 but differ
between themselves by 1 part in 1,000.
The possibility of improving this
measurement by the radio echo
technique will certainly receive immediate
attention if the initial attempts at
detection are successfully

The foregoing constitute a few ex-
amples of the type of work on which
the telescope is likely to be engaged
during the next few years. Its field of
activity is enormous and as opportu-
nity allows it will be used to study
the radio emissions from the sun
and planets in addition to the galactic
and extragalactic work already mentioned.
On the transmitting side, in addition
to the solar and planetary work it
will be deployed in the study of radio
echoes from very faint meteors, from
the aurora borealis, and from the
earth satellites. This telescope en-
joys as its research career at a moment
of extreme interest, and it may well
be expected to make a significant
contribution to astronomy and vari-
ous aspects of geophysics for many
years to come.
DO YOU pride yourself on your familiarity with radio and television components? If you do—here is a crossword puzzle for you to try to see if you can back up your professed familiarity with the various parts and devices used in electronic circuits with performance. Fill in all the blanks correctly and your "parts rating" is excellent. This will also indicate that you are better-than-average on theory as well!

(See page 169 for solution.)

HORIZONTAL
2. A type of electron tube which contains little or no gas.
4. Letter symbol for the screen grid of an electron tube.
5. A chemically reacting device that stores electrical energy.
6. A circuit protector.
7. Tubing sometimes used to provide additional insulation for a wire.
11. Device used in one circuit to control another circuit.
12. Abbreviation meaning wires are not connected.
16. When a transformer has loose laminations it often does this.
17. Resistor-type control used in a circuit to vary amount of current flow.
20. Some power transformers have a center which is grounded.
21. Found around the neck of a cathode-ray tube in a television receiver.
22. Replaceable part of some cartridge-type fuses. Also a type of r.f. coupling.
23. Found in projection TV receivers and cameras.
25. Abbreviation for secondary winding of a transformer.

VERTICAL
1. Compact, unilateral device which is gradually replacing electron tubes in some circuits.
2. Used in a car radio to convert direct current to alternating or pulsating d.c.
3. Used in conjunction with a speaker or several speakers to improve reproduction.
4. Abbreviation for wire: meaning single-cotton-covered over enamel wire.
5. Metal used in the construction of transformer cores.
6. Abbreviation for speaker.
8. A connecting wire.
9. Usually used in conjunction with capacitors to form a filter.
10. Letter symbol for mutual conductance.
11. A record player or disc recorder needle.
12. A six-element electron tube.
13. Placed around a component to prevent stray coupling.
19. A three-element electron tube.

THE MOST INTRICATE SOLDERING JOBS BECOME EASY WITH A

Weller SOLDERING GUN

You hold the Weller soldering gun like a pistol. Merely touch the trigger and soldering tip heats instantly... dual spotlights flick on to light up your work and eliminate shadows. Even more, the Weller tip can be bent to get into the most difficult places. Nothing matches a Weller Soldering Gun for speed and accuracy. Universally used by electronic servicemen, it's the most useful tool ever designed for hams, experimenters and hi-fi enthusiasts.

WELLER SOLDERING KIT

Includes Soldering Gun, Soldering Tool, Wire Bristle Cleaning Brush and Kester Solder.

See Professional Model Weller Soldering Guns at your Electronic Parts Distributor

WELLER ELECTRIC CORP. • EASTON, PA.
Within the Industry
(Continued from page 32)

J. Thompson Memorial Prize Award for his paper entitled "Backward-Wave Oscillator Experiments at 100 to 200 Kilomagecyles" which appeared in the April 1957 issue of "Proceedings of the IRE." The award is given annually to the author under thirty years of age whose article constitutes the best combination of technical contribution and presentation of the subject.

Both awards will be presented at the annual IRE banquet March 26, 1958 during the 1958 national convention of the Institute.

* * *

DR. J. R. MADIGAN has been promoted to the position of chief engineer by the Hoffman Semiconductor Division, Hoffman Electronic Corporation of Evanston, III.

He joined the firm about a year ago as a physicist in the research department. He will report to Donald C. Dickson, vice-president and director of engineering for the company and will be responsible for developing and controlling the pilot production of new electronic devices made from solid-state materials as well as product improvement on the firm's line of semiconductor devices.

Mr. Madigan was director of the solid-state physics laboratories of the Illinois Institute of Technology, before accepting his present position.

* * *

CLARENCE F. JENSEN is the new chief engineer of Jensen Industries, Inc., Forest Park, Ill. He was with Webster Electric for 14 years before assuming his new post . . . ALBERT J. MARCHER is the new production manager at Elevate Transistor Products. He was formerly associated with CBS-Hytron before accepting this newly created position . . . JOHN M. MALONE, electronic equipment sales manager of Tung-Sol Electric Inc., has been named assistant general manager of the firm . . . Sylvan Products Inc., manager of its wire plant in Warren, Pa. Mr. KLINE has joined the corporate staff of Litton Industries to undertake new development planning activities. He was formerly connected with Stanford Research Institute where he held various engineering positions . . . DONALD S. PARRIS has been named director of the electronic division of the Business and Defense Services Administration of the U. S. Department of Commerce. He joined the government service in 1953 and since 1953 has been acting director of the division.

THOMAS P. CLEMENTS has been appointed national service manager of Admiral Corporation. He has been as...
sociated with the service department for nine years, most recently as assistant service manager.

EDDON MANUFACTURING COMPANY of Los Angeles has acquired controlling interest in UNGAR ELECTRIC TOOLS, Inc. Both companies will operate independently but under the presidency of Robert Silverstein . . . HARRIS-INTERTYPE CORPORATION of Cleveland has purchased GATES RADIO COMPANY of Quincy, Ill. The new acquisition will remain in Quincy with Parker S. Gates continuing as president. It is planned to operate the business on a decentralized basis with the present organization . . . PERMACEL TAPE CORPORATION has changed its name to PERMACEL-LEPAE'S INC. to reflect the increasing diversity of its product line. Headquarters of the corporation are located in New Brunswick, N. J., with plant facilities in six other cities in the U. S. and Canada . . . A new manufacturer's representative firm, WILLIAM LOGAN, has been established at 1477 S. Mayfair, Daly City, Calif. The company will cover northern California and northern Nevada. Warehouse facilities are being provided.

INSTITUTE OF HIGH FIDELITY MANUFACTORERS, INC. has announced the appointment of subcommittee committee in connection with the Standards of Measurement for High Fidelity Equipment program now under way.

Daniel Von Rocklinghausen of Hershey, Pa., Scott Inc. heads the high-fidelity tuner group; Dick Stotfend of Pilot Radio Corp. is in charge of the amplifier subcommittee; Abe Cohen of University Loudspeakers, Inc. will preside over the speaker group; George Silver of Radio-Kut Company will handle turntables; Milton Thalberg, Audiophas Corp. will act for the record changer group; and Walter Stanton of Pickering & Company will head the activities of the phonograph cartridge subcommittee. The entire standards program is under the direction of Joseph N. Benjamin, Pilot Radio Corp., a director of the Institute.

Answer to Puzzle

February, 1958
**NEW ANTENNA FOR HAMS**

Freeman Company of Yankton, S.D., is in production on a new short-wave antenna which is just 27" high by 22" wide that is claimed to do the work of a standard antenna 32 feet wide.

Designed and developed by Stan Byquist, W9MBH, the antenna resonates at a half wave over the full range of the design spectrum and all intermediate frequencies. It accepts r.f. over a band 50 kc. wide each side of the resonant frequency. Resonance is easily accomplished with the adjustment features provided.

Tradenamed "The Little Giant," the compact and lightweight construction permits the antenna to be mounted on a standard TV roof mount. A standard 52-ohm coax fitting is provided in the antenna's base for feedline connection and the line is substantially flat at the resonant frequency.

The manufacturer will supply full details on the various models available in standard and custom versions.

**FM ANTENNA KIT**

Telco Electronics Mfg. Co., 400 S. Wyman St., Rockford, Ill., is now offering a new FM antenna kit which is especially easy to install. The antenna itself is of the turnstile design and features a self-supporting base. No alignment or orientation is necessary and the electrical portion is engineered to give longer trouble-free life.

The kit comes ready for installation with ½" aluminum elements. A mast, mast base, and 60 feet of transmission line allow the unit to be mounted to meet the user's requirements. All necessary mounting hardware is included with the kit. The kit is catalogued as No. A-124. The company will supply additional details on request.

**WHIP ANTENNA FOR MOBILES**

Mark Products Company, 6412 W. Lincoln Ave., Morton Grove, Ill. is now in production on a new line of "Heliwhip" antennas for mobile operations in the ham bands from 3 to 30 mc.

The design consists of a variable pitch helical winding on a fiberglass rod with the turns so proportioned as to result in an essentially linear current distribution on the radiator. The v.s.w.r. on 50-ohm line runs around 1.3:1 on frequency with the total bandwidth for a 2:1 v.s.w.r. of 100 kc. at 29 mc., 500 kc. at 21.2 mc.; 250 kc. at 14.2 mc.; 100 kc. at 7.2 mc.; and 60 kc. at 3.8 mc.

The units are 4 feet long for 10 and 15 meters and 6 feet long for 20, 40, and 80 meters. Custom units for all frequencies in the range 3 mc. through 50 mc. are available on special order. Write the company for a data sheet.

**"WUN/ROD" ANTENNA**

Snyder Mfg. Co. of Philadelphia, Pa. has recently introduced a single-staff indoor antenna for TV receivers.

The new antenna, known as the "Wun/Rod Diectronic 9-D", is designed to be mounted quickly and safely on the back of any set. It can be used for black-and-white, color, u.h.f., v.h.f., and FM reception in any metropolitan area.

The most unusual feature of the new design is its tuned vertical polarization which permits the extension of the four-section single staff to the height which permits best reception. In addition to extension of the single mast, the latter can also be rotated for adjustment to bring clearest reception for each channel.

**ANTENNAS AND ACCESSORIES**

JFD Electronics Corp., 6101 Sixteenth Ave., Brooklyn 4, N.Y. is now offering two new sales promotion brochures for service dealers.

One 6-page, 4-color brochure describes comprehensively and illustrates in giant size every major indoor an-
TELECO ANTENNA CATALOGUE

Telco Electronics Mfg. Co., 400 S. Wyman St., Rockford, Ill. has published a 24-page illustrated catalogue which lists 92 different antenna models for v.h.f. and u.h.f., color, and black-and-white TV, and 10 do-it-yourself antenna kits. The catalogue A-58 lists and pictures conicals, in-lines, dipole, bow-ties, corner reflectors, and yagis. Copies of this publication are available without charge from the manufacturer.

ANTENNA DISPLAY CARTON

In order to stimulate the sale of its new "Piggy Back" indoor television antennas, Clear Beam Antenna Corporation, 21341 Roscoe Blvd., Canoga Park, Calif. has issued a new point-of-sale display carton for dealers and distributors. When set up, the display contains an antenna mounted as it would actually be installed on the rear of the TV set. Since the display doubles as a master container, all orders are being shipped already packed in the display.

OUTDOOR SET COUPLER

J.F.D Electronics Corp., 6101 Sixteenth Ave., Brooklyn 4, N.Y. is now in production on a new line of outdoor receiver couplers. The new units install on the mast by means of a sturdy U-bolt assembly. This enables the service technician to run all necessary lead-in along the exterior of the house to the rooms in which TV sets are installed. Messy drilling through interior walls or floors is eliminated. (Continued on page 172)

New SUPREME 1958 TV Manual

AMAZING BARGAIN

The new 1958 TV manual is the scoop of the year. Covers all important sets of every make in one giant volume. Your price for this mammoth manual is only $3. This super-value is suitable for any competition. Other annual volumes at only $3 each mean factory service material simplifies repairs. Includes all data needed for service TV receiving. Practically tells you how to find each part and how to make the repair. More pages, more diagrams, more service data per dollar of cost.

TELEVISION SERVICING COURSE

Let this new course help you in TV servicing. Amazing bargain, complete, only $3, full price for all lessons. Giant in size, mammoth in scope, topics just like a $26.95 correspondence course. Lessons on picture faults, circuits, adjustments, troubleshooting, TV antennas problems, trouble-shooting, test equipment, tubes, circuits, specifications, tips, tricks.

$3

Companion Radio Course, Introduction to TV $2.50

Here is your complete radio training in 21 easy-to-follow lessons. Covers fundamentals, fault finding, use of test equipment. Everything is radio, introduction to TV, all self-teach questions. New edition. Special, only $3

17 RADIO VOLUMES

Here is your complete source of all needed RADIO diagrams and service data. Covers everything from the very recent FM radios to pre-war old-timers; home radios, auto radios, mobile installations, changers, 51-59, 60, and 61, broadcast, Fm, and portables. Seminal all values, only $3 for most volumes, every manual has extra large schematics, all needed alignment facts, party lists, voltage values, trimmer values, troubleshooting, and helpful hints. Volumes are large in size, 8½ x 11 inches, about 150 pages. See coupon at right for a complete list of these radio manuals.

February, 1958

NEW SUPREME 1958 TV Manual

The new 1958 TV manual is the scoop of the year. Covers all important sets of every make in one giant volume. Your price for this mammoth manual is only $3. This super-value is suitable for any competition. Other annual volumes at only $3 each mean factory service material simplifies repairs. Includes all data needed for service TV receiving. Practically tells you how to find each part and how to make the repair. More pages, more diagrams, more service data per dollar of cost.

SIMPPLIFIES TV REPAIRS

These giant TV manuals have complete circuits, needed alignment facts, service data, tips, hints, all factory production changes, voltage charts, waveforms, and double-page schematics. Here are your authentic service instructions to help you do expert work quicker and priced at only $3 per large yearly manual. Repair any TV model ever made by having in your shop all 13 volumes as listed in coupon. Your special price for all, only $36. Or try the new 1958 TV manual to see what an amazing bargain you get. Order no-risk trial coupon today.

Covers All Popular Sets

Here is your service data for faster, easier TV repairs. Lowest priced. Best by comparison. Supreme TV manuals have all needed service material on every popular TV set. Helpful, practical, factory-prepared service manuals which will really make TV servicing and adjustment easy for you. Benefit and save with these amazing values in service manuals. $36 for large volume. The choice of wise servicemen.
**Equipment and Component Specials**

- T-126/ARC S-1 to 146 Mc. Xmr w/tubes. Like new $13.95.
- T-123/ARC S-1 to 156 Mc. Xmr w/tubes. Like new $14.95.
- New 1 1/2" Square 0-1 Ma. Meters—Brand New. $5.95.
- Measurements Model 62 VTM, $5.50.
- General Radio Type 726A VTM (K.S.M. measurements). 50c, $5.50.
- Weston Model 1S-375-A/V VTVM (115 v. -50 to 1000 volts invert. output, $12.95.
- PL-55, 50c; PL-68, 60c; PL-259A (83-150V), 50c; TS-1A RF Meter in Metal Fronted Case w/Inst., $6.50.
- Heavy-Duty S.F. - 6 position R.F. Top Switch Enameled porcelain, ceramic insulation, $1.00.
- Eldico Hi-Pass TVI Filter—printed circuit, 75c ea.; 6 for $4.00.
- RCA or Hytron Jan Boxed 837 tubes @ $1.25 each—write for $10.00.
- Assorted Table, Desk, and Floor Ham Racks and Cabinets. Come in for a real bargain.
- General Radio Model 1021AU Signal Generator.
- New, $495.00.
- Eldico 2 meter (reducible) Recev. Clean, w/ a. f.c., $11.95.
- Eldico AM 30 Modulator Deck w/ built-in anode supply and tubes, $15.00.
- Eldico AM 150 Modulator Deck. With built-in micro und tubes, $32.00.
- Swinging Choke—Kenyon Type $10746—4A, Mys. @ 0.5 amp. 3.2 ohms @ 10,000 volts (Inst. Real brute—new, $39.00.
- 813 Porcelain Tube Sockets—New surplus, 75c ea.
- 872A Porcelain Tube Socket w/bayonet base, $.00.
- Dumon Model 2744—4" scope excellent cond., $45.00.
- PEC 161 Battery Charger: Input 115 or 230 vac—40 to 60 cycles. 28 volts D.C. output at 30 amp. New, mount. $125.00.
- Prop-Pitch Meter—5 lbs. un-crated. New or rebuilt, $25.00.
- General Radio Meters—Model 69-C, $125.00.
- BC 457A (4.5 Mhz.) Excellent $4.95. New $5.95.
- BC 458A (5.37 Mhz.) Excellent $4.95. New $5.95.
- O-Line—Non Metallic Gage-Link @ $2.89 per 100 feet.
- Kenyon Plate Xmr Type T-67F—Pric. 115 v. - 60 CPS. Secondary. 2900 VOLT @ 400 ma. (New), $15.95.
- Tool-Kits—23 piece imported tool kit with wrap cloth, $6.50.
- RCA Power Xmr—1100 Vct @ 250 Ma.—64 volts @ 8 amp.—5v., @ 3 amps. with 125 volt bias winding, Primary: 115 volts—60 cycles with taps, $6.95.
- Howard Loudspeaker System, 1200 ohms, $22.50.
- RJ-340 Radio Relay Boxes, $3.75 each.
- FM Tuning Control, 200-500 MHz, $25.00.
- Systems for 200-300 MHz, $35.00.
- General Radio Type 6265-A, $35.00.
- Power Supplies, $39.00.
- Toaster, Desk, and Floor Ham Racks and Cabinets. Come in for a real bargain.

**SELF-SUPPORTING TOWER**

Spaulding Products Company, 550 W. Barner St., Franklin, Ind., has developed a new self-supporting antenna tower which is available in heights up to 125 feet.

This inexpensive tower utilizes the same bridge-type construction as the firm's well-known "X Series." This unit is of tubular construction, completely galvanized, and has beaded-channel legs to give high compressive strength.

Open-type construction has been utilized to facilitate corrosion control, especially in salt water areas. The tower may be erected in a short time without the use of elaborate equipment.

**CONDUCTOR LEAD PATENT**

Fretco Incorporated, 406 N. Craig St., Pittsburgh 13, Pa. has been granted a U.S. patent for the processes involved in the manufacture of its multiple-strand conductor leads. The end products are integral parts of the company's "Fretary" antennas and open-wire transmission lines.

The product is now covered by U.S. Patent No. 2081070, granted October 22, 1957. Ten basic claims were allowed.

**COAXIAL ADAPTERS**

Antenna Specialists Company, 12435 Euclid Ave., Cleveland 6, Ohio has developed three new coaxial adapters which are designed to permit service technicians to install an antenna speedily from the outside of a car.

According to the company, it is no longer necessary to mount an antenna by tightening nuts from inside the car body. The Model ASP-160 adapter eliminates the need to split the lead-in cable and attach it to terminal screws by permitting an installer to use a coaxial fitting on the end of the lead. With Model ASP-161, a new coaxial outside mount that includes the ASP-160 in its assembly, a cable can be snaked through holes in the inner shell of the car body and attached to an antenna prior to mounting. The Model ASP-162, an outside right-angle adapter, was designed expressly for those where cable must be snaked through between the inner and outer shell of the car body.

Housings for these new couplers are molded of water-resistant and high-strength butyl rubber. Three models are currently available: Model AC-40 for coupling two 300-ohm sets, Model AC-60 for handling three sets, and the Model AC70 for coupling four receivers.

Descriptive literature on these new couplers is available from the firm.


This text covers the operation and troubleshooting of sync circuits of the type that appear in both the older and present-day television receivers.

The first four chapters of this book deal with the circuit fundamentals while the last two chapters cover troubleshooting procedures and service hints. The variations in sync systems and circuits are covered in separate chapters for most comprehensive coverage.

The text material is lavishly illustrated by schematics, graphs, scope patterns, and photographs. The treatment is straightforward and concise. Technicians should find this material helpful in speeding servicing procedures in the shop.


This is a specialized text for those concerned with designing and installing antenna systems for the reception of broadcast and television signals, particularly in domestic applications.

The text is divided into twelve chapters which cover the fundamental concepts, directional characteristics, half-wave dipoles, antennas for single-channel reception, the choice of antenna, r.f. cables and accessories, the mechanical design of antennas, installation procedures, the measurement of antenna characteristics, etc.


Since the popularity of high-fidelity sound reproduction is so widespread and since the demand for qualified technicians to install and service the equipment still exceeds the supply, this book has been prepared as a handbook for radio and television technicians who would like to expand the scope of their activities to include high-fidelity servicing.

The text is divided into ten chapters with the introductory material covering the similarities and differences in
**PHOTO CREDITS**

Page 35, 36, 37: British Information Services
39: Westinghouse Electric Co.
40 (top right): International Rectifier Corp.
40 (top left): $2, $3, 157: General Electric Company
110: Official Navy Photos
111: OREadio Industries, Inc.
113: Hughes Aircraft Co.
114: Olson Radio Warehouse
124: U.S. Naval Research Laboratory
127: Bell Telephone Laboratories
144: U.S. Army Photographs

---

**HIGH FIDELITY**

**DISGUISED ON "HI" HI-FI PRICES? Unusual Deals on Your High Fidelity Requirements. Write, Rev. Electronics, 129 Liberty St., New York 6, N.Y. EVEREVE 4-6671.**

---

**CLASSIFIED**

**RATE**: 50c per word. Minimum 10 words. April issue closes February 10th. Send order and remittance to: RADIO & TV NEWS, 366 Madison Ave., N. Y. C. 17, N. Y.

---

**RADIO ENGINEERING**

**ELECTRONICS!** Associate degree—29 months. Technician, field engineers, specialists in communications, missiles, computers, radar, automation, electronics, design, construction. Technical Institute, Dept. N., Valparaiso, Indiana.

---

**FOR SALE**


---

**WANTED**

ART-15/TGIA, Transmitter—$175.00; ART-12/IGIA: TRANSMITTER Complete—$250.00: RC-12/AR-7 Radio Components—$25.00; RC-12/AR-7 300-Watt Output, 0 & R Models—$60.00; ART-1 Transmission—$50.00: BC-112 Receivers—$30.00; BC-112 Receivers—$25.00. Also, TV. Ship via Express, C.O.D. Subject to Inspection H. Pinnock, 49 Washington Ave., Little Ferry, N. J.

---

**LABORATORY** Quality Equipment and Military Surplus Electronics bought and sold. A. Patterson Road, Dayton 9, Ohio.

---

**TAPE & TAPE RECORDERS**


---

**CORRESPONDENCE COURSES**

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Plagsh, Alaska.

---

**INSTRUCTION**

**ENGINEERING Degrees. EE Option Electronics earned by home study. Residence classes also available. Pacific International University (operating a college of engineering only at present). 713 Santa Monica Boulevard, Hollywood 38, California.**
NEW...UNIVERSITY DUAL-RANGE MLC

Weatherproof Super-Compact Speaker System for Voice and Music

Now...real high fidelity never before available in a rugged, small size, weatherproof speaker system. Unique wide-angle, dual folded horn design with separate low and high frequency drivers. Dependable, easy to install, low in cost, the MLC offers these outstanding features:

**BETTER LOWS:** Balanced "compression" folded horn, starting with 6" throat and energized by top quality woofer driver provides more lows than other designs.

**BETTER HIGHS:** Driver unit tweeter with wide angle horn transmits more highs with greater uniformity...high frequency response that you can hear!

**BETTER EFFICIENCY:** Dual range theater type system permits uncompromising design of the woofer and tweeter sections for greatest efficiency. Penetrates noise with remarkable fidelity and intelligibility.

**LESS DISTORTION:** Separate low and high frequency driver systems reduce intermodulation and acoustic phase distortion found in other systems which use two different horns on a single diaphragm.

**MORE DEPENDABLE:** Experienced mechanical engineering and careful electrical design meet the challenge of diversified application and environmental hazards. Rugged and conservatively rated—you can rely on the MLC.

**SPECIFICATIONS:**
- Power Capacity: 15 watts
- Frequency Response: 150-15,000 cps
- Impedance: 8 ohms
- Dispersion: 120°
- Sound Pressure Level: 117 db taken at 4 ft, 750-1250 cps with 1 cps sweep
- Dimensions, Bell Mouth: 12 1/4" W x 9 1/2" H
- Overall Depth: 10 5/8"
- Shipping Weight: 10 lbs

**FOR HEAVY DUTY APPLICATION...**

**MODEL BLC** employs same design principles as the MLC except for heavy duty 8" woofer with uniform response from 78 cps, exclusive "recirculating flare" wide-angle tweeter and has 25 watt power capacity. Exceptionally shallow depth, only 5", ideal for close quarters. $86.00 List.

**MODEL WLC,** largest of the series, has 30 watt power capacity. 12" super-efficient woofer with response from 50 cycles, heavy duty radial tweeter...and a decade of successful performance in concert halls, rinks, auditoriums, stadiums and outdoor theaters throughout the world. $252.50 List.
Stop tourin' the town for dual control replacements...

get the NEW

MALLORY

Dual Controls

the newest and surest solution to an old service problem

Here's how you can put a stop to those time-consuming shopping tours and special orders... eliminate those "awaiting-parts" delays. Get Mallory dual control replacements... the newest and surest solution to the age-old servicing problem of where to find exact dual control replacements.

Your Mallory Distributor can assemble a custom-made dual concentric control, with or without a switch, in just 30 seconds... with the new Mallory components and technique. You'll get a control to meet original specifications... to service just about any make or model TV set, or home or auto radio. The finished part will be as rigid as a one-piece control... won't come apart in service.