SERVICE DEALERS: ask your RAYTHEON Tube Distributor for these wonderful sales helps...

- Tube and Tool Carrying Cases: Two sizes — hold both tubes and repair tools.
- Cardboard Cutout Trucks: With your name — give them to the children.
- Aluminum Snap-Out-Form Pocket Case: Protects forms, looks business-like.
- TriPLICATE INVOICE SETS: Provides 3 copies of each bill.
- 14-Point Check-Up Card: Hang on set to show adjustments made.
- Drop Cloth: To show customers you care.
- Illuminated Outdoor Sign: A real traffic stopper.
- Go-Getter: Picks up small parts where hands can't reach.
- Window Streamer: Sells check-up service.
- Window Displays: To sell your service to passersby.

You ain't seen nothin', until you see the sensational collection of sales and shop aids in the new Raytheon BALL-OF-FIRE BUSINESS BUILDERS booklet. Pictured are a few of the new additions to Raytheon's already famous collection of tried and tested promotion items. For years, Service Dealers from coast-to-coast have been relying on Raytheon sales aids to help them get more than their share of business, using Raytheon Shop Aids to help them work more efficiently, and effectively.

Many items are free, the rest are 'way below normal cost. Ask your Raytheon Tube Distributor for a free copy of the new Raytheon Booklet or write to Department A, Raytheon Manufacturing Company, Receiving and Cathode Ray Tube Operations, Newton 58, Mass.
LEARN COMMUNICATIONS BY PRACTICING AT HOME IN SPARE TIME

Use parts I send for Actual Experience

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"Am with WCOC. Happy with my job. My course can't be beat. Passed exam for 1st class Radio-telephone license with no trouble." - Jesse W. Parker, Meridian, Miss.

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If you prefer a career in Radio-Television Servicing, I'll train you at home for it. Course includes many Kits of parts. My book shows the many make $10, $15 a week. EXTRA fixing sets while training.

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You don't have to leave home or give up your job to take NRI courses. Many of my graduates make more than the total cost of my training in a few weeks. Mail coupon now. J. E. SMITH, President, National Radio Institute, Dept. SHE, Washington 9, D.C. OUR 40TH YEAR.
First in radio-
television—audio—electronics
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August, 1955
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When the world's first transoceanic telephone cable is laid across the Atlantic it will contain hundreds of electron tubes needed to amplify voices. Deep on the ocean floor these tubes must keep on working, year after year, far beyond reach of ordinary repair services.

Bell Telephone Laboratories scientists have developed a tube of unique endurance. Before a tube is even considered for use in the cable it is operated for 5000 hours under full voltage—more than the entire life of many tubes.

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Bell Telephone Laboratories scientists began their quest for this ocean-floor tube many years ago. Now it is ready—another example of the foresightedness in research that helps keep the Bell Telephone System the world's best.

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PUT YOURSELF IN THIS PICTURE, experimenting at home with equipment we furnish, getting set to go places in TV servicing. Speed in servicing TV sets means stepped up earnings, greater security for you.

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TV Servicing...real, professional TV Servicing, pays good money to men with specialized knowledge and training. The exciting, expanding TV industry offers more than just good jobs. It offers success, a career to men qualified to render an essential community service.

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MAIL THIS NOW

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City: __________________________ Zone: _________________________ State: _________________________

Approved Member National Home Study Council
Industry Plans Week-Long Celebration

Observance, by the entire nation, of a week dedicated to “Better Home Entertainment” will begin on September 18th. Julius Haber, of RCA, headed the subcommittee of the public relations section of the Radio-Electronics-Television Manufacturers Association in designing a program for the week-long festivities.

Retail stores across the nation will display new television, radio, and hi-fi models to the public backed by distributors and the broadcasters and telecasters. These retail dealers will participate under coordinated efforts of the National Appliance and Radio-TV Dealers Association.

The National Association of Radio and Television Broadcasters and the National Association of Electrical Distributors cooperate to publicize the listener and viewer. The press, as well as national magazines, will run special feature articles covering the history and the development of the radio and television industry. It is planned that regional dinners be held in advance of the week-long celebration and that promotional material be furnished to dealers for their use in publicizing the occasion to their customers and prospects. We urge all of our readers to participate in National Radio & Television Week—dedicated to a theme of “Better Home Entertainment” during the week of September 18.

Hi-Fi in the 90’s

The history and development of the phonograph has captured the whole-hearted interest of this editor. From a modest beginning (an Edison “Gem Phonograph”) has grown the fascinating hobby of restoring many early cylinder and disc machines to their original condition. Our search for these early horn-type reproducers has been taking place for several months. Many hours have been spent in research and in the gathering of literature and clipings of old ads for an elaborate scrapbook. Many of our friends have combed their attics for certain models we are seeking. A few have been found buried under piles of keepsakes and miscellaneous junk. These have augmented our collection of early cylinder and disc machines (totaling 30) substantially, but many more are needed before we can exhibit an assortment of historical machines at future audio fairs and on other occasions visited by our readers.

It seems that substantial quantities of certain Edison machines were made, for example, and these are fairly commonplace throughout the country. They include the Edison “Home,” “Standard,” “Fireside,” and “Amberola” models. Others, such as the Edison “Opera,” “Concert,” “Balmoral,” “Alva,” and “Idelia” were not made in great quantity—and are lacking in the collection. And there were many so-called private brand phonographs made during the 1890’s. Generally, they are small spring-wound (by crank or key) machines employing short outside horns. Many of them are of the cylinder type while others, including the Berliner disc machines, could be driven directly by means of a crank.

It is hoped that our readers will search their attics and basements for some of these small machines and send us complete descriptions and data appearing on the nameplates.

Our interest has been shared by other collectors to the point that they urge this publication to form a collector’s club and to exchange data on the old horn-type phonographs. The greatest demand, both by our readers and from industry, has been for a series of articles giving the history, dates, and mechanical details of the early machines. Our search for a qualified writer has now been satisfied, and a series of articles is now being written by James Riley, who has collected and studied the phonograph for more than twenty years. The information being compiled will be of great interest to the audiophile and to the old-timer who recalls the “acoustical reproducers” of yesteryear.

We will be glad to give consideration to the formation of a collector’s club if there is sufficient interest to warrant the time and effort needed to make the project a success. It is suggested, therefore, that all interested readers send in their suggestions for the forming of such a group. We will be happy to give them every consideration.

TV-Radio Servicing $1.5 Billion Industry

The most encouraging report revealed by RETMA’s service chairman, H. J. Shulman, at the 31st Annual Convention, was the $1.5 billion paid by 48 million families for TV and radio maintenance during the past 12 months. The figure exceeded the retail dollar value of the 7,900,000 TV sets and 12,500,000 radio sets sold for the same period. Other items which contributed to the $1.5 billion service bill were component parts, and antennas and their installation. Labor represented about 770 million. The general feeling throughout the convention was that quality of TV service has steadily improved.

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As always, Electro-Voice is FIRST! Now E-V sponsors this unique and exciting contest for a lifetime after this glorious listening experience you will judge music reproduction equipment by its ability to approach the perfection already achieved by E-V sound matched high fidelity components and loudspeaker systems!

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2 THIRD PRIZES... outstanding E-V 1STRX 12 in. three-way speakers!
3 FOURTH PRIZES... powerful E-V 1STRXB 12 in. three-way speakers!

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Electro-Voice ELECTRO-VOICE, INC. BUCHANAN, MICHIGAN

RADIO & TELEVISION NEWS

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Alfred Wallenstein, conducting The Music Appreciation Symphony Orchestra

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August, 1955

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[ ] Mendelssohn's VIOLIN CONCERTO IN E MINOR
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[ ] Schumann's PIANO CONCERTO IN A MINOR
[ ] Beethoven's SYMPHONY NO. 5 IN C MINOR

Please send me:

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[ ]Prokofiev's Symphony
[ ]Smetana's The Moldau
[ ]Wagner's Overtures
[ ]Bach's Suite
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[ ]Haydn's Symphony
[ ]Schumann's Concerto
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Unmatched for power and performance!

This extraordinary fringe-area powerhouse is still the most sensitive all-channel antenna made today—bar none! The SUPER RAINBOW's many "years-ahead" engineering features include the triple-powered Tri-Pole, separate high and low band operation, 100% aluminum construction, and "Snap-Lock" pre-assembly. Also in great demand...

The RAINBOW, Model No. 330.

Extra elements, extra performance!

There may be antennas that resemble our TRAILBLAZER, but none can top its blazing performance. The TRAILBLAZER features extra High and Low Band directors, and full-wave directors on the High Band. It installs faster than any similar antenna, and—it's all aluminum! Especially recommended for areas with front-to-back interference problems, particularly on the Low Band. Count the elements... then compare the prices.

Advanced design — and "Super-Sembled"

Look to the LANCERS for Channel Master "extras": extra elements and extra gain — at no extra cost. Completely "Super-Sembled." The SUPER LANCER gives 1 1/2 db more gain on both the Low Band and the High Band than similar types. The LANCER, Model No. 333, has an extra director that provides 1 1/2 db more Low Band gain. Count the elements... then compare the prices!

Servicemen everywhere are discovering an entirely new answer to the problem of multi-channel fringe-area reception: Channel Master all-channel yagis. These are the antennas that have what it takes to bring top TV performance to the most distant, isolated locations. And, they're ready for color, too!

Today's leading all-channel yagis are designed — and improved — in the Channel Master Antenna Development Laboratories. Isn't it logical to use Channel Master's famous engineering skill to solve your reception problems?
PAY-SH TAX has run into a rampant snarl—legal and technical—from both the industry and the lawyers. Two definite points of view have appeared. The networks have solidly aligned themselves against any form of subscription television, claiming that such a system is incompatible with American tradition and against the fundamental interpretation of the Communications Act.

Officials of the three networks pointed out in their briefs that pay-TV cannot co-exist with free television and that the law, as it stands today, makes no provision for any form of broadcasting other than free.

The proponents of the three fee-systems strongly deny that fee and free telecasting are mutually exclusive, emphasizing that one would be a special form of tele-broadcasting that would only be in operation at certain fixed hours of the day.

Since the original decoding systems were announced some time ago, using wire or the airways, new methods of attacking the control signal have been proposed; none of these ideas has actually been put into operation. They are all paper plans at the moment. In one proposal, it was suggested that since all codes can eventually be broken and bootlegging can become commonplace, it would be futile to use a coded system.

However, a direct wire, like that used in community TV, could be used, it was said, and a push-button technique applied to control the signal into the TV set. The button would have a key supplied by the system operator or could be a combination mechanism similar to a lock.

It was also suggested that "block-purchase" could be affected and the televiwer would receive a monthly bill for the purchase of such a package. In such an arrangement, the TV viewer would indicate to the operator his desire to receive certain programs so that when they were telecast he could tune them in like a free program.

Such a system, it was noted, could be tested in any of the areas that now have community TV cables. When questioned as to the advisability of wiring up a large metropolitan center for such a test, the sponsors claimed that technically this presents no particular problem since similar systems have been in operation in London and Amsterdam for quite a while.

They admit, however, that there are a number of municipal and private utility problems that would be encountered in getting approval for the use of existing ducts to carry the wired services.

Another proposal that has appeared on the scene recommends the use of dual transmission on a single channel—one part of which would be used primarily for coded or private signals.

It was agreed that subscription-TV was a legal maze over which the experts would be arguing for many months. The FCC will have to decide whether subscription-TV is broadcasting or common-carryer. In a statement issued last year, the FCC declared in a rather broad report that it believed that pay-TV was a broadcast service and could be operated under the present act. However, a number of Congressmen do not believe that this is so and propose to debate the point thoroughly.

TV SET MAKERS and telecasters, a few weeks ago, found themselves faced with another scheme designed to solve the high-band puzzle; this time a completely new channel-shift plan offered by another than a member of the Commission, Robert E. Lee. He told engineers at the annual meeting of the National Association of Radio and Television Broadcasters that perhaps a consolidation of the bands into one continuous chain running from 60 to 342 megacycles, sliced up into 47 channels, could remove all of the problems that now appear on the low- and high-band scene. Such a rocking re-shuffle would alter completely not only the present allocation program, but the complete philosophy behind the post-war spectrum edict.

According to the Commissioner, his idea, offered as a personal recommendation, would eliminate the need for the varied proposals to demix or set up boosters or satellite stations. To accommodate the combined channels, channel 2 would go: FM, now in the 88 to 108-mc. region, would be moved up to the 342-362 mc. band; and all non-broadcast services would be placed either below 60 mc., or above 362. This would mean that the following services would have to be moved: aero-
GENERAL CEMENT MFG. CO.

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Safer; sets are easy to carry
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Protection for printed circuits.
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For drive-in theaters, etc.
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Two punches, "C" & "I".
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Contains 4 G-C socket adapters.
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Tenite 5" prongs, 50' leads.
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Printed circuit touch-up, pure silver, 1 oz. Troy.
No. 21-1 NET $2.37

G-C PRINT-KOTE SOLDER
Low melting, non-corrosive flux.
No. 9131 NET $0.45

G-C 2-WAY HEX RATCHET BOX WRENCHES
Two sizes, 1/4 x 1/4, 3/8 x 3/8.
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9235 2.10

G-C PRINT-KOTE SOLDERING FLUX
Liquid flux for printed circuits.
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G-C WIRE MARKERS
Self-sticking; pre-cut, 3 strips.
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G-C TERMINAL STRIP ASSORTMENT
Box of various types.
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Set, strip, cut twin leads; crimp lugs.
No. 9220 NET $3.95

G-C 300-OHM LINE TOOL
No. 5209 NET $14.95

G-C SOLDERLESS TERMINAL REPAIR KIT
Fastener tool and terminals.
No. 8176 NET $3.95

G-C 6-PC. SCREWDRIVER KIT
Fitted case and complete set.
No. 8615 NET $1.17
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G-C TUBE-LIFTER
Protects fingers and tubes.
No. 9207 NET $2.40

G-C 6-PC. HEX NUT DRIVER KIT
Case with sockets 1/8 to 1/2.
No. 9206 NET $2.40

G-C 7.5-OHM FUSE RESISTOR
Replacement for drive-wired set.
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G-C TV "PICTO-VUE" RACK & TRUCK
Easy to use, includes mirror.
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Send postcard for your complete illustrated G-C Catalog

G-C TV TUNER KLEEN-O-MATIC
Cleans, shields Standard coil tuners. Easy to install.
No. 9221 NET $1.50

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Fitted case and complete set.
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Case with sockets 1/8 to 1/2.
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Replacement for drive-wired set.
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G-C TV TUBE-CHECKER
Easy-to-use series filament tube checker and continuity tester re-quires no tube warm-up. Simply plug tube in and get immediate check.
No. 9270 NET $3.95

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In popular capacity and voltage ranges—
ultimate in convenience for the serviceman

Here are two of the new "ILLINI HANDEE-PAK" Assortment Kits now on display at your jobber. Attractively and conveniently packaged on cards and sealed in transparent polyethylene bags, each of the kits contains the most popular capacity and voltage ranges in use by the service industry.

Each of the ELECTROLYTIC "HANDEE-PAK" kits consists of five popular assorted capacitors. The paper capacitor "HANDEE-PAK" kits are made up of ten assorted of the new type ITC oil impregnated ceramic cased capacitors.

These capacitors lead the field in advanced design, superior quality and workmanship and are the ultimate in packaging and convenience. "HANDEE-PAK"s simplify storage, banish shelf-life problems.

A few "HANDEE-PAK"s in your service kit take
up little room, serve you by being factory fresh and easily identified. Use them with confidence—millions of capacitors produced to date are your assurance of "Time Tested Quality."

If your jobber cannot supply you at present, drop us a line for full details on the new "HANDEE-PAK" kits. We will also send you latest catalog covering our complete capacitor line.

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THE CAPACITOR LINE OF "Time Tested Quality"

nautical marker beacons and operational fixed, now on 72 to 76 mc.; aeronautical radio navigation and mobile, government, amateur, domestic public, land transportation, industrial, public safety and maritime mobile, now on 108 to 174 mc.; and government, amateur and aeronautical now on 216 to 342 and 342 to 362 mc.

The FCC representative said that he chose 47 channels because during a number of early Commission sessions it was pointed out that a dozen very-high channels and 35 ultra-high channels (each 12 megacycles wide to permit colorcasting) would be sufficient for nationwide coverage. Now that it has been found possible to transmit color on 6-megacycle channels, he felt, the earlier suggestions had even more merit.

Broadcasters didn't seem to feel as optimistic about the move as the Commissioner. One FM operator, who had to change his transmitter when the 45-mc. shift to the 88-mc. zone was authorized, remarked that the new frequency hike would involve an expenditure of well over $60,000; much too costly for him at the moment. Others said that the Lee plan would seriously affect high-band set sales and conversions and should be shelved immediately, with an official statement from the Commission. As long as the proposal is alive, it was strongly emphasized, we'll have a market slump.

HIGHER POWER and more sensitive receivers were described as the key to the present ultra-high problem by another FCC spokesman, this time the chairman of the Commission, George C. McConnaughey.

In an address before another group of NARTA members, he reported that the Commission felt so strongly about the possibilities of such power and its coverage on the high bands, that the FCC staff had been instructed to initiate rule-making proceedings that would step up the maximum radiated power output from one to five megawatts. The Commissioner emphasized that these instructions were also told, to obtain information concerning the possibility of improving the sensitivity of u.h.f. receivers. The broadcasters were informed that these instructions were issued in an effort to . . . "explore the practical possibilities of making u.h.f. and v.h.f. comparable." The rule-making plan, explained the Commissioner, will . . . "offer industry the opportunity to provide practical assistance. . . . These proposals, if successful, offer a potentially more efficient use of the authorized spectrum space."

Noting that he realized that telecasters had been faced with a serious situation, the Commissioner said that he was sure that industry would, in their ever-continuing spirit of cooperation, help develop sound solutions.

"You broadcasters," he recalled, "were beset with many baffling and complex problems in the infancy of broadcasting and you solved them; in

(Continued on page 106)

RADIO & TELEVISION NEWS
ROHN NO. 6 TOWER
"All-Purpose" Tower

Self-supporting to 50 ft., or guyed to 120 ft. Utilizes mass production techniques to give you lowest prices, yet highest profits for a tower of this type. Ideal for home and industrial requirements. Permanent hot-dipped galvanized coating inside and out. Dependability — a feature customers demand — is assured with the Rohn No. 6 Tower . . . designed to "stand up" for years to the rigors of weather and climatic conditions. Easy to climb for fast, efficient servicing. In 10 ft. sections.

ROHN PACKAGED TOWER
"Space Saver"
cuts storage space
300% or more!

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

Both Towers Feature...

1. MAGIC TRIANGLE CONSTRUCTION
Famous wrap-around design with full 1 1/2" corrugated cross-bracing welded to tubular steel legs.

2. INTERLOCKING JOINTS
. . . formed by swaging tower ends so that they overlap each other, becoming a single unit in structure. Proven by tests to be superior.

3. WEATHER SEALED
. . . against condensation and moisture.

4. HOT DIPPED GALVANIZING
. . . both inside and out gives the finest protective coating known. This sales point is one of the best you can offer . . the finest quality and at lower than competitive prices!

these two HOT DIPPED GALVANIZED
Rohn Towers will satisfy 90% of your TV tower needs!

HEAVY DUTY NO. 30 TOWER

Heights up to 200' or more when guyed Self-supporting up to 60'
Sturdy communication or TV tower that will withstand heavy wind and ice loading. Heavy gauge tubular steel, electrically welded throughout. Weather resistant, non-corrosive double-coating provides durable finish. All sections in 10' lengths. Only 2-4 manhours required for installing 50' tower! Tremendous sales potential for you in this tower!

SPECIAL INSULATOR SECTIONS are available to permit the Rohn No. 30 Tower to be used as guyed "series fed" radiators for amateur and commercial uses.

NEW LINE OF ROHN ROOF TOWERS

Four superior designed "Roof Towers" are available for inexpensive, yet sturdy roof installations. 3', 5' and 10' sizes are available. These completely galvanized Rohn Towers have unbeatable sales appeal when this type installation is desired.

for • larger profits • customer satisfaction • greater ease in ordering, handling and shipping

GET ALL YOUR REQUIREMENTS FROM ONE RELIABLE SOURCE

ROHN Manufacturing Company
116 Limestone Avenue, Bellevue, Peoria, Illinois
"Now, where is that audio amplifier?"

You don't need a high powered microscope to examine the "Surprise" trade-in figure offered by Walter Ashe on your used (factory-built) test and communication equipment. For the giant, economy size allowance, get in touch with "Surprise" Trade-In Headquarters today. Wire, write, phone or use handy coupon.

HALLICRAFTERS SX-96
Less speaker. Net $249.95

HAMMERLUND HQ-140X.
Less speaker. Net $264.50


ELMAC AF-67 TRANS-CITER.
Net $177.00

Model R-9 Receiver. Double conversion. Six bands 80 through 10 meters. 9 tubes. 5 meter. Less speaker Net $149.50

NATIONAL NC-98
Less Speaker. Net $149.95

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YOU MUST PLEASE
YOUR CUSTOMERS
IF YOU WANT
TO MAKE YOUR
BUSINESS GROW

It’s a woman you have to please in
76.9% of your service calls.
You’ll please more women when you
use tubes with the Good House-
keeping Guaranty Seal . . . CBS
tubes.

CBS tubes are advertised and mer-
chandized to millions of women in
national magazines . . . and on
Arthur Godfrey’s Talent Scouts over
nationwide TV and Radio networks.
More and more women will have
greater confidence in you and your
service when you use tubes with the
Good Housekeeping Seal . . . tubes
with the respected name — CBS.

Ask your distributor for
CBS tubes

CBS-HYTRON
Danvers, Massachusetts
A DIVISION OF
COLUMBIA BROADCASTING SYSTEM, INC.
Within the Industry

DANIEL R. VON RECKLINGHAUSEN has been appointed chief research engineer of Hermon Hosmer Scott, Inc., Cambridge, Mass., manufacturer of acoustic measuring instruments and sound reproduction equipment.

He received his degree from Massachusetts Institute of Technology where he was elected to Tau Beta Pi, Sigma Xi, and Eta Kappa Nu, honorary engineering societies.

Prior to his study and work at M.I.T., Mr. von Recklinghausen had experience with Rohde and Schwarz of Munich in the design and development of u.h.f. test gear and allied instrumentation. He joined H. H. Scott, Inc. in 1951. Until his new appointment, he served as senior project engineer for the firm.

CHARLES GOLENPAUL, vice-president in charge of distributor sales for Aereovox Corporation, was elected chairman of the Sales Managers Club of New York.

He was one of the founders of the club in 1935 and served as the organization's chairman for two terms in 1935 and 1937. The Club is one of the sponsors of the annual Radio Parts Show in Chicago.

ROBERT C. OVERSTREET has been elected president of Timmerman Products, Inc., succeeding George J. Schad who has retired.

He has been associated with the company since 1941 and has served as executive vice-president since 1953. He was named assistant to the vice-president and general manager in 1945 and was made secretary in 1948. He was elected a vice-president and to the board of directors and re-elected secretary in April 1952.

Serving as secretary and treasurer of the firm under Mr. Overstreet is John E. Potter who was formerly comptroller of the firm. He was also named to the board of directors.

NATIONAL ELECTRONIC DISTRIBUTORS ASSOCIATION has moved its headquarters to 4704 W. Irving Park Road in Chicago... ELECTRA MANUFACTURING COMPANY of Kansas City, Mo. has moved its sales and executive offices to 4051 Broadway. Its engineering and production facilities have been transferred to a new plant on a 10-acre site at 800 N. 21st Street, Independence, Kans... ASSEMBLY PRODUCTS INC. of Chesterland, Ohio is establishing a Southern California plant which will be located on a 40-acre site on Dillon Road, miles southeast of Desert Hot Springs... LENKURT ELECTRIC CO. OF CANADA LTD. is building a new $200,000 factory and office building in Burnaby near Vancouver, B.C. Completion is scheduled for early 1956... RUST INDUSTRIAL CORPORATION, manufacturer of remote control units for radio station transmitters, has built a new one-story air-conditioned plant in Manchester, N. H... Construction of a 203,874 square foot plant to be occupied by RAYTHEON MANUFACTURING COMPANY has begun in Melrose Park, Illinois. The building will be the nucleus of manufacturing and warehousing facilities the company expects to expand later on the 624,000 square foot site... ESPEY MFG. CO. INC. has expanded its engineering and production facilities and consolidated these facilities at the firm's Saratoga, N.Y. plant for greater efficiency... TYLER-EVANS, INC., manufacturer of transformers and coils, has opened a new factory at Antioch, Illinois.

JOHN M. MILLER, JR. has been named to fill the newly-created position of director of engineering of the television and broadcast receiver division of Bendix Aviation Corporation.

The new position was made necessary by the firm's expanding program and added activities in connection with the development of color television.

Formerly chief engineer of the firm, Mr. Miller joined the company eight years ago. During World War II he was a radio and radar engineer at the Naval Research Laboratory and the Navy Bureau of Ships.

He will be assisted in his new duties by Stanley R. Scheiner who has been named second-in-command.

EXPOSITION MANAGEMENT ASSOCIATION has been formed in New York for the purpose of instituting an active public relations program aimed at clarifying and promoting the value of the billion-dollar-a-year trade show industry to exhibitors, trade buyers, and consumers and serving as a management-labor clearing house for its members.

A diversified group of 28 trade show...
PUT YOURSELF IN THE High-Paying TELEVISION PICTURE

Today, when demand for trained men is higher than ever before, pay is higher than ever before, you can train AT HOME in your SPARE TIME to become a Television Technician.

PREPARE FOR A BRIGHTER FUTURE AS A TV TECHNICIAN

You can hold down a full-time job and still train AT HOME by the same successful methods I used to help hundreds of men—many with no more than grammar school training—master television!

NO EXPERIENCE NEEDED... I'LL TRAIN YOU AT HOME IN YOUR SPARE TIME

VETERANS!

My School fully approved to train veterans under new Korean G.I. Bill. Write discharge date on coupon.

Good Spare Time Earnings

Almost from the very start you can earn extra money while learning by repairing radio-TV sets for friends and neighbors. Many of my students earn up to $25 a week... pay for their entire training from spare time earnings... start their own profitable service business.

Expert FM-TV Technician Training

My FM-TV Technician Course can save you months of training if you have previous Armed Forces or civilian radio experience. Train at home with kits of parts, plus equipment to build BIG SCREEN TV RECEIVER. ALL SUPPLIED AT NO EXTRA COST!

New! Practical TV Cameraman & Studio Course

I train you at home for an exciting big pay job as the man behind the TV camera. Work with TV sets in the TV studio or "on location" at remote pickups. Available if you want it... one-week course of practical work on TV studio equipment at Pierce School of Radio & TV, our associate resident school in New York City.

Optional 7 Weeks Training in New York City at No Extra Cost

You get two weeks, 58 hours, of intensive laboratory work on modern electronic equipment at our associate school in New York City—Pierce School of Radio and Television. And I give you this AT NO EXTRA COST whatsoever, after you finish your home study training in the Radio-FM-TV Technician Course and FM-TV Technician Course. However, your home study course is complete even without this two-week laboratory session. It is only one of the many Extras available to you from RTTA if you want it.

Radio Television Training Association

52 EAST 19th STREET • NEW YORK 3, N. Y.
Licensed by the State of New York • Approved for Veteran Training

August, 1955
A KLIPSCH CORNER FOLDED HORN OF MINUTE PROPORTIONS!

An amazing 20' high, the Rebel 5 design involves a cavity (capacitance); a slot (inertance) and a corner horn to provide back loading for a direct radiator speaker. The middle and extreme high ranges are preferably reproduced with corresponding horns and the resulting 3-way speaker system can be squeezed into the tiny space.

Reduction in size of speaker structure sacrifices one or more of the following: the maximum wavelength the system can produce; the smoothness of response (reduction of size invariably produces peaks in the bass range); introduction of distortion because of extreme diaphragm excursion if the enclosure is too small (this is usually associated with peaked response). All Rebels necessarily violate these principles. The trick in retaining a high level of quality typical of Rebel design is to coordinate the design of the low-pass filter with the short length of horn exterior to the housing and to introduce an effective cut-off of gradual slope such that the output, instead of becoming highly distorted in the extreme bass range, merely attenuates without presenting frequency doubling and resultant inter-modulation of high frequencies.

Dimensions: 21" H, 16 3/8" W, 14" D.

---|---|---
Unfinished $33.00 | $48.00 | Leatherette $48.00

WALTER A. WEISS has been named general manager of the radio tube division of Sylvania Electric Products Inc. at Emporium, Pa. Herbert A. Ellers has been named to succeed him in the post of general manufacturing manager of the same division.

Mr. Weiss, who had been general manufacturing manager of the division since 1952, succeeds Matthew D. Burns who was recently promoted to the post of vice-president-operations and general manager in charge of the company's electronic tube operations. He will make his headquarters in Emporium, Pa.

MICAMOLD RADIO CORP. has changed its corporate name to MICAMOLD ELECTRONICS MANUFACTURING CORPORATION in order to more accurately reflect the firm's position as a supplier of capacitors to the entire electronics industry. INSTRUMENTS FOR INDUSTRIES, INC., will henceforth be known as INSTRUMENTS FOR INDUSTRY, INC. No other changes in corporate structure are contemplated . . . RADELCO MANUFACTURING CO., Cleveland antenna manufacturer, has changed its corporate name to TENNA MANUFACTURING COMPANY. Headquarters are at 7580 Garfield Blvd.

LEONARD C. TRUESDELL has been named vice-president and director of sales for Zenith Radio Corporation. He joined the company in 1949 as sales manager in the home instrument field and, until recently, has been vice-president in charge of radio and TV sales.

Prior to joining Zenith, Mr. Truesdell served as vice-president in charge of marketing for Hotpoint where he completely rebuilt the company's national sales organization within a three-year period.

He succeeds H. F. Bonfig, who recently resigned, in his new post.

PHILCO CORPORATION has created a new division to be known as the LANDALE TUBE AND TRANSISTOR COMPANY for the manufacture of electron tubes and transistors. The division's main plant is at Lansdale, Pa. . . . A Community TV Cable Service Section has been created by FEDERAL TELEPHONE AND RADIO COMPANY of Clifton, N.J. The new section will offer technical information and associated services to (Continued on page 82)

(Continued from page 23)

Managers took part in the organization. Allen Bryan Associates, Inc., 551 Fifth Avenue, New York 17, N. Y. is acting as public relations counsel and clearing house for the new association.

An exclusive manufacture by Cabinet
Become a top-notch television service technician

Now . . . RCA INSTITUTES offers modern TV KIT with Comprehensive Television Servicing Course

START to build with a TV Kit developed by one of America's foremost radio-tv schools—RCA Institutes. LEARN with simple step-by-step instruction how to build a modern, large-screen receiver. TEST each stage, as you build, and see how it works. Learn how "trouble-shooting" is applied. FINISH your Home Study Course ready and able to service all make and model sets!

Easy-to-follow instructions are planned and prepared for you through the efforts of RCA Institutes' instructors, engineers at RCA Laboratories, and training specialists of the RCA Service Company.

The RCA Institutes' TV Kit utilizes up-to-date circuits including:
- Synchro-Guide horizontal automatic frequency control circuit.
- Horizontal magnetic reaction scanning.
- Latest deflection circuits.
- FM sound discriminator.
- High-gain, low-noise cascode tuner.

Join the many thousands who have been successfully trained by RCA Institutes for a good job (or business of their own) in television servicing.

BASIC KNOWLEDGE OF RADIO NECESSARY
NO NEED FOR PREVIOUS TV TRAINING

FREE BOOKLET! MAIL COUPON NOW.

RCA INSTITUTES, INC., Home Study Dept. NK-8-55
350 West Fourth Street, New York 14, N.Y.
With no obligation on my part, please send me a copy of your booklet on the TV Servicing Home Study Course and Kit.
I understand no salesman will call.

Name: ____________________________ (Please print)
Address: ____________________________
City: ____________________________ Zone: ______ State: ______

August, 1955
WEBSTER • GARRARD • COLLARO
3-SPEED • HI-FIDELITY RECORD CHANGER

Now Lafayette makes it possible for you to save money on the three most popular makes of 3-speed Record changers.

WEBCOR Discomaster... It's completely automatic, 33 1/3, 45 and 78 RPM, automatic shut-off after last record, balanced tone arm, etc. 12 1/2" x 12 3/4". Shpg. Wt. 16 lbs.

Stock No. PK-49—With G.E. RPX 650 Triple Play Cartridge... 24.50

COLLARO, THE WORLD'S FINEST 3 SPEED INTERMIX CHANGER... Collar Model 2/512—3 speed automatic changer designed and engineered to meet the most exacting demands of the finest audio systems. While our stocks last. Shpg. Wt. 23 lbs. With G.E. RPX-050 Triple play cartridge... 34.50

With G.E. RPX-052A Triple play Golden Treasure cartridge with Diamond and Sapphire stylus installed... 44.95

Collaro RC-54: Latest Collaro 3 speed intermix less cartridge... 47.77

With G.E. RPX-050 Triple play cartridge... 49.95

With G.E. RPX-054A Triple play Golden Treasure cartridge with Diamond and Sapphire stylus installed... 59.95

Garrard Model RC-80: 3 speed Record changer less cartridge... 48.51

Model RC-80 with G.E. RPX—050 Triple play Cartridge... 51.95

Model RC-80 with G.E. RPX-052A—Latest triple play Golden Treasure Cartridge with Diamond and Sapphire stylus installed... 62.53

GREAT TAPES BUY EVER!

1200 FT. REEL
Genuine Plastic Base
RECORDING TAPE

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<td>Harry G. Frame; box 429, Charles town, W. Va.</td>
<td>2nd Class</td>
<td>12 Weeks</td>
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<tr>
<td>Charles Ellis; Box 449, Charles City, Iowa</td>
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<td>28 Weeks</td>
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<td>Kenneth Rue, Dresser, Wisconsin</td>
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YEARS ago people discovered that it was as much fun to go “hunting” with a camera as it was with a gun. It was a painless bit of conservation, too, since it was possible to “shoot” the same game over and over again. Now there is an added attraction. Sound is beginning to move in on sight. Thanks to the tape recorder and such special auxiliary equipment as a parabolic reflector, Nature’s sounds can be captured with a fidelity that charms the hi-fi fan as well as serves the scientist.

Just as with photography, best results come from those Siamese twins—good equipment and smart techniques. Neither can do the job alone but, fortunately, both can be acquired.

As far as the technique is concerned, there is obviously more to recording wildlife sounds than just pushing a button. Nothing is being handed to you on a platter when you are seeking to record the roar of an alligator, the Spring trill of a toad, the gobble of a wild turkey, or a vocal by a songbird. That shy bird, for example, how can you entice him close enough to the mike? There is no doubt that recording wildlife involves problems but there is a real thrill in liking them.

As far as equipment for such “hunting” is concerned, the choice in recorders has widened considerably in recent years with truly portable units now being generally available. For instance, there are new simple units which weigh under 10 pounds and are powered like hearing-aid units. As small as a lady’s handbag, these units are suitable companion pieces to the vacationist’s camera kit but, of course, have certain limitations. On the other hand, there are true portables which weigh under 20 pounds yet satisfy such professional requirements as 15 ips speed and dual amplifiers and heads for recording and playback to permit continuous monitoring of the tape.

For the true professional or the serious hobbyist there are fine recorders which are “portable” in the sense that they can be installed in a car and operated from the auto’s power system by means of accessory units. In this way the car becomes, in effect, a “sound truck” which can be parked convenient to the “hunting” grounds.

One of the best ways to learn any new technique is by example. To that end, let’s visit Cornell University’s Prof. Peter P. Kellogg since this world-famed scientist has blazed the trails for us, having pioneered both the techniques and the equipment.

Prof. Kellogg “explores” the electronics way. Together with his fellow ornithologist, Prof. Arthur A. Allen, renowned for his color photography, Dr. Kellogg has been responsible for a notable series of sound movies, record albums, and “sound books” on birds.

He has hunted in the jungles of Panama, on the rugged coast of Labrador, the barren grounds of Hudson Bay, in the swamps of Florida, in the arid deserts of the Southwest, and in his own back yard. From such safaris he has captured bird twitters, chirps, and assorted twirps besides miscellany of all sorts; alligators bellowing, monkeys howling, thunderstorms raging, and the patter of gentle rains.

At Cornell, Dr. Kellogg edits the tape, preserves it on master discs, and files them in the priceless collection, the only one of its kind, known as the Albert R. Brand Library of Natural Sounds.

The collection has already passed the 20,000 “cut” mark and includes the voices of over 500 wildlife species. One of the prize items is a “vocal” by America’s rarest bird, the ivory-billed woodpecker.

During World War II, as a radar and sound expert, Dr. Kellogg was called upon to help the Army—a job that added more footage to the Library. That particular job involved an expedition across Panama and consisted of a study of jungle acoustics designed to build morale among the troops training for southeast-Asian warfare. He came out of the jungles of Panama some months later with 30 solid hours of recorded sound to show jittery GI’s that a howler monkey needn’t frighten a mouse and that Nip prowlers sounded different from raindrops pattering through the leaves.

Thus we see that there is a practical aspect to sound hunting as well as just fun. A good tape recording can be as valuable to the missionary as to the tough “private eye”. The recorded squeal of a hungry pig is now used to wake up little pigs so that they’ll take on another load of food and grow faster. A bustling fellow like New
In his sound studio at Cornell University, Prof. Kellogg listens for tone quality in the sound track he is preparing for a movie on the adventures of "Archy," the ruby-throated hummingbird. Wall decorations are color-photo trophies "bagged" by his fellow-adventurer professor, Dr. A. A. Allen, also of the Cornell U. faculty.

York's Tom Valentino prospers by selling noise by the foot—everything from barnyard clatter to a Model-T bumping along on one flat tire to snake-charm music for cobsars.

On a private consultant basis, Dr. Kellogg himself once taped the sound of a moth larva chewing a wool sock. This was used by a radio program advertising a moth repellant.

Any scientist can obtain free service from Cornell's Natural Sounds Library. All he needs to do is send in a roll of tape and his catalogue request. The tape is erased and the correct recording put on it.

Hollywood, on the other hand, has been glad to pay $100 rental for a certain bird solo, lasting perhaps 30 seconds, needed for a picture. A few seconds of a babbling brook has brought $50 from a radio network. Such proceeds help to finance the research at Cornell.

Dr. Kellogg feels that this field is wide open. Since such recordings involve the use of electronic equipment, the ideal combination would be a biologist and electronics man. Dr. Kellogg happens to combine those unique attributes and carries the professional title of "Professor of Ornithology and Biological Acoustics."

Twenty-six years ago, when talkies were still in their infancy, a Hollywood movie-maker wanted to prove that his recording system was the best. He sent out two top technicians and a sound truck to capture bird songs.

The birds refused to cooperate. After two weeks of chasing, the hunters drew a complete blank. The expedition finally reached Cornell where, by coincidence, student Kellogg, under Dr. Allen, had just started research on his doctorate thesis, "The Problems of Bird Sound Recording."

Dr. Allen and Dr. Kellogg were glad to lend a hand. The first stop was at a blackberry patch where a song sparrow had staked out three singing perches. The scientists guaranteed results. They told the movie men that they could pick any perch as a bird would be singing there within a half-hour. The equipment was set up and the sparrow came through on schedule.

This performance looked sensational but, in fact, was just an application of the basic technique of knowing the habits of the game being stalked. Generally, it is the male bird who warbles the most spectacular arias and his solos aren't completely spontaneous. Study your "quarry" as you would in any other type of hunting and you will soon note an aspect of what science calls "territorial behavior." The bird always stakes out a home area for himself and his mate. Along its boundaries, he chooses perches for singing. The songs themselves are "No Trespass" warnings to rival males.

Such knowledge is a help to the wildlife sound hunter. One day, in the Florida Everglades, Dr. Kellogg helped a friend set up to record an alligator's bellow, then moved off. When he heard the beast, he returned to listen to the recording but there was nothing on the tape. The recordist reported that all he had heard was the noise of a nearby truck racing its motor to get out of a mudhole. "That," Dr. Kellogg said sadly, "was your 'gator."

Actually, your hunting needn't be far from home. For a starter, your own back yard can be challenging enough. A recent recording by Valentino is intended for the country fellow who gets homesick in the big city. It is a recording of frogs, mooing cows, and other "back home" sounds.

Nature's sounds can be nearer than you imagine. Dr. Kellogg advises that the best place to record the widest variety of bird songs and related sounds is near a pond that is surrounded by brush fading off into woodland. That will be a hangout for all kinds of sound-makers to challenge your ingenuity and know-how. However, hunting down a sound and recording it properly are two different things.

Knowledge of the range of frequencies likely to be encountered is important in order to select the proper equipment.

In his early research days, Dr. Kellogg evolved a thorough working knowledge of these ranges by means of conditioned-reflex experiments he performed with the aid of Albert Brand. When a bird heard a certain note it hopped off its feeding tray. Then Dr. Kellogg raised or lowered the pitch until the bird didn't react. This indicated that the note was above or below the bird's auricular range.

This project also revealed that although the canary could see moving lips, he couldn't hear a sound. The horned owl doesn't go hunting for the ruffled grouse nearby because the latter's drumming, down around 80 cycles, is pitched too low for the owl's hearing.

The hi-fi ears of a normal human aren't so crude and we usually demand a wide range of frequencies on our recordings. Outdoors the bass notes of the grouse (down to 80 cps), the staccato trills of a blackpoll (over 12,000 cps) can be heard by the average human ears. There is no bird, however, who can hear higher frequencies than humans can. We hear down to 20 cps, four octaves lower than the pigeon can, with our best hearing occurring around 2000 cps.

Another factor in hearing is relative energies. The primary output of a man's voice is around middle C, so it sounds emasculated through a speaker weak on the lower notes. The maximum of a bird's vocal energy comes, on the other hand, just a bit above the piano's highest note. For this reason the average home recorder capable of handling human conversation and song can be overloaded by a bird.

For these reasons, Dr. Kellogg doesn't use equipment which records at less than 7½ ips and he generally works at 15 ips which he considers a fair compromise between perfection and what the industry finds practical.

Now suppose you know where and what to hunt. You want a good recorder. You're not busy, willing to climb trees, sleep out nights, and rough it to make a rare recording. You have
Outdoor acoustics are generally musty. You’re good at editing so you can take out the hand claps you used to make a bird yell at you. Even with all this you still have the technique to master. For a good recording, a bird must sound right up front, yelling like an opera singer. It must be remembered, however, that outdoor acoustics are generally bad—too deadening. More important, amplifying the bird’s song to obtain the proper volume means that every other background sound is being amplified too. Distant trucks and tractors shatter the solo, an airplane drowns it out, even a mosquito sounds like a bomber and the brook that should babble roars. As an antidote to all these potential problems, Dr. Kellogg makes use of his extensive knowledge of bird behavior plus a piece of specialized equipment. Years ago, he and M. Peter Keane, now with Columbia Pictures, put a 40-inch parabolic reflector on the car’s trunk. The reflector was hand-made out of wire screen and papier-mâché and the big, shallow, cone-shaped “dish” worked splendidly.

Today this earlier parabolic reflector has been replaced by an aluminum unit 40 inches in diameter which has been adapted from a war-time radar dish. One made from reinforced plastic might prove more satisfactory but the aluminum unit is easier to handle because of its light weight. When driving to his recording location, Dr. Kellogg mounts the reflector outside the car’s trunk compartment like a bustle. There is only one catch to this equipment and that is that the 40-incher doesn’t do much reflecting under 300 cycles. To handle some of Nature’s lower pitched sounds the parabola would have to be so large that it would be unwieldy. However, the efficiency increases rapidly with frequency and the parabolic reflector does a better-than-average job.

When a bird won’t come near enough to make a top-notch recording, Dr. Kellogg makes a “test” recording with the aid of the reflector. This recording is good enough to arouse the bird’s jealousy as he thinks that a rival is singing. Hopping mad, he comes right down to the playback unit and sings full force into the hidden mike. This mild deception has worked so well that it has now become a standard technique with Dr. Kellogg.

Depending on field conditions, Dr. Kellogg uses the naked aluminum reflector or paints it with camouflage colors of green, red, yellow, etc. Dr. Kellogg usually uses a dynamic mike which he has found to be rugged with broad, flat frequency response and a certain immunity to heat and humidity. In addition, its low impedance allows it to be used at relatively great distances from the first amplifier stage. Most of his footage has been recorded with the car serving as the “sound truck.” The rear seat of the car has been given over to the recorder, amplifier, frequency controls, etc. Power is one of the big problems. Dr. Kellogg finally settled on four standard car batteries to operate the power plant which is installed in the trunk compartment. The batteries operate the small converter which provides the necessary voltage for recording. (Continued on page 76)
VARIABLE damping is the latest thing to be hailed in the audio field as a panacea. As with any innovation in any field which is hailed as a cure-all, a little time elapses before it is possible to evaluate its true significance. David Hafler's article on the subject ("Control of Amplifier Damping Factor," July, 1955 issue of Radio & Television News) seems to have been the first attempt so far at making such an evaluation. Earlier writings on the subject have all eulogized this innovation as something that would provide the ultimate in reproduction.

Irrespective of the true worth of this innovation, while the craze is still on, variable damping will undoubtedly sell a great many amplifiers. Now that the trend has started (audio enthusiasts being the fervent species they are) undoubtedly every one will want to verify for himself just what variable damping has to offer.

The author was among the early ones on the variable-damping bandwagon. In fact, some two years ago, when asked what possible changes could be incorporated in amplifier design, this was one that was suggested. In fact, as soon as the opportunity presented itself, the author designed an amplifier incorporating this feature and conducted some experiments in its operation. As a result of these experiments with different loudspeaker units, the company with which the author was then affiliated decided to abandon variable damping as a feature for the present.

This decision was not made because the amplifier into which it was incorporated was not a successful design, but as a result of evaluating the tests made with different loudspeaker units. The conclusions drawn from these tests were as follows: (a) With high class loudspeakers, in which the impedance is held reasonably constant throughout the frequency band by efficient acoustical loading of the unit in its enclosure, the variable damping had so little effect that it was extremely difficult to detect any difference in reproduction, between positions of the control corresponding to maximum and minimum damping.

(b) The effect could be detected using a cheaper loudspeaker or a cheaper enclosure, which possessed acoustical resonances that required damping.

Based on this discovery the opinion was expressed that a person who would not be prepared to buy a better class loudspeaker, would scarcely be impressed with the idea of paying more for an amplifier to improve the quality of a cheaper loudspeaker; and the person who buys a better speaker and enclosure does not need it. Whether this decision was justified or not remains to be proven.

Meanwhile the boom in variable damping goes on. Many readers of this magazine have still to satisfy themselves, in one way or another, about the precise value of this innovation. The hard way (on most budgets) is to trade in one's present amplifier for a new one incorporating variable damping in one of its various forms. The easier way is to try variable damping out first, by a simple addition to one's existing amplifier, to find out whether it really does something, before investing in a whole new amplifier.

The Essentials

Before describing how to do this, let us take a little time to make sure we have clearly in mind just what we are going to do with the amplifier. We want to make sure that the effect we are testing is really that of variable damping, and not some of the other things that can accidentally get mixed up with it. Unfortunately many of the amplifiers now on the market, advertised as providing variable damping, do other things besides adjust the variable damping, when you turn the damping control knob. But we will discuss that after seeing what is required.

We have to add variable damping to the amplifier without interfering with its performance in any other respect. The way to introduce variable damping is by modifying the feedback circuit, but in doing this we should be careful about two things:

(1) We want to keep the over-all feedback constant, because changing the amount of feedback applied to an amplifier varies its stability margin, and this, in turn, interferes with its frequency response, so it is no longer the same amplifier; and

(2) We need to make sure that the additions to the circuit will not alter the operation conditions of any of the tubes.

Evolution of a Practical Method

Take the circuit of Fig. 1 as the essential part of an amplifier to be modified. Here $R_i$ is the cathode resistor of an early stage, to which the over-all feedback is connected through $R_c$ and $C$. The feedback factor is determined by the ratio of $R_c$ to $R_i$, while $C$ is necessary to maintain stability at ultrasonic frequencies. We have to maintain the same feedback factor and stability condition, when we insert our variable damping circuit. Using the method described, it is quite easy to make the calculations necessary to modify the circuit.

Fig. 2 shows the circuit modified to include variable damping. The first stage cathode bias must be maintained. In the original circuit, $R_i$ did not appreciably shunt $R_c$, but in the revised circuit $R_c$ will have a much lower value. To maintain the same bias, the resistance measured between the cathode and ground must be the same as the original circuit. The easiest way to be sure of this is to just double the original value of $R_c$, in arriving at values for $R_c$ and $R_i$ in the circuit of Fig. 2.

Now suppose that, in the original circuit of Fig. 1, $R_c$ was $20 \times R_i$; the
values $R_v$ and $R_v$ in Fig. 2 will provide a two to one reduction, so we have to make only a 10 to 1 reduction ahead of resistor $R_v$, from the secondary of the output transformer. In addition we must keep this fraction constant as we vary from current feedback to voltage feedback.

To achieve this for current feedback a resistance of one-tenth the load value at the tap used is inserted in the return from the grounded side. This can easily be adjusted by using a wirewound potentiometer for this value. If a resistance meter to measure such a low value is not available, it may be adjusted by estimate, if the potentiometer is of a linear type, to give the resistance required. This resistor will provide the necessary amount of current feedback equivalent to the original feedback.

Now we place a shunt across the output transformer secondary, consisting of two fixed resistors, whose values have a ratio of 10 to 1. They should be of sufficiently high value not to shunt away appreciable power from the circuit, and at the same time low enough not to interfere with the over-all resistance in the return path of the first stage cathode. Values of 10 and 100 ohms would be quite suitable.

Now we place a low value potentiometer, 100 ohms would do, across the pick-off points for current and voltage feedback, as shown in Fig. 2.

With the slider of this potentiometer all the way over to the junction between the 10- and 100-ohm fixed resistors, the feedback will have the same value as the original circuit and will be entirely voltage feedback; so the damping factor will be identical to the original damping factor of the amplifier, which most likely has a value quite high enough for any practical purpose.

With the slider of the potentiometer moved all the way over, the resistor connected between the output terminal and the transformer secondary will give the same amount of current feedback as the original voltage feedback when the correct load is connected; and the damping factor will be reduced, in all probability, to a fraction of value.

Positions along the potentiometer between the two ends will adjust the damping factor continuously between these two limits, while maintaining the same over-all value of feedback.

It just remains to see that the capacitor is connected to maintain the same stability condition that was provided in the original amplifier. As we have kept the same combined resistance in the cathode ground return, although the method of attenuation in the midband has been modified, the same capacitor will still provide the same boost at the high end (which is beyond the audio spectrum). Connect it between the top end of the transformer winding and the cathode (exactly where it was before).

So the modifications necessary to incorporate variable damping into any normal type of feedback amplifier are quite simple. All the additional components are of fairly low resistance values—lower than the value of $R_v$, which was removed—so there is no problem of the additional components introducing instability in themselves. But care should be exercised in making the modification, not to interfere with the lead dress of the amplifier as it stands, because this often proves to be important to the stability of the amplifier.

From this example, the reader should have no difficulty in applying details from his own amplifier to calculate values for its particular circuit: in all probability, the ratio between $R_v$ and $R_v$ will not be quite as convenient as 20 to 1; but whatever it is, the ratio can simply be divided by 2, and the same procedure adopted to calculate the other values in the circuit. The value of the cathode resistor can be doubled in each case, and an equal resistance used for the capacitive feed from the slider of the 100-ohm potentiometer. This will preserve the correct operating condition for the first tube of the amplifier, and also insure that the stabilizing effect of the capacitor already in the amplifier is maintained.

What to Expect

It is suggested that in making these alterations care should be taken not to heck the circuit, as it cannot be put back in its original condition, because the author is strongly of the opinion that most readers, having conducted the experiment, will decide that it is not worth having this extra paraphernalia hanging on the amplifier.

If you have any of the better class loudspeakers, you will find that turning the control from one extreme end to the other will make so little difference in the reproduction, it is rather difficult to detect.

If you are using an inferior loudspeaker or enclosure, or both, you may notice a considerable difference and you can then adjust the damping control to give the reproduction that you think sounds most pleasing; or, if you prefer, you can run a square wave through the system, look at the waveform across the voice coil with an oscilloscope, and adjust the damping control until the nearest approach to a square wave is achieved. This procedure has been recommended elsewhere for the adjustment of damping control.

The author will not guarantee, however, that this means ideal damping has been achieved, with an inferior loudspeaker in an inferior enclosure. In fact, it is extremely unlikely to have done so. The reason for this lies in the poor electro-mechanical coupling factor of the inferior loudspeaker unit. This means that the acoustical resonance of the diaphragm in its enclosure is not very well coupled to the electrical circuit of the voice coil. Consequently, although the impedance caused in the electrical circuit by this resonance may be adequately damped by the amplifier, the acoustical vibrations which cause the electrical resonance have not been equally well damped.

A careful examination of this problem shows that the only satisfactory (Continued on page 109)
GREAT strides have been made in the development of new types, sizes, and values of capacitors, resistors, and coils which form the bricks in the electronic circuit structure. To acquaint the reader with the present state of the art, this article is devoted to fixed capacitors of all types. The various applications, advantages and disadvantages, ratings, and tolerances will all be covered here.

It is impossible to give complete coverage of every type of capacitor or discuss each individual model and its application in detail in a single article. The most frequently used types are described here and it should be pointed out that in almost every instance several manufacturers offer the same type of capacitor, though sometimes under different names.

To say that a capacitor is a device which is charged up by an electric current, or to call it a d.c. block or an a.c. impedance are all incomplete descriptions from a physical point of view. Fig. 1 shows a true electrical representation of a capacitor which covers all theoretical aspects. \( R \) is the shunt or leakage resistance which is usually negligible, except in the case of electrolytic capacitors or some designed for special applications. \( R_s \) represents the series resistance due to the resistance of the wires, the capacitor element, and the dielectric. \( C \) represents the capacity to ground which may be considerable in video amplifiers using large coupling capacitors. \( L_a \) is the inductance due to the leads and the foil making up the capacitor plates. This inductance leads to self-resonance of certain types of capacitors at the higher frequencies and also becomes considerable when electrolytic capacitors are used as by-passes for r.f.

\( C \) is the actual capacity which is marked on the capacitor. This value can cover quite a large range. Capacitors are available from 5 micromicrofarad up to 2000 microfarads. Although ranges overlap somewhat. Table 1 lists the approximate ranges in value for the major capacitor types. These types are usually named according to the dielectric material which is used between the capacitor plates.

In addition to the capacity value, the voltage rating of a capacitor is always a necessary specification. There are actually two voltage ratings for a capacitor; one for the maximum a.c. and one for the maximum d.c. voltage which can be applied without causing an internal short. For most practical applications, the d.c. working voltage is the most important criterion since the a.c. rarely is so much higher as to cause damage. It is possible, however, to damage a capacitor with a.c. signals alone, especially when the r.f. dissipation exceeds the limit of the capacitor. This is usually only of concern in transmitters or power oscillators.

One of the confusing aspects of any capacitor catalogue is the value designation. For example, there are .22 \( \mu \)fd. and 25 \( \mu \)fd. paper capacitors; and .05 \( \mu \)fd. will appear together with .047 \( \mu \)fd. and occasionally, .056 \( \mu \)fd. paper types. The reason for this is the incomplete acceptance of the standard values recommended by the Radio-Electronic - Television Manufacturers Association (REMTA) for capacitors and resistors. Old values such as .25 and .05 \( \mu \)fd. or 200 and 500 \( \mu \)fd. are still manufactured together with the new REMTA values based on a mathematical progression. In actual circuitry, the interchange of values depends on whether a tuned circuit is involved or not.

Tolerance on capacity is another aspect which deserves consideration.
especially in critical circuits. Mica capacitors and some small ceramic units have tolerances of ±5 or ±10% and are so marked. Other types of ceramic capacitors, especially some disc types, are generally specified as having a tolerance of −20% and +80%. This makes them suitable for coupling and bypass applications, but not very reliable for tuned circuits. Paper capacitors usually are rated at ±1% unless otherwise specified, while electrolytics often have a −20% +50% tolerance. Special types for military or transmitter use are designated with their individual tolerances by the manufacturer.

Before going into a discussion of the small value capacitors, the polarity indicated by the symbol should be mentioned. This polarity becomes important when d.c. is applied across a large capacitor of the electrolytic type or when the capacity to ground of the outer foil becomes a problem. The curved portion of the capacitor symbol indicates the outer foil which should generally be the negatively polarized portion.

**Mica Capacitors**

In Fig. 2 is shown a mica capacitor. Mica capacitors have been in use practically since the beginning of the electronics industry. They are constructed of thin sheets of mica interleaved with two sets of aluminum, tin, or silver foil. Each set of foil goes to one side terminal and its pigtail wire. The entire assembly is molded into a Bakelite insulator and color coded as to its value. Unfortunately, the color coding of mica capacitors has long been a source of bafflement. This is due to the fact that there are at least three widely-used color codes and it often requires considerable thought to figure out which one is being used on any one unit. Shown in Fig. 3 are the various ways in which a mica capacitor can be marked. It should be pointed out that the color values are the same as in the resistor and other color codes.

Mica capacitors generally come in voltage ratings of 300 volts, 500 volts, 1000 volts, and higher. For transmitting equipment there are large mica capacitors which will be most familiar to the radio amateur and experimenter. These units are designed for consider-
Fig. 8. Various types of paper capacitors are shown here: molded (Pyramid), glass-sealed (Astron), metalised-paper and metal encased (Cornell-Dubilier).

Fig. 9. Ceramic encased paper capacitor.

Fig. 10. Typical impregnated capacitor. This unit, by Pyramid, is oil-filled.

Fig. 11. The "bathtub" shaped containers shown here enclose capacitors whose dielectric is oil. Sometimes such metal containers enclose an electrolytic.

Fig. 12. Shown here are various types of electrolytic capacitors. Some in metal cans. Others in cardboard containers. The two on the left are manufactured by Mallory.

type capacitor has a negative coefficient and usually has a number designation such as N470 or N1500, indicating the specific variation with temperature. The larger the number the greater the change in capacity.

Additional types of ceramic capacitors include the button type for v.h.f. and u.h.f. bypassing and coupling, and a wide variety of special types for the military equipment manufacturer. Most TV high-voltage capacitors are ceramic as are some of the new transmitting types.

Special advantages of ceramic capacitors include their compactness, very low internal inductance, and good temperature performance. Capacitance tolerances range from special 10% and 20% types to the capacitors generally used in TV and radio sets which have a standard tolerance of ±80% and ±20%. Often, these capacitors have a guaranteed minimum value (GMV). Temperature coefficient capacitors are most likely found in critical tuned networks such as u.h.f. and v.h.f. oscillators where only exact replacements should be used when necessary.

Paper Capacitors

New versions of the popular tubular paper capacitor include such variations as molded bodies, metalized paper, and metal bodies with glass seals. The latter type is favored for military equipment applications because of its imperviousness to moisture, heat, and fungus. Special models are available which will operate satisfactorily at temperatures as high as 185° centigrade.

For radio, TV, and most radio "ham" receiving equipment, molded paper capacitors are becoming more and more standard since they combine reasonable price with good performance and long life under ordinary operation. Fig. 8 shows typical paper capacitors of various types. Note that on some there is a band around one end of the capacitor. This indicates that the nearest lead is the outside foil and in some circuits should be the side going to ground. The polarity indication in paper capacitors is not the same as in electrolytic types. In the case of paper capacitors the d.c. polarity does not matter. The reason for marking the lead to the outside foil is to allow minimum capacity to ground in certain applications. In audio and video amplifiers the coupling capacitor often goes from a high to a low impedance and in such cases the outside foil should go to the low impedance side.

Some circuits use ceramic case, paper capacitors like the one shown in Fig. 9. Be sure to replace such a unit with the same type.

In general, paper capacitors of the molded type are rated for operation up to 85° centigrade, which is satisfactory for most radio and TV uses. Where higher temperatures are found, a simple derating method can be applied. As the temperature increases, assume that the voltage rating of the capacitor decreases. For example, a 200 volt capacitor may be good up to 65° centigrade, but if the equipment gets to be 85°, then a 400 volt capacitor should be used.

Voltage ratings of paper capacitors should never be exceeded. A good rule is to use 200-volt capacitors where the d.c. voltage never exceeds 100 volts. Use 400-volt units where the voltage goes up to 250 volts; 600-volt ones are suitable for circuit voltages up to 350 to 400 volts at the most. For higher voltages use 1000- and 2000-volt capacitors.

Impregnated Capacitors

Using such special dielectric materials as "Dykanol," "Pyranol," and various kinds of oil, these capacitors are distinguished by their long life, maintenance of the rated capacity over a relatively wide range of temperatures, and rugged exterior. They are generally contained in metal cans of the type shown in Fig. 10. Capacity values range from about .01 μfd. up to 20 μfd. with voltage ranges of 400 to 5000 volts. Some of these capacitors are supplied with special brackets and are mounted with their terminals easily accessible.

In replacing this type of capacitor care should be taken not to break the ceramic or glass-type terminal insulators sometimes used. Such breakage could occur when the mounting brackets are tightened if the capacitor is not properly seated in.

Many of these capacitors are used as motor starters, some as filters for low frequency circuits or power supplies, and some for bypass and coupling applications in transmitters. Many find application in test equipment and military gear of all types.

One variation of the oil-filled type shown in Fig. 10 is the "bathtub" capacitor, so named because the case looks like a small metal bathtub. See Fig. 11. These capacitors are supplied not only in the oil-filled variety but also as low voltage electrolytcs. Values up to 50 μfd. at 150 volts are obtainable. They are also furnished as multiple units.

Electrolytic Capacitors

Electrolytic capacitors are so named because their capacity is due to an electrochemical process known as electrolysis. When a potential is applied (Continued on page 114)
MOST "wireless" record-players consist of an oscillator which is amplitude-modulated by a crystal phono pickup, the signal being received on a standard AM broadcast receiver in the usual manner. By this method, the quality of reproduction is limited mainly by the crystal cartridge, and the bandpass of the i.f. transformers in the receiver.

This article describes a simple and economical wireless record player which is frequency-modulated by a capacitance phono pickup, and received on a standard AM broadcast receiver by "slope detection." By this method, the quality of reproduction is dependent on the audio amplifier and the speaker in the radio.

You can buy a factory-made capacitance phono pickup cartridge, or you can easily build a pretty good one very cheaply, as described in this article. And there is no need to build up a special oscillator and power supply; you can use the oscillator in an old table model superhet! Any small superhet will do, just so the oscillator works and the power supply is well filtered.

How It Works

A capacitance phono pickup is simply a needle or stylus (having the lowest possible amount of mass and mechanical resonance) which is mounted on one side of a stationary metal plate. There is a small air gap between the needle and the plate, thus the two parts serve as the two plates of a small variable capacitor, the needle being the variable plate. As the needle moves in the record groove, it vibrates from side-to-side in accordance with the waves in the groove, causing a corresponding variation in capacitance between the needle and the stationary plate. When the needle and the plate are connected across the tuned circuit of an oscillator, the frequency of the oscillator is shifted up and down (frequency-modulated) accordingly.

Fig. 1A shows the front-end of a typical table model superhet. Note that the capacitance pickup is connected directly across the tuned circuit of the oscillator to frequency-modulate it. When the table radio is placed directly on top, or very near, the large AM radio in your living room, the small radio's oscillator will feed a good FM signal to the large radio and the latter detects it by slope-detection.

Fig. 1B shows how an FM signal can be received on an AM receiver by slope-detection. The incoming FM signal is not tuned in "on the head," but a little off to one side of the i.f. selectivity curve's peak. As the frequency of the FM signal swings up and down over a small range with modulation, these variations in frequency are converted to variations in amplitude and the resulting AM is detected in the usual way. The FM signal is tuned in on one side of the selectivity curve's peak until the audio quality sounds best. If the audio is too weak, the swing of the record player's oscillator should be increased by reducing the air-gap between the needle and plate of the capacitance pickup. If the audio quality is poor ("splashy" with distortion on volume peaks) the swing of the oscillator should be reduced by increasing the air-gap between the needle and plate of the capacitance pickup.

Phono Motor and Cabinet

Chances are, you already have a phono motor and cabinet suitable for this FM record player and don't have

(Continued on page 39)
Fig. 2. Layout of the wood tone arm used by author. Pattern can be used for arm for either home-built or commercial cartridge.

Fig. 3. A U-bracket is used to mount the swivel to underside of tone arm. The swivel is from an old Astatic crystal pickup.

Fig. 4. Details for making U-bracket.

Fig. 5. The two leads from the cartridge end at the two lugs mounted close to U-bracket. Flexible leads with tips go to receiver oscillator.

Fig. 6. (A) How home-made cartridge is sawed from \( \frac{1}{2} '' \) o.d. copper tubing. (B) Cartridge before bending and drilling.

Fig. 7. "Head-on" view of home-made capacitance pickup. Note \#38 gauge wire lead from needle to lug at right side of arm. The \#38 gauge plate lead is soldered directly to end of mounting bracket. The air gap between needle and plate can be altered by bending the plate as described in the text.

Fig. 8. The completed copper cartridge ready for insertion of the needle. See text on choosing a suitable needle.

Fig. 9. The capacitance cartridge ready to be screw-fastened to the nose of wood tone arm. Details in article.

Fig. 10. Rear view of the record player with the radio removed from bracket to show two 2-way lugs screw-fastened to the arm to serve as functions for the leads from cartridge and the leads to radio. Brass L-bracket holds pickup arm and modified shelf brackets support the small AM receiver.
to assemble one. The author's cabinet was home-built and is 12" long, 8" wide, and 2½" high. The framework was made from ¾" lumber securely screwed and glued together. Masonite ¼" forms the top panel but ⅜" Masonite would have been better. The cut-out in the cabinet top was figured so that the turntable shaft of the motor would set about 4½" back from the front end of the cabinet. The cabinet was sanded smooth, the sharp edges and corners rounded off, and given a coat of flat chocolate brown paint (a lighter color paint would have photographed better!). A chromed-plated drawer-pull was mounted on each side of the cabinet to make it easy to move the cabinet around. The phono motor (45-rpm in the writer's case) was mounted in the usual manner, and wired in series with a s.p.s.t. toggle switch and a 10-foot length of rubber-covered lamp cord and plug.

The Tone Arm

Fig. 2 is the layout for the wood tone arm made by the writer. This pattern can be used for either the factory-made or the home-made capacitance cartridge. If desired, you can copy the shape of any good transcription arm instead. Select a piece of good quality wood with low mechanical resonance. The wood should not "ring" but should give off a dead "thud" when you hang it by one end and strike it sharply in the center with the knuckle of your forefinger. Basswood and dogwood are two woods with comparatively low resonance. The tone arm should be a full ¾" thick. The writer made his arm pretty long (12½") in order to reduce tracking-error. After jigsawing, the arm should be sanded smooth all around, and all sharp edges and corners rounded off to improve its appearance. The arm can be given a coat of white shellac, followed later by a coat of clear varnish, or you can stain it or paint it to match the cabinet.

The swivel used may be one removed from an old crystal pickup arm. Many of these old arms may be found in radio repair shops and may be obtained for as little as 25¢ each! Fig. 4 shows the simple U-bracket made by the writer to fit the swivel to the wood tone arm while Fig. 3 shows how the U-bracket mounts to the underside of the tone arm by means of two short round-head wood screws. The exact location for the U-bracket will have to be determined later to give lowest tracking-error. Fig. 11 is a diagram of the angle-bracket made from ¾" by ½" brass band which is used to hold the swivel and tone arm to the back end of the cabinet. If desired, you can dispense with this bracket by making your cabinet 15½" long instead of 12" long, and by mounting the swivel directly on top of the cabinet. The writer likes compact cabinets!

Fig. 12 shows the simple counterweight used to counterbalance the tone arm. This weight is simply a 1" or 1½" length of 1" diameter iron rod, drilled through the center (lengthwise) for the flat-head wood screw used to mount it to the underside of the arm near the back end. After the tone arm is completely assembled and mounted, the counterweight is placed to give a needle pressure of about 5 or 6 grams.

The author used the little capaci-

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Fig. 15. The scraped ends of the wire leads are wound tightly around the lugs on Motorola cartridge and held with Duco cement. Do not solder! The cartridge is held in groove with Duco and the wire leads are cemented into the grooves as shown in the photo. Be sure not to solder, see article.

Fig. 14. How the Motorola capacitance pickup cartridge is mounted and wired into the wooden tone arm. Other similar cartridges could be used with slight changes in the mechanical layout of the tone arm groove as shown.

Fig. 12. How to make the counterweight for the wood tone arm. Refer to text.

Fig. 13. Side view of the home-built capacitance phono pickup. Note two-way lug, cut from sheet copper and screw-fastened to side of arm. This serves as a junction for needle lead and lead to oscillator. The plate lead runs in a groove on opposite side and is soldered to bracket.

Fig. 16. A groove is filled and groused in wood arm to accommodate cartridge.

Fig. 17. The pencil points to the soft wax which covers the air-gap adjustment screw. To make changes remove wax. Cartridge is the Motorola replacement number 1C630821 phono unit.

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August, 1955
tance phono pickup cartridge made by Motorola for its Models 53F2 and 21F5 high-fidelity phonographs in his installation. This cartridge, Motorola part number 1CB08921, has a precious-metal needle tip with a diameter of .002" for use with records of all three speeds. The needle has very little mass, which allows it to reproduce a very wide frequency range, and the needle is tightly damped to reduce mechanical resonance to a minimum. These replacement cartridges are available from the company's distributors or service shops. The list price is $3.45.

A small gob of wax is used to cover the slotted head on the adjustable screw which forms the stationary plate of the pickup. If you want to change the air-gap between the needle and the plate, simply dig out the wax and adjust the screw with a small screwdriver. After the adjustment is made, lock the screw again with a few drops of wax, or Duco cement, but be careful not to get any in the air-gap where it will interfere with the free movement of the needle.

Fig. 16 shows how a groove is cut into the bottom of the front end of the wood tone arm, using a rat-tail file and a narrow gouge, to form a socket for the capacitance cartridge. Make the groove %" deep and just the right width for a snug fit for the cartridge. How the cartridge is mounted and wired into the arm is illustrated in Fig. 15. Since no socket is available for the cartridge to plug into, you will have to wrap the wire leads tightly around the lugs on the back of the cartridge and then apply a little Duco cement to hold the connections securely. The cartridge is secured in the groove with a little Duco, and the wire leads are cemented into small grooves cut along the bottom of the arm, as shown. Keep the leads as far apart as possible to reduce the capacitance between them. Fig. 14 is an improved version of the technique shown in Fig 15 in that two soldering lugs are placed close to the cartridge to make it easier to wire in a new cartridge when the stylus has worn out on the first one. As shown in the photograph of Fig. 5, the wire leads end at two soldering lugs mounted on the underside of the arm close to the U-bracket for the swivel. The two short flexible leads with phone tips, visible in the photo, go to the oscillator of the table radio.

This same photograph also shows how the counterweight is mounted to the underside of the arm by means of the flat-head wood screw.

The Home-Made Cartridge

The home-made version of the capacitance phono pickup, now to be described, is easy to make, costs almost nothing, and gives nice results when used with a good quality phono needle having low resonance in the audio range. The cartridge consists of a copper ring, a mounting bracket, and an adjustable plate, which are all in one unit hack-sawed from a short length of 1/4" o.d. copper tubing. A round plug of soft rubber is pushed into the ring, and the phono needle is pushed into the rubber so the needle sets parallel with the metal plate, allowing for a small air-gap between the needle and the plate. The rubber plug serves a dual purpose: it holds the needle, and it gives the needle high compliance. The size of the air-gap between the needle and the metal plate can be adjusted by bending the plate. One wire lead is taken off the top of the phono needle, and the other wire lead is taken off the mounting bracket. That's all there is to it!

Figs. 6A and 6B show how the combination ring, mounting bracket, and plate are sawed from a short length of 1/4" o.d. copper tubing. Use a fine-toothed hacksaw or tin and narrow blade, and then file the rough sawed edges smooth with a small fine-toothed file. The two projections, shown in Fig. 6B, are pressed flat by squeezing in a vise.

As shown in Fig. 8, bend the mounting bracket back and drill two 1/8" diameter holes about 1/4" apart; these are for the mounting screws. Now bend the stationary plate as shown; the final adjustment will be made later. Cut a round plug (slightly oversize) from a soft pencil eraser, and push the plug into the copper ring. The plug should have the same thickness as the depth of the ring with which it is used. The rubber eraser should be soft and grit-free; expert gum should not be used because it tends to crumble. The round plug can be cut from the eraser by putting a sharp edge on one end of a metal tube of the right diameter, and then twisting the tube through the eraser. Or you can chuck the metal tube in a drill-press, if the chuck will accept it.

Fig. 9 is an "x-ray view" showing how the small wire lead is connected to the top of the needle, and how the needle is mounted in the rubber plug. Scrape the top end of the needle clean and bright, then scrape the end of a short length of #38 copper wire and wind 6 or 8 turns tightly around the end of the needle, as shown, and secure the winding by melting a little Duco cement. The winding should be held firmly until the cement sets. Now, starting at the top of the rubber plug, push the needle down through the plug so it takes the position shown. The air-gap between the needle and the plate can always be adjusted later on.

The quality of reproduction obtained with this capacitance pickup depends largely on the type and quality of the phono needle used in it. The needle should have a straight shank, preferably of uniform cross-section, and it should have the lowest possible amount of mechanical resonance within the audio range. The needle point, preferably diamond or genuine sapphire, should be precision ground and polished. Use a 0.003" needle point for 78-rpm records only. A .001" needle can be used for both 45-rpm and 33 1/2-rpm records. If you want to play all three speeds, you can use a needle with a compromise point of .002". Of all the needles tried by the writer, the best results were obtained with the Audio-point #132 microgroove sapphire-point needle, shown in the illustrations. List-price is $2.00 or at most radio mail-order houses. Other makes of straight-shank needles with various point diameters and point materials are available to the experimenter.

Fig. 7 is a "head-on view" of the cartridge screw-fastened onto the nose.

(Continued on page 90)
MARINE ELECTROLYSIS AND RADIO

By ELIOT DRAKE

ANYONE having anything to do with marine radio will run into the term "electrolysis" before they have gone very far. If they know the score in this important subject there will be no trouble. But anyone taking on boat work without having full knowledge of the peculiar effects encountered when salt water and electricity are mixed had better learn fast. If you make a mistake working on a TV set, the worst that can happen is that the set might not work. But one mistake on a marine hookup can sink the boat before you have time to get ashore.

Applied to boating, electrolysis is the decomposition of underwater metals due to electrical current flow between them. Put a piece of zinc and a piece of copper in a bowl of brine, connect them together, and the zinc will start disappearing. The life of the zinc electrode depends upon the size of the pieces and their spacing. As the action progresses (the same as in a primary battery cell) bubbles will form on the copper, deterioration of the zinc will tend to slow up, and the cell is then said to be "polarized." However, agitation will jar the bubbles away, depolarizing the cell, and even increasing the speed of action. If the water around a boat is anything, it is agitated, so the consequence is that any simple cells on boats are extremely active.

Electrolytic decomposition takes place between almost any two dissimilar metals in salt water. Which of the two metals will dissolve and how fast depends upon the relative positions of the two metals in the Galvanic Series of Table 1. Base metals lose material to the nobler ones; the farther apart on the scale the metals are, the faster will the base one disappear.

This shows up most rapidly in small pieces of hardware, such as nails and screws. First of all, ferric metals should never be used. Next, the usually noncorrosive common brass screw is a bad actor afloat. This is because common brass is a mixture of copper and zinc—the very materials of the active primary cell mentioned previously. Use a brass screw to hold something in contact with salt water, or even salt spray, and a month later the screw may be gone, having "do-zined" or devoured itself through electrolysis.

The same action will occur if a brass screw is used to secure a "nobler" metal, as for instance, stainless steel radio fittings, copper ground plates, etc. It is not necessary that fittings be constantly immersed to be in danger. Occasionally-wet fittings, particularly those in constant exposure to spray or near the waterline of vessels, sometimes deteriorate the fastest due to the high oxygen content of the water under these conditions.

To be safe, use fastenings of exactly the same material as the fitting to be fastened. Marine bronze or "Everdur" are popular for boat hardware.

Ground plates of 12 or more feet of copper are required for marine radio transmitters and other radio installations. Putting a sheet of this fairly noble material on the hull is an unavoidable invitation to an increase of primary cell electrolysis which will eat away bazer fittings bonded to the ground. With reasonably good fittings, the action will be slow enough to spread the process over so many years it will hardly be noticed. But a bad fitting might start to wear away perilously fast.

Decomposition depends upon the amount of current flow. Measure ground-plate current, upon making such an installation, with a milliammeter connected in series with the ground wire. Some flow will probably be seen, with the ground plate having positive polarity. The seriousness of this flow can be gauged by the fact that each milliampere has been found to remove about .036 ounce of metal per month in typical installations. Thus, currents of a few milliampere are no cause for alarm but, if the flow approaches an ampere, something is disappearing too rapidly for safety. In this event, the ground plate should be

(Continued on page 113)

View of a steel rudder facing a bronze propeller showing the metallic decomposition due to the electrolysis between the two metals. The rectangular piece of metal affixed to the rudder is a "protector" plate made of zinc.

A radio installation on a boat can sink the craft if precautions are not taken to prevent electrolysis.

Table 1. The Galvanic Series for metals which lists metals in the order of their electrolysis activity. Those on top lose metal to those farther down.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Magnesium</th>
<th>Zinc</th>
<th>Aluminum 26</th>
<th>Cadmium</th>
<th>Aluminum 17CT</th>
<th>Steel or iron</th>
<th>Cast iron</th>
<th>Chromium-iron (active)</th>
<th>Ni-Resist</th>
<th>18-8 stainless (active)</th>
<th>18-8-3 stainless (active)</th>
<th>Lead-tin solders</th>
<th>Lead-tin</th>
<th>Tin</th>
<th>Nickel (active)</th>
<th>Inconel (active)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base metals</td>
<td>Magnesium</td>
<td>Zinc</td>
<td>Aluminum 26</td>
<td>Cadmium</td>
<td>Aluminum 17CT</td>
<td>Steel or iron</td>
<td>Cast iron</td>
<td>Chromium-iron (active)</td>
<td>Ni-Resist</td>
<td>18-8 stainless (active)</td>
<td>18-8-3 stainless (active)</td>
<td>Lead-tin solders</td>
<td>Lead-tin</td>
<td>Tin</td>
<td>Nickel (active)</td>
<td>Inconel (active)</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Brasses</td>
<td>Copper</td>
<td>Bronze</td>
<td>Copper-nickel alloys</td>
<td>Monel</td>
<td>Silver solder</td>
<td>Nickel (passive)</td>
<td>Inconel (passive)</td>
<td>Chromium-iron (passive)</td>
<td>18-8 stainless (passive)</td>
<td>18-8-3 stainless (passive)</td>
<td>Silver</td>
<td>Graphite</td>
<td>Gold</td>
<td>Platinum</td>
<td></td>
</tr>
<tr>
<td>&quot;Noble&quot; or protected end</td>
<td>Brasses</td>
<td>Copper</td>
<td>Bronze</td>
<td>Copper-nickel alloys</td>
<td>Monel</td>
<td>Silver solder</td>
<td>Nickel (passive)</td>
<td>Inconel (passive)</td>
<td>Chromium-iron (passive)</td>
<td>18-8 stainless (passive)</td>
<td>18-8-3 stainless (passive)</td>
<td>Silver</td>
<td>Graphite</td>
<td>Gold</td>
<td>Platinum</td>
<td></td>
</tr>
</tbody>
</table>

August, 1955

"BASE" OR CORRODED END.
The popular dip-soldered "K" chassis has more than the usual number of test points for rapid servicing.

The dip-solder method of construction used in all recent General Electric television receivers makes available to the technician many more above-chassis test points than usual. As can be seen from Fig. 1, these test points are in the form of projecting, soldered rivets, secured to various terminal boards and to the tube sockets. The most commonly used test points on the "K" chassis which includes models 17T14, 17T16, 21T17, 21T18, 21T28, 21C102, and 21C238, are indicated by Roman numerals in the top view of the chassis in Fig. 2. In addition to the designated test points, many additional test points are available directly at the projecting tube socket solder joints.

As can be seen from Fig. 1, top chassis shielding is used over the video i.f. and video amplifier circuits to prevent direct signal pickup in these stages, hence these tube socket joints are not exposed. It is a simple matter, however, to remove this shielding to expose tube socket joints in these circuits. When this is done, all tube socket connections except the tuner tubes, the 5U4G rectifier, and the 12BH7 vertical deflection stage, can be reached from the top of the chassis.

Circuit Description

The "K" chassis employs a 13-position cascode tuner with a 6BQ7A r.f. amplifier and 6X8 mixer oscillator. Test point I, which is in the mixer grid circuit, is useful mainly as a quick v.t.v.m. check to determine if the oscillator section of the 6X8 is functioning. Since this point is isolated from the 6X8 mixer grid by a 15,000 ohm resistor, no external isolation is needed and the d.c. v.t.v.m. probe can be connected directly to this point. A secondary use of this test point is signal insertion for alignment of the video i.f. stages.

The 13th position of the tuner is used for u.h.f. reception, the local oscillator being disabled and the tuner circuits functioning as a 40 mc. amplifier in conjunction with a single-conversion u.h.f. converter which uses a 6AF4 local oscillator and 1N82A diode mixer.

The three-stage 40 mc. video i.f. amplifier uses two 6CB6's and one 6AU6, with one 47.25 mc. trap at the input of the first 6CB6. The first and second 6CB6's are connected in series across the plate supply for power supply economy reasons. Test point II is tied (Continued on page 96)

RADIO & TELEVISION NEWS
Table 1. List of the test points available on the "K" chassis together with a procedure for utilizing them for servicing.

<table>
<thead>
<tr>
<th>TEST POINT</th>
<th>VOLTAGE READING</th>
<th>SCOPE WAVEFORM</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I—Converter grid</td>
<td>Use v. t. v. m.</td>
<td>Always negative</td>
<td>Check on oscillator section of 6X6. Zero volts indicates no oscillation.</td>
</tr>
<tr>
<td></td>
<td>Always negative</td>
<td>averages –1.5 volts.</td>
<td>Positive voltage could be caused by gassy tube or internal component failure</td>
</tr>
<tr>
<td></td>
<td>and varies with</td>
<td></td>
<td>in tuner.</td>
</tr>
<tr>
<td></td>
<td>signal level.</td>
<td>2.5V</td>
<td>Feed an AM signal through a .001 μfd. capacitor for video i.f.</td>
</tr>
<tr>
<td></td>
<td>from –.5 to –3</td>
<td>(Scope synced at</td>
<td>trap alignment. Feed a sweep signal in through .001 μfd. capacitor</td>
</tr>
<tr>
<td>II—A.G.C.</td>
<td>volts.</td>
<td>½ horizontal frequency)</td>
<td>for visual alignment of i.f. amplifier strip.</td>
</tr>
<tr>
<td></td>
<td>Use v. t. v. m.</td>
<td>Always negative</td>
<td>Check a.g.c. action by noting voltage reading with antenna connected</td>
</tr>
<tr>
<td></td>
<td>Always negative</td>
<td>and varies with</td>
<td>and disconnected. Reading should become more negative with increasing signal</td>
</tr>
<tr>
<td></td>
<td>and varies with</td>
<td>signal level.</td>
<td>strength. Positive voltage at this point can be caused by gassy or shorted i.f.</td>
</tr>
<tr>
<td></td>
<td>signal level.</td>
<td></td>
<td>tube or internal capacitor leakage. No change in reading with varying signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>strength can be caused by leaky or shorted a.g.c. line bypass capacitors.</td>
</tr>
<tr>
<td>III—Video detector</td>
<td>Use v. t. v. m.</td>
<td>Always negative</td>
<td>Connect —3 volt battery bias to this point during video i.f. alignment.</td>
</tr>
<tr>
<td></td>
<td>Always negative</td>
<td>and varies with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and varies with</td>
<td>signal level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>signal level.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV—Video amplifier</td>
<td>Always positive.</td>
<td>Varies with setting of</td>
<td>Signal continuity test between antenna terminals and detector. Correct indication</td>
</tr>
<tr>
<td>output</td>
<td>control.</td>
<td>brightness control.</td>
<td>here shows tuner and video i.f. amplifier stages OK. Very weak or no indication</td>
</tr>
<tr>
<td></td>
<td>averages +8 volts.</td>
<td></td>
<td>indicates trouble in one of these sections. Use this point in conjunction with TP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Scope synced at ½</td>
<td>IV as described below to check gain of video amplifier.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>horizontal frequency)</td>
<td>Connect scope to this point through 10,000 ohm resistor for visual indication</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of trap alignment with AM signal and for video i.f. sweep alignment.</td>
</tr>
<tr>
<td>V—Ratio detector</td>
<td>Use v. t. v. m.</td>
<td>+8 volts.</td>
<td>Check 12BY7 video amplifier gain by reading peak-to-peak video</td>
</tr>
<tr>
<td>output</td>
<td>+8 volts.</td>
<td></td>
<td>drive at this point with picture control full on. This reading, divided by</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45V</td>
<td>peak-to-peak reading obtained at TP III equals 12BY7 stage gain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Scope synced at ½</td>
<td>Normal stage gain should run between 15 and 20. Normal indication at detector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>horizontal frequency)</td>
<td>with weak or no output from 12BY7 will result in weak or no audio, as well as no</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>picture and no sync.</td>
</tr>
<tr>
<td>VI—Horizontal phase</td>
<td>Use v. t. v. m.</td>
<td>+6 volts.</td>
<td>Check audio system by touching this point with finger or screwdriver. No</td>
</tr>
<tr>
<td>detector</td>
<td>+6 volts.</td>
<td></td>
<td>output from loudspeaker means trouble in either 6T8 audio amplifier or 6AQ5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.5V</td>
<td>audio output stage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Scope synced at ½</td>
<td>Connect v.t.v.m. between this point and ground when adjusting horizontal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>horizontal frequency)</td>
<td>stabilizer coil. L60. Adjust for +4 volts. In noisy, weak signal areas, adjust</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for +8 volts and retouch L60 for maximum horizontal picture stability while</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>watching picture.</td>
</tr>
<tr>
<td>VII—Output of 6CS8</td>
<td>+130 volts.</td>
<td></td>
<td>Check cleanliness of sync pulse by connecting scope to this point. If clean</td>
</tr>
<tr>
<td>noise canceller</td>
<td></td>
<td></td>
<td>pulse cannot be obtained, be sure “local-distant” switch is not at fault. Too</td>
</tr>
<tr>
<td>and clipper</td>
<td></td>
<td></td>
<td>strong a signal with switch in “distant” position will compress sync. Aging</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12BY7 video amplifier can cause same effect. Occasionally, a slightly gassy video</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>i.f. tube will have same effect.</td>
</tr>
<tr>
<td>VIII—Main “B+”</td>
<td>+275 volts.</td>
<td></td>
<td>Low voltage here, evidenced by reduced picture size and brightness, generally</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>caused by weak 5UG. Same effect can be caused by low capacity input filter C_off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60 μfd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Open or low capacity output filter, C_off, 80 μfd, will have little effect on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>voltage reading but will produce hum in picture, and poor vertical sync. Scope</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>reading will show much more than one volt peak-to-peak at TP VIII if this section</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of capacitor is at fault.</td>
</tr>
</tbody>
</table>
Extend the usefulness of your signal generator by building this handy accessory unit for measuring unknown frequencies.

Frequency measurement is of fundamental importance in almost every electronic endeavor—be it servicing, experimenting, or just plain hamming. The degree of accuracy may vary, but the necessity for frequency measurement is still present. Often crude and cumbersome methods must be resorted to—particularly when the proper frequency measuring equipment isn't available. The frequency measurement adapter described should make life simpler in this respect for it converts the ever-present signal generator into a frequency meter.

The adapter itself is the acme of simplicity, utilizing as its main components a germanium diode mixer and a single-tube, two-stage audio amplifier. This adapter can double the usefulness of any signal generator.

The basic principle of the frequency measurement adapter is quite simple. A block diagram illustrating the operation of the unit is shown in Fig. 1. An unknown frequency is mixed with the known signal-generator frequency. The signal resulting from the mixing of these two signals consists of four separate frequencies; namely, the sum of the known and unknown frequencies, the difference of these two frequencies, the known frequency, and, lastly, the unknown frequency.

When the two signals (the known and unknown frequency) are within a few hundred cycles of each other, the difference frequency will be an audio signal. The remaining three resulting frequencies will be r.f. signals which can be easily bypassed to ground by a small capacitor. The audio signal is then amplified in two stages and fed to a pair of earphones. When the known and unknown signals are exactly the same, no audio signal will result since the difference frequency is now zero. However when the known and unknown signals differ by any frequency within the audio range, a tone is heard in the earphones. This process is more familiarly known as zero beating.

The circuit for the adapter is shown in Fig. 2. The coaxial inputs for both the known and the signal and the signal generator are terminated in 47 ohm resistors. These resistors are connected directly to the coax connector. These terminations are important when measuring frequencies in the v.h.f. region with the adapter. The inner conductor terminals of the two coax connectors have 680-ohm isolating resistors in parallel.

(Continued on page 91)
New Hi-Fi Tone Arm

OF INTEREST to owners of high-fidelity sound systems is the new tone arm recently released by Gray Research & Development Co., Inc. of Manchester, Connecticut.

The Type 108-C viscous damped arm incorporates a silicone damping fluid that is placed at the interface between a ball and socket, as shown in Fig. 1. An adjustable cone-point pivot screw allows the degree of damping to be readily controlled and, at the same time, provides practical freedom from static friction with arm movement. This damping virtually eliminates troublesome low-frequency resonance which frequently causes groove-hopping and distortion on loud passages. Vertical damping also prevents damage to the record and stylus due to accidental dropping of the arm and improves the tracking of warped records.

All of this is made possible by the use of a silicone, which is chemically inert, whose viscosity remains relatively constant over a wide range of temperatures. Unlike most hydrocarbon compounds, it will not oxidize or change its characteristics over a long period of time.

The principle behind this feature is that the viscosity of the liquid controls the arm damping, with additional corrections made possible by various settings of the pivot adjusting screw.

The arm itself is supported by the single needle-point pivot in the center of the ball and socket. See Fig. 1. It is this gap between the ball and socket—a few thousandths of an inch—which is filled with the damping fluid.

The adjustment of the arm's damping is a relatively easy process for the user. He merely holds the arm level and then presses firmly down around the pivot. The pivot screw can then be turned slowly in the clockwise direction until it contacts the cone point of the pivot. A single one-half turn of the screw in the same clock-wise direction gives the maximum adjustment for damping.

The useful range, however, extends about 1 ½ turns beyond this point. The user merely turns the screw clockwise in one-quarter turn increments, with a delay of about one minute between trials, to achieve the optimum condition whereby it takes about two seconds for the arm (with cartridge in place) to drop one inch to the record.

Each tone arm comes with three cartridge slides of the user's choice. The correct weights for the specific cartridges to be used are included with the arm assembly. The company has developed slides and weights for Electrosonic ESL-111, Fairchild 215A, 215B, 215C, 220A, 220B, and 220C; General Electric RPX-046 and RPX-046 (3 mil); Pickering 120, 200, 140, and 240; and Weathers cartridges.

The stylus force is adjusted at the factory by lead weight positioning at the back of the arm. Proper force for each cartridge is automatically fixed by the small weight associated with each of the slides. From 6 to 8 grams force is obtained with the combined cartridge-weight-slide assembly. Identical weights are used for the two Pickering models because the 2.5 and 3 mil cartridges are about 5 grams heavier than the 1 mil model, thus providing proper force.

Three special base levelling screws are provided with the arm and the user, after temporarily inserting the correct cartridge slide, can then make the necessary adjustments to insure that the bottom edge of the arm is parallel to the surface of the record.

All groove widths, all record diameters up to 16", and all normally used stylus forces can be accommodated with this single arm. By utilizing the quick-change slides, cartridge interchange is facilitated. Each slide and cartridge assembly is preset to proper stylus force, reducing to a minimum the danger of unauthorized tampering.

Over-all length of the arm from the stylus end to the center of the pivot screw is 11½ mil. By proper placement of the arm, the unit can be used with virtually all sizes of records. The various dimensions for the different types of installations are given in the instructions which accompany each arm.
If you are looking for a new and inexpensive project, here is a compact two-way system that costs less than $25.00!

The current lack of activity on the amateur bands above two meters and the supposed difficulties involved when working these frequencies proved to be just enough of a challenge to the author so that he designed and built the pair of 435 mc. transceivers to be described in this article.

After a few weeks of experimenting with standard components, this design was evolved, built, and tested in a matter of hours. No u.h.f. difficulties were encountered and if there was anything unexpected about this construction, it was the lack of trouble in putting this unit together.

The only tools and instruments required to build this transceiver are a screwdriver, a soldering iron, and a pair of Lecher wires which can be made at no cost from six-foot lengths of bare wire, a couple of nails, and a piece of board. The over-all cost of each transceiver was below $13.00, so a complete “system” is available for $25.00.

A pair of these units has been used together to communicate up to a mile over favorable terrain. With a dipole distances up to five miles line-of-sight are entirely possible, the author found.

These units are ideal for Civil Defense and rescue activities where close range communications are needed and the current budget calls for really low-cost transceivers.

All parts required for this construction are easily obtainable from any local radio parts supplier or, in short cases, the necessary components can be dredged out of a well-filled junk box.

Tracing the circuit through operationally, it may be noted that the single-button carbon microphone is supplied mike current from a 1.5 volt standard flashlight cell or from a 1.5 volt tap on the 6-volt filament supply battery.

The combination 1:3 interstage and mike transformer was handmade and is an adaptation of a commercial unit. The core should be removed from a Stancor A-35 or similar interstage transformer and 50 turns of #30 d.c.c. solid wire added for the mike winding. It will be found that there is ample room for this extra winding and that no difficulty should be experienced when replacing the transformer laminations. A strip of plastic insulating tape should be wound around the core after the additional winding is in place to secure all transformer leads.

The first triode of the single 12AT7 is used as an AM modulator while transmitting and as a straight audio amplifier when receiving. The second section of the 12AT7 is used as an oscillator whose cathode is above ground since this was found to be the most stable type of u.h.f. oscillator when subjected to both varying “B+” voltages and AM modulation. When receiving, this triode acts as a self-quenching superregenerative detector with extremely high sensitivity. The quenching frequency is determined primarily by the time constant of the 500 µfd. capacitor (C) and the 2.2 meg-ohm resistor (Ri) grid RC circuit. It is also affected by the plate r.f. choke and bypass capacitor which should be of the values specified.

As shown in the photographs, the grid and plate tuned lines are soldered directly to the grid and plate pins of the oscillator triode and terminate on the two stators of the butterfly tank capacitor. The antenna coupling link is soldered to a terminal strip mounted behind the butterfly capacitor and runs parallel to the grid-plate tuned lines for approximately 2 inches.

A quarter-wave vertical antenna is used on the model shown by grounding the grid side of the antenna link coil and running a short length of RG-59U coaxial cable to the banana plug antenna mount. A half-wave folded dipole antenna may be used if desired and fed with 300-ohm twin-lead from the antenna link, neither side of which should be grounded. Both types of antennas were tried, with the folded dipole having slightly better gain than the quarter-wave vertical but performance with the latter was more than satisfactory, hence it was chosen for size and convenience.

**Performance specifications on the home-built u.h.f. transceiver equipment.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter Power Input</td>
<td>2.2 watts</td>
</tr>
<tr>
<td>Tuning Range</td>
<td>10 megacycles</td>
</tr>
<tr>
<td>Weight</td>
<td>3 pounds</td>
</tr>
<tr>
<td>&quot;A&quot; Battery Drain (Reception)</td>
<td>6 volts @ .3 amp.</td>
</tr>
<tr>
<td>&quot;B&quot; Battery Drain (Transmitting)</td>
<td>180 volts @ 8 ma.</td>
</tr>
<tr>
<td>Maximum Range</td>
<td>Line-of-Sight</td>
</tr>
<tr>
<td>Average Cost</td>
<td>$13.00</td>
</tr>
</tbody>
</table>

By ROBERT M. RICHARDSON, W4UCH
Richcraft Electronic Engineering Company

The author is shown using one of the transceivers.
As shown, all parts are mounted on the front of the case including the tube, transformers, and two slide switches. Since a specially-designed four-pole, double-throw switch had been required for this unit, two 16 cent double-pole, double-throw slide switches which fit the case perfectly were used instead.

The microphone and headphone, along with their respective plastic mountings, were made from two surplus telephone handsets. This was done by sawing the mounts off of the handset directly behind the cap's threaded mounts. The threaded discs were then drilled and bolted to the face of the transceiver case. The case itself may be made from an aluminum "Minibox" or any other convenient-sized housing.

After all parts are mounted and wired, the two slide switches should be snapped down into the "receive" position and if all wiring is correct the faintly heard superregenerative hiss should be heard in the earphone. A pair of temporary Lecher wires should then be constructed by using a board about three feet long with two nails at each end, one-half inch apart. Any scrap of bare solid wire can then be strung from end to end. These two wires may then be coupled to the antenna post of the transceiver. By slowly moving a razor blade or knife along these two wires a definite quieting will take place in the receiver. The distance between any two of these quiet points is exactly one-half wavelength of the frequency to which the receiver is tuned. The butterfly capacitor should then be set at the desired frequency and that point marked on the front of the case. It will be found that when the slide switches are placed in the "transmit" position, the same frequency, determined by the Lecher wires, will be transmitted. For the 3/4 meter band (435 mc.) L2 and L3 should be 2 3/8" long with the distance between Lecher nulls 13 3/4".

A selenium rectifier voltage-doubler, 117-volt a.c. power supply with a 6.3 volt filament transformer has been built for use where line power is available to conserve the batteries. It is recommended that two 90-volt flat, snap-on "B" batteries and one 6-volt plug-in battery be used since a small canvas carrying case may then be made for the batteries and the whole thing clipped onto a belt for field use.

Although this transceiver could operate in the Citizens band, FCC regulations require that only type-approved equipment be used in this service. As of this date, models of this unit have not been submitted to the FCC laboratories for test and approval, but it is felt that with minor component changes the frequency stability of the transmitter could meet all of the requirements of 465 megacycles (the Citizens band). Since this unit has not been submitted to the FCC for type approval and there are no current plans for doing so, only licensed radio amateurs should operate the unit under current regulations. 

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August, 1955

Complete schematic of transceiver. Parts are standard and circuitry non-critical.

Side view of transceiver. The earphone and mike are from salvaged telephone handset.

Rear view of set showing how the various parts are fitted into a compact "Minibox."
Many hard-to-service radio and TV troubles originate in the local oscillator — here are a few examples.

TECHNICIANS tend to become slightly apprehensive when it comes to troubleshooting a local oscillator stage. One reason, perhaps, lies in the complex wiring frequently present in this stage. Bandswitching arrangements make such rat's-nest circuitry unavoidable. Another cause of that low-down feeling is the complicated—often unnecessarily complicated—way in which these circuits are presented schematically. When the service technician has, in addition, only a hazy notion about how oscillators operate, a fine indulgence to hit-or-miss troubleshooting is set up.

Many oscillator faults are due to defective tubes, loose coil connections, poor grounds, etc. There are other faults, however, which require some knowledge if they are to be readily identified and serviced. A discussion of such troubles, with a review of the theory associated with them, may prove helpful to service technicians whose understanding of oscillators has lost some capacitance, so to speak. Let’s briefly consider, first, the kind of oscillators the technician is likely to do business with.

The r.f. oscillators used in radio and TV receivers are of the following basic types: tuned plate, tuned grid, Hartley, Colpitts, electron coupled, and ultraduction. Most modern radio receivers use an electron-coupled oscillator. The chief difference among most of the oscillators cited lies in the method of feedback.

Feedback in the tuned-plate oscillator (Fig. 3A) is from plate to grid, through the coupling between plate and grid transformer windings. The same is true of the tuned grid oscillator (Fig. 3B); the grid and not the plate is, however, tuned in this circuit. In the Hartley oscillator (Fig. 3C), plate signal current flowing through L is fed back to the grid by autotransformer action.

In the Colpitts circuit, feedback is capacitative, not inductive (Fig. 3D). Oscillator plate signal voltage developed across C excites the tank circuit, a portion of the resultant voltage built up in the tank is tapped off across C, and fed between cathode and grid. The amount of voltage fed to the grid depends on the reactance ratio of C and C.

The ultraduction oscillator (Fig. 3F) is basically a modified Colpitts. The voltage feedback takes place through the interelectrode capacitances in the oscillator tube, and not by way of external circuit capacitances. Signal is fed back from plate to grid through the plate-to-grid interelectrode capacitance; feedback signal is also developed between grid and cathode by the passage of the oscillator signal through the cathode-to-grid capacitance.

The electron-coupled oscillator generally uses a converter tube. Coupling between oscillator and radio-frequency signals takes place inside the tube, rather than in an external circuit. In Fig. 3E, a Hartley-type oscillator using electron coupling is shown.

Excessive Output

One of the problems both designer and service technician are concerned with relates to oscillator output. The designer’s job is to provide an oscillator with an output large enough to insure an adequately-sized i.f. signal, but not so large that undesired side reactions occur. The service technician has to recognize when excessive oscillator output (not due to design faults) is present, and must know what to do about it.

First, why is excessive oscillator output bad? One reason is that whistles may be produced (in radio sets). Harmonics of the oscillator frequency are stronger than they should be when the oscillator output is too large: when these harmonics beat with harmonics of r.f. signals, spurious frequencies that fall into the i.f. bandpass are produced, and whistles are heard in consequence. The symptoms are most apt to manifest themselves at the high-frequency end of the band, because oscillator output tends to rise with increase in frequency.

In the television receiver, excessive oscillator output may produce “splug over.” Among the symptoms possible are jagged vertical lines across the picture, accompanied by a rushing noise in the sound.

Some engineers believe that excessive oscillator excitation can shift the frequency of oscillation. When the proper alignment or tracking of an oscillator cannot be obtained, this possibility is worth checking.

Receiver sensitivity can be reduced when the oscillator output is excessive, if a separate mixer-oscillator is present. The reason for this is that the
control grid of the mixer will be driven positive when the oscillator voltage injected at this point is excessive. The resultant flow of grid current will reduce the voltage developed in the r.f. tuned circuit, and will lower the mixer output as well (due to the tube's increase in bias). This condition may be detected by inserting a 0-1 millimeter between the "cold" side of the mixer grid coil and ground. Now rotate the tuning capacitor throughout its range. If the meter needle moves at any time, either the oscillator output is excessive or the mixer bias is too low.

Still another effect of excessive oscillator output, especially noticeable in the case of TV reception, is the production of interference (via radiation) in other receivers. This may manifest itself in the affected TV set as a herringbone pattern, diagonal lines, or bars. Insufficient shielding as well as other design inadequacies are, of course, more often to blame for such conditions than excessive oscillator output. The latter should not, however, be overlooked as a possible source of TVI.

Finally, excessive oscillator output may promote parasitic oscillations which will be discussed shortly.

How can the service technician determine when the oscillator output is excessive? One of two checks may be used for this purpose. First, the grid-to-ground voltage of the oscillator, as measured with a v.t.v.m. and properly isolated probe, may be compared with the corresponding voltage listed on the set schematic. If no such listing is present, the symptoms present may serve as a guide. If the symptoms previously described can be traced to no other cause, and the oscillator grid voltage seems quite high (in excess of 10 volts in a radio receiver, beyond 5 volts in a TV set) the oscillator may be putting out too much signal.

Possible causes of the trouble include: excessive oscillator plate voltage (due to a decrease in a plate dropping resistor, for example); changes in the coupling of the oscillator coil (possible but not likely); increase in the oscillator grid resistance. The presence of a high line voltage in conjunction with any of these circuit and component changes will increase the likelihood of symptoms.

Parasitic Oscillations

Parasitic oscillations take place at a frequency other than that to which the tuned circuit is resonant. They are due, in part, to the resonating of the stray inductance and capacitance in the circuit. Shunting of large capacitors by small ones may help introduce such undesired resonance.

Troubles which may be due to parasitism are "dying" spots in the tuning range and large fluctuations in the amplitude of the oscillator output. Excessive heating of the oscillator tube, reduced oscillator output, and a general instability of voltages and currents in the oscillator may also result. In a broadcast AM receiver, squawks and whistles may be heard at the high-frequency end of the band when parasitic oscillations are present. All-wave receivers are more likely to develop the trouble than single-band broadcast sets. In the TV set, the picture may, in some instances, be weak or absent on the channel affected; in other cases, bar interference may be seen on the picture tube.

The trouble may be readily identified by shorting out the tank circuit. If an oscillator grid-to-ground voltage is still present, parasitic oscillations exist. Shortening leads, redressing grid and plate wiring to minimize undesired coupling between the two, and changing the placement of critical components, may be attempted to remedy the condition.

Other Troubles

Squegging is generally a problem on short-wave frequencies, but it may occur on broadcast as well as on TV bands. This trouble develops when an excessive time constant is present in the grid circuit of an oscillator that is putting out a large-amplitude signal. When R, or C, (Fig. 3) is too high in value, the negative voltage built up across R, is excessive. Oscillations may die out in consequence, until the discharge of C, through R, reduces the bias enough to restore oscillation. Then the cycle repeats. A regular interruption in the oscillator's operation thus tends to take place. If the frequency of the interruption is ultrasonic, i.e., beyond the audio range, a very high noise level in the sound of the radio will be the chief symptom. When the squegging takes place in the audible frequency range, a continual squeal or whistle will be audible. Motorboating, as described later, may also result.

If the r.f. oscillator in a TV set is squegging, lines or parts of lines may be ripped off the picture during the time the oscillator is cut off, since no video information is reaching the CRT in those intervals.

A good test to determine whether squegging is present is to bridge the oscillator grid resistor with another one of a lower nominal value. If the symptoms disappear, squegging is probably present. Suitable tests will readily show whether C, or R, is of the wrong value.

A resistor of about 1000 ohms is sometimes inserted in series with the grid (see Fig. 2) to prevent squegging on a short-wave band. This resistor, in series with the grid-to-cathode capacitance, shunts and loads down the oscillator tuned circuit on high-frequency bands, reducing the tendency to squegging on these bands. Check the value of this resistor, if such short-wave squegging is present.

Flutter and motorboating. When a strong signal is tuned in, and the regulation of the radio's "B" supply is inadequate, the "B" voltages rise, due to the increase in a.v.c. voltage. The oscillator plate voltage may change appreciably in such a manner that frequency of the oscillator will be shifted in conse-

(Continued on page 101)

Fig. 3. Partial schematic diagrams of basic types of oscillators found in radio and TV receivers. (A) is a tuned plate oscillator; (B), tuned grid; (C), Hartley; (D), Colpitts; (E), electron-coupled; and (F), ultraudion oscillator.

August, 1955
HI-FI CONTROL AMPLIFIER WITH "EXPRESSION"

By MAURICE P. JOHNSON
Engr. Dept., Station WAAM

Details on a five-tube unit which features an 'expressor' circuit for volume expansion and compression to enhance the dynamic range of reproduction on recorded material.

The ultimate objective of most audio equipment design is to produce a greater degree of realism in the reproduction of sound. A perusal of past issues of this magazine reveals that considerable material has been published concerning various circuitry germane to achieving this goal. A comparison between present designs and those prevalent only a few years ago will show that much progress has been made. Harmonic and intermodulation distortion in audio amplifiers have been reduced to microscopic amounts. Speaker damping and controlled feedback loops have improved transient response and provided extended linear frequency characteristics. Loudspeakers, enclosures, pickup devices, and preamplifiers have likewise been immeasurably improved. An appreciation of the benefits of "high fidelity" in the home, ambiguous as the term may be, is indicative of the increased interest in high quality sound reproduction, even by the layman.

A major program source for home audio reproduction is derived from recorded material, supplied directly by playing phonograph records, or indirectly via radio broadcasting. The reproduction may well be free from distortion and be "clean," hum and noise may be at a minimum, and still not compare favorably with an original live performance.

The restricted dynamic range of most recorded material is a definite factor contributing to the destruction of realism of such reproduction. The feeling of "presence" can often be enhanced by artificially increasing the dynamic range of recorded reproduction. An electronic circuit for such action is referred to as a "volume expander." The relative merit of volume expansion in audio reproducing equipment has been the subject of much discussion by engineers and others, but a few basic facts should be mentioned.

Even present-day disc recording techniques are such that the volume range on the record must be restricted in order to prevent excessive cutter swing on peaks which would otherwise overcut the groove. Likewise, the minimum audio level is limited by the signal-to-noise ratio of the finished disc, although this has been considerably improved by modern plastic pressing materials.

Radio stations indulge in "gain riding" even during recorded programs, in order to keep their average modulation high at the transmitter. To this end also, limiting amplifiers are used on the transmitter feed, with the result that these techniques further alter the original dynamic range of the program.

Of course, no electronic circuit to date will restore the exact dynamic range of the original live performance to material that has been subjected to such volume restrictions. Nevertheless, most listeners and audio enthusiasts will agree that a degree of volume expansion will do much toward increasing the brilliance and life-like character of the reproduction.

This article will be concerned with a control amplifier which is intended for use with a home audio system, incorporating a versatile expander circuit together with several other desirable features.

The control amplifier was designed with certain specific requirements in mind. The power amplifier to be used in the system, of the Williamson type, requires an audio input of approximately one volt r.m.s. This level was needed from a low impedance output, to allow operation of the control at a point remote from the power amplifier. Such output was obtained by use of a cathode-follower stage, which allows the control and power amplifiers to be separated by almost any reasonable distance without hum pickup or high frequency roll-off due to cable capacity shunting effects. It should be noted that, although the cathode-follower output impedance is low, the input to the power amplifier should be of high impedance, in the neighborhood of 100,000 ohms or more, for proper operation.

The control amplifier functions as a centralized focal point for all signals used with the complete audio system. For such use, it was necessary to include three inputs for relatively high-level signal sources. These three inputs accommodate feeds from the tape recorder playback and an AM-FM tuner, as well as a TV tuner chassis. The inputs require approximately 0.2 to 0.5 volt r.m.s. signals for the proper expander operation, as will be discussed.

A fourth input is included with a simple, yet effective preamp for use with magnetic phonograph pickups capable of outputs of 0.01 volt r.m.s., such as the Pickering, Audak, and others. A single pentode tube is used in the preamplifier stage, connected in

Author's control amplifier. Controls from left to right: input selector switch, master gain control, expression potentiometer, treble, and bass.
the conventional manner for a high-gain stage. The equalization to compensate for modern recording characteristics is accomplished by shunting the preamplifier plate load with an RC circuit formed by $R_c$ and $C_s$ in series. This method is explained in detail by Herb Matthews, in “Design Considerations for High-Quality Reproducing Systems,” Part 2, Radio & TELEVISION NEWS, May, 1950. A single turnover frequency of 800 cycles, in conjunction with the tone controls to be covered, was found adequate for the majority of recordings. Some persons may desire other turnovers, which can be adjusted by the choice of the value of $C_s$. No high frequency roll-off has been included in the equalization, since this can be approximated by proper settings of the treble tone control.

Shunt-type equalizers are encountered in broadcast work and many designers have devised circuitry for exact correction for nearly all recording curves. (See “An Improved Equalizer-Preamp” by Charles Boegli, RADIO & TELEVISION NEWS, April, 1951.) Adherents of feedback-style equalizers may readily modify the stage in the manner illustrated by Lawrence Flem- ing in Audio Engineering, March, 1950 which is further improved by George Augspurger in his article “4 Problem

Under chassis view of unit. Note that terminal strips are used in construction to insure short leads. Left-to-right (bottom) are 6SJ7, 6SK7, 6S6G7, 6H6, choke, and 6SL7.

Preamps” in RADIO & TELEVISION NEWS, November, 1952.

An input selector switch in the control amplifier is used to choose the desired signal, simultaneously grounding the other feeds to prevent leakage and crosstalk. The selected signal is thus routed into the heart of the control amplifier which, of course, is the volume expander circuit. Here, three tubes are utilized for both volume expander circuit. Here, three tubes are utilized for both volume

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Complete schematic diagram of the control amplifier. Power for the unit is obtained from amplifier with which it is used.
SUPPOSE you are a DX man and have just about snagged a weak squeak from the antipodes that means a record QSO. Or maybe you’re an SWL and it has come time for a station break by a broadcaster who makes one announcement a day. Or, if you’re a traffic man, you have written down the number, date, and check. What is next? QRM! It might be a power leak or a strong local, but man, you’re dead. Throw in the crystal filter, fiddle with the phasing, cut in the noise limiter and the a.v.c. But this QRM is modulated by QRM! Turn off the set? Take up photography? Nothing so drastic—instead—get looped! The right way, that is: with a loop antenna for receiving. Using the highly directive properties of such an antenna, you can put down most local QRM and still keep enough signal to stay in business. A loop antenna does for the high- and medium-frequency receiver what the rotary beam does for v.h.f. and u.h.f. operators—provides signals in the wanted direction and a nice quiet hole to drop QRM in.

Most amateurs know about loops and some even try them for a taste of field-day direction finding. Then they usually drop the idea like a hot wire.

Stationary contact for loop ground screw is a brass strip set into bottom surface of base. Recess may be cut with chisel or knife so contactor will not project below bottom. The screw is used for the ground.
A loop antenna can do as much for your h.f. and m.f. radio as a rotary beam for v.h.f.-u.h.f. on a humid day. The common impression is that loops are suitable for commercial direction finders on the other side of the broadcast band, but no good for high frequency.

The way loops are ordinarily built for ham use gives this impression plenty of justification. A random-wound bunch of wire connected to the antenna terminals of the station receiver cannot be expected to perform. Any signals pulled in by such an arrangement are mostly accidental.

Yet, a workable loop is not difficult to construct and can be a most useful QRM cutter. Furthermore, when not in use as a main antenna it can, if suitably connected, be used with the regular external antenna as an additional tuning and impedance-matching element for the receiver front end.

Without going into a tedious amount of theory, the loop receiving antenna may be looked on as a parallel resonant circuit, in which a signal is induced magnetically. Fig. 1A illustrates the simplest workable form, the high-impedance loop. Capacitor $C$ resonates the circuit to signal frequency, and output is taken across its terminals. This form of antenna has certain characteristics common to all loop antennas, as follows:

1. The amount of magnetic field intercepted depends upon the loop area. The more the better.
2. The amount of signal induced by the field depends upon circuit "Q." Thus the inductance should be kept high, and the resistance from internal sources low.

But, in addition to these family characteristics, the loop of Fig. 1A (although it is the simplest form) has other characteristics which make it unsuitable for convenient ham use.

The drawback which puts it out of the running is the fact that the terminals and body of the loop are very susceptible to electrostatic excitation. As is commonly the case with any extremely high-impedance circuits, it is strongly affected by even slight capacitive coupling to its surroundings and operator hand capacity. Of course, this can be eliminated by surrounding the loop with a form of Faraday shield (which is done in commercial equipment); but that puts the antenna out of reach of ham facilities, entirely.

Fig. 1B shows an adaptation in which a low-impedance loop is used in conjunction with an external loading coil of good "Q." the combination of which is tuned to resonance by capacitor $C$. This circuit almost completely does away with the electrostatic pickup and hand capacity, without the mechanically complicated Faraday shield. It almost qualifies for ham use—but not quite.

The main failing of the circuit in Fig. 1B (which was also a secondary and therefore unmentioned fault of the circuit of Fig. 1A) is that the loop-output circuit is of extremely high impedance. With such circuits, the output impedance commonly runs from 10,000 to 50,000 ohms. In commercial direction finders, where the circuits of Figs. 1A and 1B are used, connection is usually made directly to the grid of the first tube, which has an impedance high enough for satisfactory operation. But if the ordinary ham-receiver antenna circuit, of from 75- to 500-ohms impedance, is connected across such a loop, the result is practically a dead short. It is this fact that accounts for most ham-loop failures—a short-circuited loop cannot work up enough signal voltage to get through the receiver noise.

All of the major difficulties are solved by the circuit of Fig. 1C, in which an impedance-matching output circuit is used to establish loop-circuit resonance and the proper degree of coupling for commercial receivers having any normal value of input impedance. It is feasible to construct such a loop to operate with good discrimination against ground-wave signals in its null sector for frequencies of from 1.8 mc. to 5 mc., using one set of components.
Then, by switching out half of the loading coil, \( L \), or replacing it with a smaller coil, the frequency range can be extended to 10 mc. or higher. By completely short circuiting the loading coil, some operation in the mode of Fig. 1A is possible, up to about 16 mc.; but only experimentation in each particular case will show if any benefit is gained.

Interference arriving by ground wave, or that following the line-of-sight, is readily squelched by the loop antenna, but reflected signals can also be reduced if they are not shifting around too much or made up of strong components from more than one direction. Only experience in operating a loop will show exactly what is to be expected. As an example, at some times a given station—like WWV—may give a well-defined null indication (which may not be in the direction one would expect; then at another time, with the signal fading in and out, no null at all can be found. These are the vagaries of reception by reflection and are to be expected.

So much for principles—now for construction.

The main requisites for the antenna are a frame for supporting the loop, a base on which it is mounted, a bearing for loop rotation, and a slip-ring arrangement for making connections to the loop. They will be taken up in order, and details can be seen in the diagrams.

The loop support (Fig. 5) is made of a vertical member of dowel (fornal term for broomstick) with a plywood crossarm. The ends of the crossarm and the upper and lower parts of the upright are drilled for passage of the single turn of plastic-insulated copper wire which forms the low-impedance loop. Ends are soldered at the bottom to lugs secured by wood screws.

The base-and-bearing assembly (Fig. 3) is simply a flat plywood block, open front and back, with a hole the size of the loop dowel bored vertically down through the center of both top and bottom. A brass strap or plate is fastened across the bottom of the hole in the base for the loop upright to rest upon and also to serve as a contactor for the ground side of the loop circuit. The wood is slightly recessed, with chisel or pocket knife, so the surface of this contactor will be flush with the bottom of the base, and counter-sunk flat-head screws hold it in place. Fastenings are machine screws, and inside the base assembly one of them is used for the ground connection.

The front panel may be made of Masonite or Bakelite. Although the tuning and impedance-matching capacitors may be secured to the panel, hand capacity to the controls can be decreased and tuning made somewhat easier by mounting the two capacitors a few inches to the rear of the panel and driving them by means of extension shafts. At any rate, they should not be installed on a metal panel, since the frame of the tuning capacitor is "hot.

Although it is not necessary for loop operation, a card calibrated in degrees can be mounted on top of the base for determination of the approximate direction of stations or interference. In a high-frequency antenna as simple as this, the directional pattern will not in every instance be true; and it may not even be a figure-eight, such as is obtained from a balanced-loop antenna. More often, the pattern may be a much-distorted figure-eight, with one lobe larger than the other, as shown in Fig. 2, which would put the null points closer together than the ideal 180 degrees. This form of distortion, carried to extremes, will result in the cardioid pattern with only one null point and one broad lobe. Since this antenna is not designed for direction finding, but instead, noise reduction, the exact nature of the response pattern is of no consequence, just so there is at least one sector in which signal pickup drops to a minimum.

The usual stumbling block in rotary antennas is making connections to the tuning element. It is ordinarily thought that machine work and complicated construction is required. But it can be made much simpler than it seems. In this loop, one connection, the ground, is made by a brass screw driven into the bottom center of the upright which rides on the brass set into the bottom of the base. Motion and friction are at a minimum here, so an ideal rotary connection is thus made. The wire running from the loop down to the screw may be run through an axial hole. However, if a long drill is not on hand, a small groove cut in the surface of the dowel with a pocket knife will work every bit as well.

A slip ring for the other connection (Fig. 4) is made by wrapping tinned copper wire tightly around the dowel, then running solder between the turns. The excess may be wiped off with a rag while the solder is hot, and a smooth surface thus formed. The brush for contacting the slip ring is cut from flat brass stock, then the sides are bent up to make a shallow "U" and the piece mounted in place on a post cut from Bakelite or polystyrene.

The loading inductor is a B & W "Minicitor" No. 3015 hung by its connecting lug under the slip-ring brush-mounting screw. If rapid frequency change is desired, a small switch may be used to connect half or the whole coil into the circuit.

With the receiver that is shown in the photograph, input impedance is nominally rated at 300 ohms, so transmission line of that characteristic impedance may be used for receiver connections. Care must, of course, be taken to connect the ground side of the loop and receiver together. If the station receiver has 75-ohm input, a line of this impedance should be used. The use of shielded cable would tend to decrease the "antenna effect" of the loop and lead-in and would improve the character of the nulls obtained.

If space permits, the loop may most conveniently be placed on top of the receiver, or it can be installed at a little distance. For best operation, it must be kept separated from both the operator's person and metallic objects, or other wiring. With some form of ex-

(Continued on page 126)
This high-fidelity business just cannot be ignored. A few years ago, when the summertime came, everybody went Yesar, then the world would just pulled in its horns and grimly waited for the September dawn. The record companies made feeble gestures by releasing a trickle of trivial records, which stimulated anyone’s musical desires nor enriched the company coffers. The shipping departments of the hi-fi equipment manufacturers were aludes of peace and quiet. And the hi-fi distributers? God, did they let us down! Those poor blokes were jolly well starvin’! Worse thing was they couldn’t even starve in peace. The summer months brought out the choosers in force, to begume our sweating experts with such darbs as, my "Atwater Kent hasn’t been sounding too good lately ‘dja think? I might think a new tube in "Sumper megaphone!" “whaddaya mean my needle is worn out? The guy that sold me my SchmagnaHowl said it was a poimament needle”! And so it was with hi-fi the old summertime. Today, things are different.

The record business and the hi-fi business no longer wither on the vine when the heat centerizes. The growth of the high-fidelity market has been so phenomenal, with its subsequent creation of a new recording market, that sales during the summer are at levels that a few years ago would have seemed fantastic dreams. Now don’t get me wrong; I’m not inferring that all is universally rosy-hued. The record companies still keep most of the money, the musician gets some of it, but nevertheless they do release a few major items, and a reasonable quantity of other acceptable musical fare. And while prices to keep back the milling throngs from the hi-fi distributor’s door are hardly necessary, the situation is not anything near as bad as it was so short a time ago. Why, we have the luck of major releases in the summertime! For instance, there is good news in the field of pre-recorded tape. As you probably know, this phase of audio activity is well on its way to its doldrums for all time. What seemed like such a bright and promising thing a few years ago, has been considerably devalued in the minds of many people for a wide variety of reasons. The lack of really high quality material, as regards both sound and repertoire, the poor signal-to-noise ratios and the unrealistic pricing, (with the few success stories this entails) are some of the reasons for the stagnation of this industry.

Not so long ago, the release of pre-taped records was the talk of the industry and the subject of much speculative talk in the doldrums for all time. And it was. While the release contained only a few really first class selections, the general level, both as to sound and repertoire, was far better than anything previously available. Unfortunately, these tapes were priced at such a high level, that they never got off the ground, commercially. Well, I guess these tapes will have been left a lot by all parties concerned, because I have just received news of a second RCA tape release, and while I do not have any details it undoubtedly shows the same trends we have seen before will be of first line material and will be substantially reduced in price.

Equally important is the news from Audio Video Corp., a pioneer in the pre-recorded tape field. According to the Tape Library, A-V has acquired the rights to release the material of the Vanguard and Bach Guild companies as well as other material from other as-yet-unannounced independent record companies. It is welcome news indeed, as many of you know some of the smaller independents have a very good reputation for high quality sound. Those who read this column regularly know that I have held the Vanguard output in particular of the first release, which we will report on in the tape section. My first reaction is one of enthusiasm and I have been informed that such delectable items as The Vanguard catalogue as Prokofiev’s Alexander Nevsky and Stravinsky’s L’est Noce et “L’Histoire du Soldat” will soon be available.

Eureka! The tape millennium must have arrived. Another as yet unconfirmed report is that some material will be released at 15 inches-per-second! This should placate those rugwiggled individualists who claim that “15 kc. at 7½ inches-per-second is for the birds.” On the other hand, efficiency is only obtained at 15 inches-per-second!” This is a matter for considerable debate and something I won’t go into here. I have heard fabulously good stuff at “augmented” 7½” and must admit most of the real “knock you off your feet” material has been heard at the higher speed. Add to this bright tape picture such recent innovations as a magazine-type tape mount which eliminates tape threading (a la movie cameras) and the soon-to-be-introduced super thin tape which will permit an ear-track recording at 7½ inches-per-second and you can readily see that the Audio Fairs this fall will have much of interest for the tape fan.

Vacation time is here again and for the hi-fi music fan this means “catch up on listening” time. With this in mind I’ll try to review as many as possible (no connection with the Scotch tape, for those old timers) as possible. Since the review is aimed at the audiophile, some of you will have to listen to this review with the Scotch tape. Ed the public a pubium of “light material” any more. Indeed with the festivals too numerous to mention, the musical fare is, if anything, on an even more grandiose scale than prevails during the winter. Sooo... if you are looking for me to review stuff like “Saccharine Songs for Sultry Sundays,” or “Music for Meditation While Burning on a Beach,” I jest ain’t gonna do it!!

Equipment Used This Month: New Weather viseous-damped arm and cartridge; Component Corp.总承包; Morris audio console: 2-30 watt McIntosh amps; Jim Lansing “Hartsfield”; Jensen “Imperial.” Tape playback via Ampex 600.

AUBER

Albert Wolff rides herd on these warhorses with as much verve as his recent “Hungarian Rhapsody.” Once again there will be screams and howis from the purists about Mr. Wolff’s conductorial eccentricities, but for my dough, this fellow knows how to give these cornballs a fresh newness and interest. Or perhaps it is once again the story of Mr. Wolff’s approach plus some of London’s most fabulous sound. And sound you have here in great big glorious gobs. The “Bronze Horse” and the “Fra Diavolo” are the outstanding pieces on the disc. Their glittering, brilliant finales are sonic delight. Good, clean, if it must be said sharp string tone, brussing brass of great weight, sharply accented percussion are notable here. The over-all sound is once again that “big-hall likeness” that makes the orchestra seem much larger than it is. Groove distortion was minimal and the London engineers have let the dynamics have full swing. This will find use as a demonstration piece, as it sounds great with hi-fi systems both small and big! The curve did not require adjustment and surfaces were moderately quiet.

STRAVINSKY
PULCINELLA (BALLET SUITE) AFTER PEROGLIESI
DIVERTIMENTO (LA BAISER DE LA FEE)
Orchestre National de la Radiodiffusion Francaise conducted by Mitcham (Angel 35143. RIAA curve. Price $4.98, (Thrift pack. $3.48.)

This is a most attractive disc. The coupling is excellent, the performance is cohesive. Mr. Markievitch has had considerable success with modern ballet scores and he continues his good work here. His “Pulcinella” must inevitably be compared with the recent Columbia effort with Stravinsky himself conducting. He does come off second best, but oddly, not by any great variance with Stravinsky’s ideas, but rather through a lack of cohesion in his essayal of these ideas. I think the problem is mainly one of maturity. If Mr. Markievitch were a little surer of his ground, there would be little to choose between his version and Stravinsky’s. As it is, it is still a good representation of the score and with the better sound on the Angel disc, has its undeniable attractions. The “Divertimento” fares quite well in Markievitch’s hands. With this suite derived from more familiar Tchaikovsky material, he gives a well-paced, carefully moulded reading. To those of you who are not acquainted with this score and who like the music of Tchai-kovsky, I urge you to listen to this work. The melody of Tchaikovsky is always recog-nizable, but a magic transformation has been wrought by Stravinsky and the result is an utterly delightful fantasy. The sound on this disc is far more brilliant than it is, and with this type of music, it’s fine. Strings are still beautifully luminous and clean, wood-

(Continued on page 92)
THE use of automatic headlight dimmers for automobiles is slowly catching on. These units are designed to automatically switch the car headlights from "bright" to "dim" when another car is approaching, or when street lights provide adequate illumination. The principle of operation is quite simple—the units employ some sort of photocell, with a directive optical arrangement, amplifier, and relay. When light strikes the photocell, either from oncoming cars or from a high background illumination, the impulse is amplified, and the relay fires, dimming the headlights. When the illumination stops, the relay opens, and the bright lights are on again.

Transistorizing such automobile equipment is most natural, since the car battery can supply 6 or 12 volts, enough for most transistor applications. Thus no bulky, expensive high-voltage power supplies are necessary, and heavy filament drain, hard on car batteries, is eliminated. In the near future transistor-operated auto radios, mobile telephones, etc., will result in lower battery drain and subsequent longer battery life. The transistorized automatic headlight dimmer is only a first step in this direction.

Construction details on a compact unit which eliminates heavy filament drain and complicated high-voltage power supplies by using readily-available junction transistors.

The requirements for the headlight dimmer appear quite simple on the surface, but are actually rather complicated. It must not merely be able to respond to the proper light intensities by throwing a relay to dim the lights. It must operate only when the car foot switch is in the "bright" position, and must have a switch permitting the driver to shut it off, reverting to normal operation. The unit should preferably be small, have a low battery drain, and should not require the use of special high-voltage power supplies. The fly in the ointment is, of course, the part about "proper light intensities."

The unit should be made to respond to oncoming headlights from as far away as 400-500 feet, often two or three traffic lanes away. This requires the use of a very sensitive photocell. The "field" which the photocell must be able to "see" should extend horizontally about thirty degrees to the left of straight ahead, but should not extend very far in the vertical direction, otherwise the headlights would blink for every street light. Because of the very low light intensities encountered it is necessary to use some light-gathering apparatus, such as a condensing lens with the photocell mounted at its focal point. Use of a condensing lens drastically limits the photocell's "field of vision." Placing the photocell just inside the focal point decreases the sensitivity somewhat, and also broadens the field of vision vertically as well as horizontally. Clearly some means of increasing the illumination and decreasing the vertical field is needed.

This may at first glance seem impossible, but it is not. All lenses are subject to an imperfection known as astigmatism. This is simply the tendency of a lens which produces a sharp image for points on the lens axis, to blur the images of points off-axis. As can be seen from Fig. 5, an off-axis point will produce both a vertical and a horizontal image, and various other elongated patterns. In general, the larger the lens, the worse the astigmatism. Some lenses are corrected for astigmatism, and some are not. The amount of astigmatism usually depends on which way the light passes through the lens, so some lenses which are perfect one way will have bad astigmatism the other way.

If our photocell could be placed on the horizontal image of a headlight, the headlight could be anywhere in a large horizontal "field" and still actuate the photocell. This feature is used to produce the elongated field of vision needed for the dimmer. Fig. 1 shows the image produced by a flashlight on the photocell used. This image is about four times as long as it is high.

In practice, the larger the lens, the more light it will gather, and thus the more sensitive the instrument. More than adequate sensitivity was obtained with a 4" diameter war surplus lens, with a 6" focal length, so a smaller one could be used with satisfactory results. The side of the lens with the bad case of astigmatism was located by experiment, and selected as the side to be used.

The photocell is one of the supersensitive crystal units made by the Clairex Corp. At present, the only other source for these photocells is
Ave., area plastic imbedded in units, called Allied Radio shows effect following more decreases when resistance the significant increase the the current "would be an could be made to fire the relay, there would be an adequate safety factor.

The relay used is a surplus 4000-ohm, 1 ma. unit, listed in the bargain sections of some of the large mail order catalogues, for about $2.00. Since this sensitive relay cannot handle the heavy headlight current, it was used to fire a second relay mounted under the hood. The relay "on current" is 1.2 ma., and the "off current" 1.0 ma., providing a "relay differential" of 0.2 ma. Since the "input differential" from the photocell is to 2 microamps, the amplifier must have a current gain of 100 or more. Using CK722 transistors, two stages are necessary.

Fig. 3 shows how the two stages are wired to provide a current gain greater than 100. A base bias current for the first stage of ten microamps is maintained by Rs. The polarity of Rs., the photocell battery, is such that when illumination hits the photocell, the base current in the first transistor decreases, rather than increases. With more illumination, thus more photocell current, the base becomes positive with respect to the emitter, so the base-emitter junction is biased backwards, instead of the more usual forward bias. With very little base current, the collector current drops very low, and the transistor is said to be "cut off". If the photocell receives even more light, base-collector current will start to flow, but in comparatively small amounts. The transistor will then remain essentially cut off until the light stops striking the photocell.

The first stage of amplification acts upon the second stage in precisely the same way as the photocell acts upon the first stage. Here Rs and Rs are adjusted so that the second stage collector current is just sufficient to throw the relay, that is, about 1.25 milliamperes. Normally, however, the first stage, not being cut off, will have a collector current, which will lower (Continued on page 122)
THE "TESTUNER"

By ANGELO PALMIERI and CARL QUIRK
Allen B. Du Mont Laboratories, Inc.

Build this TV tuner tester for rapid localization of tuner troubles. It's inexpensive and versatile.

In the process of troubleshooting a TV receiver, the service technician tries to localize the difficulty in the over-all circuit. Many troubles, fortunately, are relatively simple to localize. Such things as lack of vertical or horizontal sync, no brightness, insufficient vertical size, and no sound fall into this category.

There are, however, and this is certainly not news, a number of other difficulties that are not as simple. Many of these occur in the tuner.

Interestingly enough, the service technician in the field is not the only one who has trouble due to the tuner. The troubleshooter in a TV factory has a similar problem. The man in the field, however, must procure a replacement, which may take several days. If the replacement fails to cure the trouble, then the service technician is in hot water with the customer.

The "testuner" shown in Fig. 1 consists of a turret-type tuner mounted on an appropriate power supply. A 0-50 microammeter is included for checking u.h.f. crystal mixers. The positive terminal of the meter is connected in series with a 2200-ohm resistor and thence to an alligator clip through a length of hookup wire. The negative terminal is connected through its lead to the TV chassis ground.

Because of its simplicity, the "testuner" should make an ideal piece of test equipment for the service technician's bench, as well as in a customer's home. With proper use, it should reduce by a substantial amount the time normally required to service u.h.f.-v.h.f. chassis in which the trouble may stem from the tuner.

The schematic diagram of the voltage-regulated power supply used for the "testuner" is shown in Fig. 2. The voltage regulation feature, while desirable, is not absolutely essential. The most important consideration is that the voltages fed to the tuner are correct. The 6.3 volt transformer winding, in addition to supplying heater power, is also used in a low-voltage power supply circuit to provide a variable bias. This bias is set to the value of the normal a.g.c. voltage for the tuner in the receiver under test.

It is important to note that the use of the "testuner" depends upon the manner in which the signal from the tuner is physically coupled to the i.f. stages on the main chassis. In the case of the Du Mont model RA-307 TV receiver, for example, the tuner output feeds the main chassis through a short length of coaxial cable. This cable plugs into the chassis via a phono-type plug and socket. Thus, it is possible to substitute this "testuner" for the questionable one merely by pulling out the coaxial lead of the original tuner and inserting that from the "testuner" into the receiver chassis. Therefore, with this in mind, it should be mentioned that the output cable of the test unit should be long enough to permit it to be plugged into or otherwise connected to the chassis with a minimum of physical difficulty. Different lengths of this output cable will affect the band-pass characteristics of the mixer; however, this is relatively unimportant if the main interest is to localize the source of trouble.

As an example of how the "testuner" is used, assume that a u.h.f.-v.h.f. chassis has no signal on v.h.f. It is a simple matter to check the v.h.f. tuner; merely remove the tuner output lead from the i.f. input on the chassis, and in its place insert the "testuner" output lead. Then, connect an antenna to the "testuner" antenna terminals. If the original tuner was defective, normal operation will now be in evidence.

Suppose now that with this same receiver the reception on v.h.f. is OK, but the u.h.f. is unsatisfactory. In this case, the source of trouble may be the u.h.f. tuner, the crystal diodes, the connecting link between the u.h.f. tuner output and the u.h.f.-v.h.f. switch, or the feedthrough strip in the v.h.f. tuner.

Connecting the microammeter to the u.h.f. test point (output of the u.h.f. mixer crystal) will immediately tell whether or not the mixer crystal is defective. In order to determine the proper output signal, an operating receiver can be measured for comparison. The output of the Du Mont u.h.f. tuner, for example, should not be less than 6.4 microamperes. This value will vary slightly, of course, depending upon meter calibration.
By injecting an i.f. signal from a sweep or signal generator into the u.h.f. tuner test point and using a detector probe and oscilloscope anywhere in the i.f. strip, an i.f. passband response should be seen. If there is no output observed, then the trouble is between the u.h.f. and v.h.f. outputs. A simple continuity check of the feedthrough strip will localize the trouble to either the switch or the strip. A block diagram showing how most single conversion u.h.f. and v.h.f. tuners tie together appears in Fig. 3. The output signal from the u.h.f. tuner is at the i.f. of the receiver—either 21.25 mc. for sound and 25.75 mc. for video, or 41.25 mc. and 45.75 mc. respectively. Therefore, when the u.h.f. output signal is applied through the u.h.f.-v.h.f. switch, it does not go through any r.f. circuit. Instead, the signal is fed through a special strip known as an i.f. feedthrough strip, which is essentially an i.f. amplifier, generally using a 6BK7 tube.

Although the "testuner" will be useful for a large number of tests, some precautions should be observed. On a particular job, a set exhibited excessive hum in the picture. From an examination of the condition, it was established that the trouble was due to 60-cycle hum. The service technician tried a normal test, which consists of shorting the cathode of each tube in the i.f. and i.f. circuits to ground (60-cycle hum is usually due to a heater-cathode short or leakage in one of the tubes). When he arrived at the tuner in the process of making this shorting test, he decided to try the "testuner." Lo and behold, the condition cleared up when he inserted the "testuner" in place of the regular tuner. He then replaced the original tuner and as he expected, the hum was back again.

He now surmised that the trouble was due to a heater-cathode leakage or short in the r.f. amplifier. (The mixer tube was an unlikely choice since both cathodes were grounded.) However, replacing the r.f. amplifier tube did not solve the problem. The technician happened to have a replacement tuner handy, so he replaced the one in the set—still the problem persisted. A final test was made by shorting (Continued on page 77).

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**Fig. 2.** Schematic diagram and parts list of the "testuner." The output voltages are suitable for the tuner shown in Fig. 1 if another tuner is used requiring different voltages. Omit the voltage regulator tubes and change R6 to a voltage divider.

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**Fig. 3.** Block diagram of the usual hook-up between the u.h.f. and v.h.f. tuner sections of a combination TV receiver.
New ideas for increasing the signal-to-noise ratio obtained from u.h.f. TV signals in fringe locations.

Television coverage in the u.h.f. bands has been improving steadily with the use of super-power, proper transmitting site location, and better radiators. The use of transmitting boosters and satellites has helped to fill in propagation pockets. Just as important in obtaining peak u.h.f. performance is the receiving equipment and its sensitivity and noise factor. A high-gain, properly positioned and carefully installed u.h.f. antenna is indeed a necessity in most u.h.f. areas. A u.h.f. converter or tuner with a good noise figure is likewise helpful in delivering a clear picture from u.h.f. stations.

It is a fact that more sensitive u.h.f. tuners with exceptionally good noise figures could further extend u.h.f. coverage. However, additional r.f. amplification ahead of the crystal mixer of the u.h.f. device has presented economical and technical difficulties. There are as yet no inexpensive receiving-type vacuum tubes suitable for r.f. amplifier circuits at ultra-high frequencies. What should be kept in mind is that such an amplifier must have a low noise factor to be effective, and such amplifiers and tubes have not yet been developed for u.h.f. Besides the tube factor, the circuitry itself at these high frequencies would be extremely critical. All of this brings up the cost factor.

True, television and component manufacturers have been able to produce u.h.f. converters and tuners inexpensively; however, these are relatively broadband affairs with no signal-to-noise problems. It is only recently, relatively speaking, that manufacturers have adopted the cascode amplifier circuit for v.h.f. r.f. amplifiers. That they will come up with a similar circuit and inexpensive tube for u.h.f. in the near future is certain. However, the answer to increased sensitivity at u.h.f. must be found elsewhere at the present.

There is one economical approach to the sensitivity problem—that is the delivery of a stronger signal to the mixer to obtain a resultant improvement in signal-to-noise ratio.

If the crystal mixer is located at the antenna a better signal-to-noise ratio can usually be established. In this arrangement, improved signal-to-noise ratio is established by permitting the application of a stronger u.h.f. signal to the u.h.f. mixer.

Signal losses at insulators, arresters, fittings, terminations, etc., are great-
U.H.F. Mixing Methods

There are three basic methods for systems that employ u.h.f. mixing at the antenna, Fig. 3. The simplest method locates the crystal mixer at the antenna and the local oscillator at the receiving point (Fig. 3A). Local oscillations are sent up the transmission line to beat with the incoming u.h.f. signal at the crystal mixer. The difference frequency (in the v.h.f. range) is conveyed down the same line to be applied to a v.h.f. amplifier or to the antenna terminals of a v.h.f. receiver.

In this arrangement it is not necessary to apply any power to the antenna-mounted segment of the u.h.f. converter system. The u.h.f. channel selection is made by varying the frequency of the local oscillations sent up to the crystal mixer. The crystal input circuit at the antenna can be tuned or untuned. If untuned, the entire u.h.f. range can be accepted by varying the local oscillator frequency.

Added selectivity can be obtained by employing a tuned input circuit at the crystal mixer. This limits the bandwidth and confines the u.h.f. frequency range that can be accepted. However, selectivity and noise figure are improved.

A second basic method locates the crystal mixer and a v.h.f. i.f. amplifier at the antenna and the local oscillator (u.h.f.) at the receiver (Fig. 3B). Again, the local oscillations are sent up the transmission line to the mixer. This arrangement is capable of excellent sensitivity because even the v.h.f. difference frequency is amplified before it is applied to the transmission line. The local oscillator is tunable from the receiver location to permit station selection over the entire u.h.f. range.

A third arrangement even moves the local oscillator up to the antenna (Fig. 3C). In this method, the u.h.f. converter is pretuned. Thus, the unit can only be used for single channel reception. A remote tuning mechanism could be devised for tuning such a converter over the entire u.h.f. band.

It is to be anticipated that economical and practical antenna-mounted u.h.f. devices will soon be made available. It is not unlikely that narrow-band antennas will be designed to include tuned circuits and crystal mixers in a completely matched and peaked unit. A coaxial cable will convey v.h.f. i.f. signals down to the TV set; at the same time, the cable will carry the injection signal up to the crystal.

A method based upon this idea will be described shortly. Of course, although the unit was constructed by modifying a Regency u.h.f. converter, other converters may be used. The unit should have a crystal diode mixer however, since this does not require power, either for the heater or plate circuit, for proper operation. When vacuum-tube type mixers are used power must be transported up to the antenna and, while this in itself is not bad, some city ordinances forbid this practice.

One thing should be understood and that is that placing the mixer at the antenna location makes it more susceptible to interference. While the emphasis in antenna-mounting u.h.f. mixers is placed on sensitivity and noise factor, interference can not be neglected.

Careful shielding at the antenna of the mixer and allied circuitry may provide the answer. Chances are also that interference may not be as important a problem in fringe and other weak-signal areas. The use of a highly directional antenna will also reduce the interference problem, as will a highly selective antenna, such as a u.h.f. yagi, cut for a specific channel or small band of channels. Such an antenna is shown in Fig. 1, together with the antenna-mounted mixer to be described in the following paragraphs.

A Typical Unit

An antenna-mounted mixer unit was made by modifying a Regency RC-53 u.h.f. converter as shown schematically in Fig. 4. The high-pass filter and crystal diode were attached at the switch terminals (points "A" and "B"). The whole section between the u.h.f. antenna terminals and points "A" and "B" was detached as a unit, and in its place a small length of 300-ohm line was substituted as shown in Fig. 6.

The detached filter and crystal combination were then mounted in a weatherproof plastic box as shown in Fig. 5. The unit was then fastened across the terminals of the u.h.f. antenna. The transmission line was connected to the output side and run down to the main section of the RC-53 at the receiver. A small section of line links the receiver terminals on the converter to the antenna input terminals of the TV receiver.

Local oscillations are supplied via the 33 µfd. capacitor and conveyed up the transmission line to the crystal diode. Here the u.h.f. signal is also introduced to produce a difference signal that is now conveyed down the line to the converter. The difference signal is supplied to the receiver output terminals via points "A" and "B" and the switch contacts.

For very long lengths of line it may be necessary to increase the value of the 33 µfd. capacitor to provide a strong enough injection voltage to the crystal. For under 100 feet of 300-ohm line use the 33 µfd. capacitor.

Wrap a two-inch length of aluminum foil around the transmission line near the u.h.f. antenna terminals on the converter. By sliding the foil along the transmission line, standing wave conditions along line are shifted, permitting some control of the amplitude of the local oscillator injection voltage reaching the crystal mixer. The foil is adjusted by observing the picture on the TV screen and setting it to the position of best picture.

Fig. 4. Schematic diagram of the Regency u.h.f. converter model RC-53 modified so that the high-pass filter and mixer crystal diode are located at the antenna.

Fig. 5. The high-pass filter and crystal mounted on the base of a plastic box.

Fig. 6. View of the modified Regency converter showing the short length of transmission line substituted for the high-pass filter and crystal in the foreground.

August, 1955
A LOW-COST CAPACITANCE BRIDGE

By DAVID JOHN LEWIS, W1SE

A well-filled "junk box" plus a few spare dollars and you can add this valuable test unit to your workbench.

Complete schematic of capacitance bridge. Standard resistors will work satisfactorily in circuit.

- R1 = 100 ohm, 1/2 w. res.
- R2 = 10,000 ohm, 1/2 w. res.
- R3 = 100,000 ohm, 1/2 w. res.
- R4 = 1 megohm, 1/2 w. res.
- R5 = 100,000 ohm linear taper pot
- C1 = 0.001 µfd silver mica capacitor (±5%)
- C2 = Capacitor being measured
- J1 = Open circuit jack
- J2, J3 = Banana jack
- T = Small output transformer
- S1 = 5-p. 3-pos. rotary switch
- B = 1 1/2 volt battery

Under chassis view demonstrates the simplicity of wiring and construction.

ALTHOUGH it is one of the fundamental building blocks of electronic circuits, capacitance is probably the least often measured quantity in the average amateur workshop. The expense of commercial capacity bridges or the time and labor involved in most home-brew projects does not seem to be justified by the amount of service most of us can get from such an instrument.

However, the value of a simple bridge is undeniable, since many of the capacitors in any junk box are apt to be indistinctly marked. Variable capacitors, in particular, pose a problem when the minimum capacity must be known or when some sort of calibration in terms of capacity is required.

The bridge described in this article is designed to meet just this kind of general shop work need. It will handle the most common values of capacitors in its range of from 10 µfd to 1 µfd, with accuracy sufficient for all but the most critical applications. The unit is self powered and small enough to fit on the most crowded workbench. Since simplicity and low price were considered important objectives, earphones are employed as an inexpensive but sensitive null detector. If all components were purchased new, including jacks, knobs, etc., the cost would be about five dollars but the average junkbox will supply most of the necessary parts and the price should run well below this figure.

Construction is quite simple; an evening's work should finish the job.

The bridge circuit itself is quite simple and straightforward as can be seen from the diagram. The bridge is balanced when the ratio of the unknown capacitor, $C_u$, to the resistance of the balance arm $R_b$ is equal to the ratio of $C_b$ to $R_b$. This can be expressed mathematically as $C_u/R_u = C_b/R_b$ ($C_u/R_b$). The setting of the balance arm is proportional to the unknown capacity, so a linear calibration can be obtained by using a potentiometer with a straight-line characteristic for $R_b$.

With $C_u$ equal to .001 µfd and a variable resistance with a .1 megohm maximum value for $R_b$, the bridge will read from .1 to 1 µfd when $R_b$ is 100 ohms, from .01 to .1 µfd when $R_b$ is 1,000 ohms, etc. Five standards of 100, 1,000, 10,000, 100,000 and 1,000,000 ohms will enable the bridge to cover its full range. An additional 10 ohm standard will extend the range to 10 µfd if desired.

The exact values of the bridge components are not extremely critical, but a little extra care expended in getting them right will pay off in improved accuracy. $C_u$ should be a high quality silver mica unit with a fairly close tolerance for best results. An ordinary paper capacitor can be used, but the null may be less clearly defined when the bridge is being balanced.

The five range resistors must be very close multiples of ten unless you are willing to use a different dial cali-

(Continued on page 123)
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IT WAS Barney's first day back at work after he and his parents had taken a vacation trip out to the West Coast, and he showed up bright and early with a coat of tan so thick it faded his freckles.

"Welcome home, Marco!" Mac greeted him as he came into the service department. I missed you. You can't imagine how quiet it was to find my tools always exactly where they belonged, not to feel your hot breath on the back of my neck when I was working on an interesting 'dog,' and not to go home at night with my ears aching from questions."

"Aw, I'm not that bad," Barney said with a broad grin that said plainly he knew his employer was joking. "And let me confess I missed you and the shop, too. Eager as I am to get out of here every night, I'd never have believed it; but I hadn't got to Tucumcari before I began to miss being out of this electronic birdcage. Still, I went on quickly, 'I sure had a good time, and I'm glad I went. You know, to coin a phrase, travel is broadening.'"

"Yeah," Mac said as he walked around the youth and gazed fixedly at the seat of his trousers, 'I thought I detected a certain premature middle-aged spread as you waddled through the door.'

"You really notice those three pounds I put on?" Barney asked delightedly. He had the ambition of many lanky people—exasperating those who have to diet—to put some pounds on his lean frame. "But that is not what I meant. You see as I read our radio and TV magazines I'm often steamed because they contain several articles not of interest to me personally. I always felt that what didn't interest me wouldn't interest anybody. Now I know better. After that trip I've finally got it through my thick head that there are a lot of angles and problems to this radio and TV business that we never hear or think about at this location. The article I consider dull and a waste of space may be the very thing some other reader has been waiting for."

"Tell me more," Mac urged with interest.

"Well, take that business of figuring out the heights TV transmitting antennas and receiving antennas should be. I surely saw examples of both extremes. Out in Oklahoma City they have the tallest TV transmitting tower in the world. It's even taller than the Empire State Building, and they can make any use this height to poke a signal into the pockets and over the tops of the hills in the rough country that falls within the fringe area of this skyscraping tower. On the other hand, you know we are used to the familiar sight of those cement relay towers two or three hundred feet high with a couple of pairs of horn-type antennas on top for relaying telephone messages and TV programs. I always had a hankering to see those antennas up close, and I got my chance out on the Great Salt Flats between Wendover, Utah, and Salt Lake City. Out there I found this whole top antenna assembly sitting right on the ground. There was no need to put it up on a tower for it had easy line-of-sight contact with other relay stations on mountain tops to the west and east. Sure did look funny, though, to see it squatting out there on the salt flats.

"Then, when we reached Los Angeles, it was very odd not to see any antennas with rotating motors. They have no use for them because all the TV transmitting antennas are on Mount Wilson. You just point your receiving antenna at this and get all the stations I think there are seven of them. What's more, you get line-of-sight reception for a heck of a distance by our flat country standards. Even though you can't always see the mountain because of haze and the notorious smog, it's there, and the TV signals come right on through. Friends with whom we stayed live better than fifty miles from the mountain, and they just use a simple one-bay conical sitting on the attic floor; but judging by the pictures on their twenty-four inch screen, I'd guess they must be getting three or four thousand microvolts of signal. I'd imagine that close to the mountain you might have ghost problems and other troubles caused by too much signal. However, I'll bet those technicians skip over the articles on rotating motor maintenance we find so interesting here."

"You must have run into some areas where reception was not so good, didn't you?"

"I'll say. We went up through Bakersfield to the Sequoia National Park, and around Tulare, California, I saw several eight-bay conicals on top of tall towers. The bays were mounted side by side in vertical stacks of four. Judging just from that, I'd guess signal strength was pretty low there. And I also saw several installations that took advantage of 'natural' antenna towers. By that I mean the receiving antenna was up on top of a hill or knob and a long run of open wire line—often up to two or three thousand feet or more—took the signal to the house in the valley. I'd read about these, but I never had a chance to see one before."

"Anything else interesting in the TV line?

"I did notice something I never ran across here. While listening to a weak radio station on the car radio—and there are many places where all signals are weak—I kept noticing a funny heterodyne whistle that would start in low and quickly build up to a loud sound and then die out again. It came and went without any predictable pattern, and I began to think a bypass was opening up in the car receiver; but then I noticed the sound was only heard while passing a house with a TV antenna. What I was hearing was the interference from the TV set's horizontal oscillator. Around here, where we only listen to loud radio signals, you never get this; but out there many of the sets would have much more of a radio signal for better than a quarter of a mile in either direction."

"How about radio out there? Is it pretty much of a dead issue?"

"Yes, we passed through many areas in which we passed judge, by the lack of antennas, that TV reception was practically impossible; but I'm confident every isolated house had a radio. Radio is much more than just a means of casual entertainment in many of these out-of-the-way places in the mountains and desert. It is a combined newspaper, telephone, church, school, market ticker, and show all rolled into one. In the sheep country we passed several of those little houses on hillsides in which the shepherders live, and I saw a portable radio sitting beside the window in two or three of them. In fact, we even saw one herder carrying a portable with him on the saddle as he rode his horse across country. It doesn't take much imagination to realize what radio must mean to those lonely fellows."

Barney stopped for a moment and then went on slowly and slyly, 'You know around here I practically never (Continued on page 126)
The technical specifications for this fine instrument speak for themselves. Vertical channel sensitivity is 0.025 volts RMS/1 inch at 1 kHz. Vertical frequency response is essentially flat to 5 Mc, and down only 1.5 db at 3.55 Mc. Ideal for Color TV work.

Extended sweep generator range is from 20 eps to 500 Kc in five steps, far beyond the range normally encountered at this price level.

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This basic audio reference generator deserves a place in your laboratory. Complete frequency coverage is afforded from 20 cps to 1 Mc in 6 ranges, and output is constant within ±1 db from 20 cps to 400 Kc, down only 3 db at 600 Kc, and 8 db at 1 Mc. An extremely good sine wave is produced, with a distortion percentage below 0.4% from 100 cps through the audible range. Plenty of audio output for all applications; up to 10 v. under no load conditions. Output controllable with a continuously variable step-type attenuator with settings of 1 mv, 100 µv, 1 v, and 10 v. Cathode follower output.

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0-120 ma at 200 volts essential for circuit design and development. Voltage or current read on 4½” meter.

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Measures resistance, capacity, capacitance, inductance, dissipation factors of condensers, and the storage factor of inductance. Employs 2-section CRL dial, D, Q and DB functions are combined in one control. 1½% resistors and capacitors used in critical circuits. 100-0-100 milliammeter for null indications. 1000 cycle oscillator, 4 tube detector-amplifier, and power supply built-in.

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**New Heathkit DX-100 Phone and CW Transmitter Kit**

This one compact package contains complete transmitter, with built-in VFO, modulator, and power supplies. Provides phone or CW operation—VFO or crystal excitation—and band-switching from 160 meters through 10 meters. R.F. power output 100—135 watts phone, 120—140 CW. Parallel 6L6's modulated by push-pull 1620A's. In network interstage and output coupling for reduced harmonic output. Will match non-reactive antennas between 50 ohms and 600 ohms. TVI suppressed with extensive shielding and filtering. Rugged metal cabinet has inter-locking seams.

The high-quality transmitter is packed with desirable features not expected at this price level. Copper plated chassis—potted transformers—wide spaced tuning capacitors—ceramic insulation—illuminated VFO dial and meter face—remote control socket—prefocused wiring harness—concentric control shafts—high quality, well rated components used throughout. Overall dimensions 20 1/4" wide x 12 1/4" high x 16" deep.

Supplied complete with all components, tubes, cabinet and detailed construction Manual. (Less crystals.) Don't be deceived by the low price! This is a top-quality transmitter designed to give you years of reliable service and dependable performance.

**Heathkit Amateur Transmitter Kit**

Enjoy the trouble-free operation of commercially designed equipment while still benefiting from the economies and personal satisfaction of "building it yourself."

This CW Transmitter is complete with its own power supply, and covers 80, 40, 20, 15, 11 and 10 meters. Single knob bandswitching eliminates coil changing. Panel meter indicates grid or plate current for the final. Crystal operation, or can be excited by external VFO. Crystal not included in kit. Incorporates features one would not expect in this price range, such as key-click filter, line filtering, and metering circuits.

Overall dimensions 20 1/4" wide x 12 1/4" high x 16" deep. Weight 4 lbs. $4.50 deposit required for C.O.D. orders.

**Heathkit DX-100**

Shipped motor freight unless otherwise requested. 5.50 deposit required for C.O.D. orders.

Model AT-1

$29.50

Model AM-1

$14.50

Model AR-1

$25.50

Model VFO Kit

$19.50

Heathkit Grid Dip Meter Kit

Model GD-18

$19.50

Heathkit Impedance Meter Kit

Model AM-1

$14.50

Heathkit Communications Receiver Kit

Model AR-1

$25.50

Heathkit Antenna Coupler Kit

Model AC-1

$14.50

Heathkit Communications Coupler Kit

Model AC-1

$14.50

Heathkit VFO Kit

Model VFO-1

$19.50

Heathkit Communications Receiver Kit

Model AR-1

$25.50

Heath Company

A Subsidiary of Daystrom Inc.

Benton Harbor, Michigan

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Radio & Television News

www.americanradiohistory.com
### Heathkit ADVANCED DESIGN
### HIGH FIDELITY AMPLIFIER KIT

This advanced-design 25 watt Hi-Fi Amplifier features a new design. Peerless output transformer, improved circuitry, and uses KT-66 output tubes. This results in higher power output; improved bass and high frequency response; and reduced IM and harmonic distortion. Incorporates all the "extra" features that make for real listening enjoyment. Power handling capabilities increased to follow instantaneous power peak of full orchestra. Also new type aligning circuit, and "tweeter saver" to suppress HF excitation. Now physical design results in attractive appearance, suitable for use either in or out of a cabinet.

**KIT COMBINATIONS**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PRICE</th>
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<tbody>
<tr>
<td>WA-P2</td>
<td>$19.75</td>
</tr>
</tbody>
</table>

**SHIPPING WT.** 7 lbs.

**SHIPPING IN USA.**

- Orders of $10.00 or more, express charges paid.
- Orders under $10.00, must remit complete net amount.

**SHIPPING TO CANADA AND APO'S.**

- Orders of $15.00 or more, express charges paid.
- Orders under $15.00, must remit complete net amount plus $1.00 for express charges.

**SHIPPING TO OTHER COUNTRIES.**

- Orders of $25.00 or more, express charges paid.
- Orders under $25.00, must remit complete net amount plus $2.00 for express charges.

**PAYMENT.**

- Layaway arranged by your local dealer.
- Check or money order acceptable.
- All remittances must be in U.S. currency.

**ORDER BLANK**

- One item per order.
- All orders must be prepaid.
- All orders subject to change without notice.

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**Heathkit 6-WATT AMPLIFIER KIT**

- Model A-7B: $15.50
- Model A-7C: Same as Model A-7B; $13.50

**Heathkit HIGH FIDELITY PREAMPLIFIER KIT**

- Model WA-P2: $19.75

**SHIPPING WT.** 1 lbs.

- Orders of $10.00 or more, express charges paid.
- Orders under $10.00, must remit complete net amount.

**SHIPPING TO CANADA AND APO'S.**

- Orders of $15.00 or more, express charges paid.
- Orders under $15.00, must remit complete net amount plus $1.00 for express charges.

**SHIPPING TO OTHER COUNTRIES.**

- Orders of $25.00 or more, express charges paid.
- Orders under $25.00, must remit complete net amount plus $2.00 for express charges.

**PAYMENT.**

- Layaway arranged by your local dealer.
- Check or money order acceptable.
- All remittances must be in U.S. currency.

**ORDER BLANK**

- One item per order.
- All orders must be prepaid.
- All orders subject to change without notice.

---

**Heathkit 20-WATT HIGH FIDELITY AMPLIFIER KIT**

- Model A-98: $35.50

**SHIPPING WT.** 23 lbs.

- Here is your least expensive route to real high fidelity performance. Full 20 watt output—separate bass and treble tone controls, frequency response 25 db 20-20,000 cps—four switch-selectable components, input—low hum and noise-level—output transformer tapped—output transformer completely separate audio level control. Full record equalization accomplished with separate turnover and roll-off controls.

**KIT COMBINATIONS**

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**Heathkit SINGLE-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT**

- Amplifier ever offered in kit form.
- Main amplifier and power supply on a single chassis. Features Chicago output transformer. Flat within 1 db from 10 cps to 100,000 cps. Maximum power output over 20 watts.

**KIT COMBINATIONS**

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**ORDER BLANK**

- One item per order.
- All orders must be prepaid.
- All orders subject to change without notice.

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**Heathkit SINGLE-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT**

- This is the low-cost model Williamsons—type.
- Main amplifier and power supply on a single chassis. Features Chicago output transformer. Flat within 1 db from 10 cps to 100,000 cps. Maximum power output over 20 watts.

**KIT COMBINATIONS**

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**August, 1955**

**MAIL YOUR ORDER TODAY TO THE HEATH COMPANY A SUBSIDIARY OF DAYSTROM, INC. BENTON HARBOR 15, MICHIGAN**

**ON PARCEL POST ORDERS include postage for weight shown. ORDERS FROM CANADA and APO's must include full remittance.**

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- [ ] Best Way

**QUANTITY**

**ITEM**

**MODEL NO.**

**PRICE**

**(PLEASE PRINT)**

Enclosed find $ check $ money order for

<table>
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<th>Ship Via</th>
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On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

NOTE: ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
NEW LINE OF HOME SOUND SYSTEMS ANNOUNCED BY RCA

Five new units, ranging in price from $129.95 to $1600, are included in new line of audio equipment.

IN THE belief that more and more people will want “ready-to-plug-in” sound systems rather than separate components which must be assembled, Radio Corporation of America has recently introduced five new assembled systems which range in price from $129.95 to $1600.00.

Top model of the line is the “Mark I” at $1600 which consists of a twin console with four speakers in a separate cabinet. The instrument includes a tape recorder, three-speed record changer, and AM-FM radio. Maximum output is 25 watts through a range of 30 to 20,000 cycles.

The “Mark II” is a single-cabinet console with three speakers, three-speed changer, and AM-FM radio. Maximum output is 25 watts, 30-20,000 cps. The price is $395 in mahogany.

The third model, the “Mark III,” is also a single-cabinet console with three speakers and three-speed changer in addition to the AM-FM radio. Maximum output is 15 watts, 30 to 20,000 cps. List price is $325 in mahogany.

The “Mark IV” is a consolette model with three speakers and three-speed record player. Maximum output is 6 watts, 50 to 20,000 cps. This model will sell for $169.95 in mahogany.

The final unit in the present series is a table model with three speakers and three-speed changer. Maximum output is 4 watts, 70 to 20,000 cps. This $129.95 unit is also available with optional legs of matching finish or brass.

One of the new features of the “Mark I” and “Mark II” instruments is the first use of transistor circuits in commercial phonographs. According to the company, this delivers quieter performance and a greatly reduced hum level.

The record changer used in the “Mark I” handles 7, 10, and 12 inch records. It has a weighted and balanced turntable and 4-pole, 4-coil motor, assuring constant speed operation with virtually no hum.

The “Mark I,” the top-of-the-line in the new RCA series. Housed in two cabinets. It features four speakers, 3-speed record player, tape recorder, and AM-FM receiver.
If you’re willing to lose your job tomorrow to a technically-trained man, turn the page, mister

But, if you’re interested in an honest-to-goodness career in the vigorous young electronics industry, here’s how you can step ahead of 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 training in radio-television-electronics.

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.

More than a quarter century of experience qualifies CREI to train you.

What qualifies you for CREI? If you have a high school education, you’re off to a good start. If you have a knack for math, so much the better. If you are currently working in some phase of the electronics industry, you’ll get going faster. 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. Your 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 applications of radio or television engineering or aeronautical radio.

How good is CREI training? Here are a few ways to judge. Ask an electronics engineer if you know one. Ask a high-school or college physics teacher. Ask a radio station engineer.
Construction details on an unregulated power supply which provides outputs from 30 to 300 volts with single control.

EVERY electronic experimenter or hobbyist needs a good utility power supply. Most power supplies constructed for utility applications are of the voltage-regulated type, and not so much because of the voltage regulation they afford, but rather for the feature of output voltage control. For example, an experimenter developing some battery-powered equipment needs a power supply that can be adjusted to the equivalent voltage of the batteries he intends to use. The fact that this voltage might vary a few volts with line or load variations is of little importance, but it is important that the correct voltage be obtained without the use of awkward, hot, and otherwise inadequate dropping resistors.

The power supply shown is not a voltage-regulated supply. The output voltage will change with variations in line voltage and current load. But the output can be varied over a range of 30 to 300 volts with a simple potentiometer control, and voltage variations can be compensated with great ease.

The wide output voltage range can be obtained by substituting 2D21 thyatrons for the conventional high-vacuum rectifier used in most power supplies. For those unfamiliar with the thyratron, it is a tube constructed very much like a conventional triode, the greatest exception being the fact that the bulb is filled with an easily ionized gas instead of being evacuated. The cathode of a thyratron emits the total current conducted by the tube, but the ionized gas greatly minimizes the space charge and gives the tube remarkable current-handling capacities. Once the tube is allowed to conduct and the gas is ionized, positive ions surround the grid and neutralize its effect on the electron stream. As a result, a conducting thyratron cannot be cut off by the restoration of grid bias. Instead, the plate voltage must be momentarily removed to allow the gas to de-ionize. The grid can again be used to control the tube when the gas has de-ionized.

Because the thyratrons are grid controlled tubes, they can be made to conduct during only a portion of each positive half-cycle produced by the power transformer. The output voltage is determined by the percentage of each half-cycle that the thyratrons conduct. Adjusted for maximum output, the thyratrons conduct over the entire half-cycle, while for a much lower output voltage they conduct only during the last few degrees of each half-cycle.

The thyratrons are controlled by driving the grids with a voltage that is out-of-phase with the plate voltage. This grid voltage is obtained with a variable phase-shift network composed of Rs, Rs, Cs, and Cs. As shown in the graph, the thyratrons will not conduct during the first few degrees of each positive half-cycle because the instantaneous grid voltage is well below cutoff during that period. As the phase shift is increased the thyratrons are caused to conduct during a smaller portion of the half-cycle. Since the filter system of the power supply averages the conduction time of the thyatrons, the output voltage will rise or fall as the grid voltage phase shift is decreased or increased. Figs. 1 and 2 illustrate the voltage waveforms at the cathodes of the thyatrons for output voltages of 250 volts and 50 volts respectively.

It is possible to obtain a 90 degree phase-shift in a purely capacitive circuit, but since a purely capacitive circuit cannot be obtained practically, a full 90 degree phase-shift cannot be produced with a simple resistive-capacitive network. The phase-shift network illustrated in the schematic diagram uses two resistive-capacitive sections, each of which is capable of approximately 70 degrees of phase-shift, and, when added, will shift the grid voltage a total of 140 degrees from the plate voltage of the thyatrons. The remaining 50 degrees phase-shift cannot be obtained, and is the limiting factor that determines the minimum output voltage to which the power supply can be adjusted. In the vast majority of applications a minimum output of 30 volts is not acceptable. However, a more elaborate phase-shift system, perhaps one with an amplifier.
or one using both inductive and capacitive sections, could give control even over the range of 0 to 30 volts.

With potentiometers, $R_s$ and $R_a$ adjusted for minimum resistance, the phase-shift in the circuit is zero. As resistance is added the phase is shifted rapidly but decreases in proportion as more resistance is added. In other words, the phase-shift network is not linear. Linear potentiometers, then, would make the adjustment at high voltages quite critical. Potentiometers with reverse audio tapers overcome the inherent non-linearity of the phase-shift network. They must be connected to the circuit so that minimum resistance change occurs at the most clockwise position of the control knob.

The voltage drop within each thyatron does not exceed eight volts even under maximum load. While this is excellent from the standpoint of voltage regulation, it creates the necessity of using a choke input filter system. A capacitor input filter would cause instantaneous plate currents far in excess of the maximum ratings of the tubes and power transformer. In a conventional high-vacuum, rectifier-type power supply, each half of the rectifier serves to damp the inductive kickback from the input choke because at least one half of the rectifier is conducting at all times. But with thyatrons, short intervals exist when neither tube is conducting, and since during those intervals the impedance at the input to the filter is very high, the input choke will tend to be very complex and large in size, not in itself undesirable, it cannot be tolerated in this particular power supply because it disrupts the wave shape at the cathodes of the thyatrons and prevents complete control. Ringing is easily prevented by shunting the 5Y3 rectifier and 5000 ohm resistor across the input choke. The resistor limits the instantaneous currents conducted by the 5Y3. Fig. 3 shows how the input choke will ring without damping.

In addition to preventing ringing, the damping rectifier also increases the maximum output voltage of the power supply. In a conventional choke input filter system the inductive kickback from one half-cycle detracts from the following half-cycle, substantially reducing the output voltage. In this circuit, the 5Y3 absorbs the kickback thereby allowing the output voltage to reach more nearly the secondary voltage of the power transformer. The maximum unloaded output voltage of the supply is about 380 volts.

The filaments of the 2D21 tubes must be heated by an independent 6.3 volt filament winding, the center tap of which is returned to the cathodes, so as not to effect the filament-to-cathode voltage rating of the tubes. Grid voltage is obtained from the 6.3 volt winding of the power transformer. It is fed through the phase-shift network to the primary of the plate-to-grid transformer, $T_p$. Capacitor $C_t$ is connected across the output of $T_p$ to minimize the inductive reactance of the transformer. The phase-shift network is a comparatively high impedance circuit and it must work into a non-reactive load. Both the control grids and shield grids of each thyatron are isolated by 100,000 ohm resistors. Since these grids are not merely in an electron stream but rather in a highly ionized gas, they would draw excessive and damaging currents if they were not returned through a high impedance circuit.

The supply is constructed on a 10" x 5" x 3" steel chassis. A piece of 1" wide steel strap is bent in the shape of a "U" and bolted to the ends of the chassis for easy carrying. All voltages are brought to a barrier terminal strip on the front of the chassis. While transformers of other manufacture might work just as well, it is recommended that $T_s$ be of the manufacture indicated in the parts list. Slight differences in impedance might affect the efficiency of the phase-shift circuit. The correct phase polarity must be observed when connecting the 6.3 volt filament winding of $T_p$ to the input of the phase-shift network. With $R_s$ and $R_a$ set for minimum resistance, the grid voltage should be in-phase with the plate voltage. Correct phase polarity can be achieved with an oscilloscope, but if a scope is not available, trial and error can be used without danger of damaging the thyatrons.

The entire unit is small, compact, rugged, and attractive, and will outperform power supplies twice the size, complexity, and cost. As with any power supply, a very practical addition would be a voltmeter and ammeter at the unit's high voltage output terminal.

If such meters can be spared for permanent installation in the supply's output circuit, they would, of course, offer greater current and voltage measuring flexibility.

Schematic of thyatron power supply. It provides output from 30 to 300 volts.

Fig. 1. Waveshape at cathodes of thyatrons with supply adjusted for 230 volt output.

Fig. 2. Same as Fig. 1 only at 50 volt output.

Fig. 3. Waveshape at cathodes of thyatrons with damping rectifier out of the circuit.
REGULAR $59.95 LIST TIMEX MAGNETIC RECORDER

RECORDS AND PLAYS BACK—PLAYS 16½ AND 45 RPM RECORDS

MODEL 40 TIMEX RECORDER $29.95
CRYSTAL PICKUP HEAD TO PLAY PHONES $2.95 EXTRA

A product of United States Timex Corp. (Timex) A multiple purpose magnetophonic plastic 12" record player, sold in regular, and sold you buying now of No. 99.95, and $9.95 for a 45 RPM record player, and crystal pickup head for phonographs. Records and plays for 31½ minutes on a 12" record. Magnetic pickup head. Variable speed control. No. 99.95 plus $2.95 for crystal pickup head, No. 95.00 for 45 RPM player.

McGEE'S LOW COST HIGH FIDELITY

20 WATT HI-FI AMP

Response 30-15000 CPS.

Push-Pull 6L6's Input $22.95

For Mike and Crystal V.R. Phono Pin, Twin Tone Controls.

A tremendous High Fidelity amplifier. No. 130 to 15,000 cps. Electronic tone and treble boost by separate tone controls. Use this amplifier with any record player. Use with either 45 or 33 1/3 records. 15000 c.p.s. range is best for 45 records. Price $22.95.

$29.95

17" FULL DORAL $29.95

Flip-down microphone with full doors. 30" x 24" x 2 1/2" deep. Bass and treble boost by separate tone controls. Use with 45 or 33 1/3 records. Price $29.95.

$19.95

10" STAND $19.95

With Crystal V.R. Phono Pin, Twin Tone Controls.

A tremendous High Fidelity amplifier. No. 130 to 15,000 cps. Electronic tone and treble boost by separate tone controls. Use this amplifier with any record player. Use with either 45 or 33 1/3 records. 15000 c.p.s. range is best for 45 records. Price $22.95.

H.T. 9283K PHONOGRAPH OR WALNUT 12" $25.95


$19.95

H.T. 9280K LP $19.95


$14.95

6-TUBE, 2-BAND RADIO KIT $14.95

16-115 150-650 KC


3-SPEED AMPLIFIED PLAYER KIT $10.95

2 TUBE AMPLIFIER—8" SPEAKER

New 3 speed amplified record player kit only for $10.95. Features include 3 speeds, 12" x 18" x 10", with 2" speaker, all-plastic cabinet and stand. Price $10.95.

8", 10", 12" SPEAKER-BAFFLE COMBINATIONS

$29.95

495

$95

Our most popular speaker-baffle combinations. Brown leatherette cover, 1 1/2" cloth cone, all-plastic cover. 3-1/2" woofer, 1" tweeter. 5 lbs. per speaker. 10 lbs. per set. Ships on 16" wheel. Model No. 225. Price $29.95, 495, $95.

TV STANDS

$393

$495

$695

Our most popular speaker-baffle combinations. Brown leatherette cover, 1 1/2" cloth cone, all-plastic cover. 3-1/2" woofer, 1" tweeter. 5 lbs. per speaker. 10 lbs. per set. Ships on 16" wheel. Model No. 225. Price $393, 495, $695.

TELEVISION BOOSTER CLEARANCE SALE

New and used television boosters for channels 2 through 13. Models SP-5, SP-5K, SP-90, SP-90K. All have variable gain control. Complete with Power On-Off switch, 150 ohm output, and instructions. Same as SP-5 except has variable gain control. Price $4.95. Same as SP-90 except has variable gain control. Price $6.95. Same as SP-90K except has variable gain control. Price $6.95. Same as SP-90 and SP-90K except has 3-1/2" speaker. Price $6.95.

McGEE RADIO COMPANY

NEW 1955 MODEL WITH CRYSTAL MIKE $9.95

MINIATURE BROADCASTING STATION FOR THE HOME

6" SESSIONS CLOCK-TIMER

_With Plastic Cabinet $3.95

6" Sessions Clock-Timer of plastic. 3" high., 3" deep. Hands are a kitchen clock radio. Lower part of box was used for a small radio chassis. Separate hands are used. Price $3.95.

UHF CONVERTER TUNERS $2.95

3 FOR $7.50

Choose your own of these three UHF converter tuners. Includes 6060, 6072, 6099. These are the three most popular UHF frequencies used in today's television sets. Price $2.95 each, $7.50 for all three.

FAMOUS STANDARD COIL CASE CASCADE TUNERS

JG 442 $12.95

JG 442 includes 3 channel tuner with 3 channel selector switch. Price $12.95.

Two-Tube SARKES-TARZAN TV TUNER $8.95

MTA-5150 7" chassis. Three channel. Price $8.95.

Two-Tube SARKES-TARZAN TV TUNER $8.95

MTA-5150 7" chassis. Three channel. Price $8.95.

McGEE'S SPECIAL PURCHASE SALE

$29.95

8" EXTENSION SPEAKER $16.95 EXTRA

For $16.95 extra you can have our regular 8 inch extension speaker. Please note: all speakers are sold EXCEPT those that are shown with a special price. All orders are shipped by registered mail. Price $16.95.

TELEPHONE VICTOR 5092

1903 McGee St., Kansas City, Missouri

www.americanradiohistory.com
McGee's Famous

12 AND 15 INCH COAXIAL P.M.

HIGH FIDELITY SPEAKERS

Model CU-14Y

$215

Model P15-CR

$195

NEW IMPERIAL IV

with General Electric

8 IN. HIGH FIDELITY P.M.

SPEAKER

$195

9-TUBE HI-FIDELITY

12 Watts Audio

Dual Tone Controls

$39.95

RECEIVES BROADCAST 550 TO 1550 K.C.

JACKSON AMYA

19 watt h.f.-radio amplifier and broadcast tuner combined. Less than you would pay for the items alone. Perfect for family radio and group entertainment. New, of course. Alsoz delivers all picture tubes. Guaranteed for Picture Tubes. Factory direct. No 95, 125, 150, 145 cr. $9.00 extra.

JACKSON AMYA

10 W. AMP.

P.P. 6V6 AMPLIFIER

$49.95

New Hi-Fi, self-powered FM AM TUNER. Separate chassis, all new cloth covered speaker, separate control panel. All original McGee design. Built-in parallel resonance circuit. Amplifier 125 watts average. Tuner has input for crystal control with separate loud speaker. Comes complete with 2 inputs, 1 speaker, no panel. Tuner list is $9.50. 125 watt, 45-50 gig. BASS. 100 watts. $30.00, CU-14Y 120 watt, 50-60 gig. BASS. 150 watts. $35.00 extra.

9-TUBE HI-FIDELITY

P.P. 6V6 AMPLIFIER

$49.95

MCGEE RADIO COMPANY

3626 W. 119TH ST.

KANSAS CITY, MISSOURI

SALE PRICE

$24.95

2-12' Woofers

2-5' Tweeters

Power Supply and L-C Cross

OVER NETWORK

25 watt, High-Fidelity Dynamic Speaker System. Receives broadcast 550 to 1550 K.C., 2000 cycle crossover network, two 12 inch *65 watt* woofers, two 5 inch high frequency tweeters, two high frequency crossover transformers, two power supply transformers, and a separate 12 volt A.C. transformer for the tweeters. MAJOR ADJUSTMENTS! 2000 cycle crossover network. The crossover network system is simple to connect or disconnect. A new feature in many of today's high fidelity loudspeakers is the high voltage capacitance type which prevents condenser deterioration. The tweeters are specially designed to reproduce only the high frequencies of the broadcast radio. Includes 15 watt output transformer. Model CU-14Y. $215. High Fidelity Dynamic Speaker System, as described above, but text 1000 cycle crossover network and with a separate audio output. Sale price $14.95.

CONSOLIDATE HIGH FIDELITY

SPEAKER SYSTEM

$49.95

EQUIPPED WITH 3 PM SPEAKERS

12 IN. GENERAL ELECTRIC WOOFER

10 IN. MID RANGE SPEAKER

8 IN. GENERAL ELECTRIC MID-HIGH RANGE

Have your old radio tuned to your own home. Strictly High Fidelity. These speakers are connected to the 125 watts program output transformer. That is, they are not "pushed" by the output transformer. The output transformer is designed to give complete response, 25 to 180 cycles, rather than 30 to 100 cycles. With a 125 watts program output transformer, the output should be increased to 25 watts. With a 30 to 100 cycle output transformer, the output should be increased to 100 watts. The tweeters that are included with the complete system will be at least 1500 cycle, 320 watt capacity if an amplifier is used. Only two wires to be connected. Installation is very simple. Model CU-14Y. $215. High Fidelity Dynamic Speaker System, as described above, but text 1000 cycle crossover network and with a separate audio output. Sale price $14.95.

NO. 9TUBE FOR WHOLE HOUSE

FM AM TUNER

SALE PRICE

$19.99

Audio Amplifier is Required to Operate a Speaker

Model 36-1, 10 watt Cramer FM/AM Tuner, Requires broadcast 550 to 1650 K.C. FM 88 to 108 M.C. With Tuner: 3-624G, 6R2G, 12AT7 and 6T8. Power this tuner from your radio output transformer or TV set and 12V 10 amp. power supply. Power output 10 watts. Your FM or AM radio needs this Tuner. Tuner is not your ordinary tuner. 125 watt, 45-500 gig. BASS. 150 watts. $30.00, CU-14Y 120 watt, 50-600 gig. BASS. 150 watts. $35.00 extra. "Built-in Magic Seles." No. 981323. 6 tube radio or amplifier, $29.95. "Built-in Magic Seles." No. 981323. 6 tube radio, $29.95. With 12 volt A.C. transformer, $39.95.

CROSLEY FM-AM TUNER

SALE PRICE

$19.99

TROUBLE SHOOTER'S REMEDIES

NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

$195

NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

$195

NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

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NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

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NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

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NEW IMPERIAL IV

8 IN. HIGH FIDELITY P.M.

SPEAKER

$195
America's TOP Tuner!

THE FISHER FM TUNER
MODEL FM-80
World's Best by LAB Standards

For almost two decades we have been producing audio equipment of outstanding quality for the connoisseur and professional user. In the cavalcade of FISHER products, some have proven to be years ahead of the industry. THE FISHER FM-80 is just such a product. Equipped with two meters, it will outperform any existing FM Tuner regardless of price! The FM-80 combines extreme sensitivity, flexibility and micro-accurate tuning. Despite its full complement of tubes and components, the FM-80 features an unusually compact chassis of fine design. Chassis Only, $139.50 Mahogany or Blonde Cabinet, $149.50

Outstanding Features of THE FISHER FM-80
- Two meters: one to indicate sensitivity, one to indicate center-of-channel for micro-accurate tuning. - Armstrong system, with two IF stages, dual limiters and a cascode RF stage. - Full limiting even on signals as weak as one microvolt. - Dual antenna inputs: 72 ohms and 300 ohms balanced (exclusive!). - Sensitivity: 1½ microvolts for 20 db of quieting on 72-ohm input; 3 microvolts for 20 db of quieting on 300-ohm input.

CHASSIS SIZE: 12½" wide, 4" high, 8½" deep including control knobs.

Price Slightly Higher West of the Rockies

WRITE TODAY FOR COMPLETE SPECIFICATIONS
FISHER RADIO CORP. · 21-23 44th DRIVE · L. I. CITY 1, N. Y.

Recording Wildlife (Continued from page 31)

standard 115 volts at 60 cycles. One problem is the fluctuating voltage which sometimes drops as low as 100 volts as the batteries discharge.

One answer to the problem was found when the car's generator was replaced by a Leese-Neville alternator and associated equipment. Heavy double-pole, double-throw switches connect the batteries in series for recording and in parallel for charging.

This system furnishes 25-55 amps at motor idling speeds and reaches full output at a motor speed equivalent to 12 mph. Under these conditions, the batteries will operate the recorder for four hours at full efficiency and recharge in less time that was needed to discharge them. Normal car operation keeps them fully charged.

Experience has shown that although it is possible to use the dynamic mike over 500 feet away from the recorder in the car, he prefers to use a small, battery-operated preamp when distances over 100 feet are involved. This unit has three stages. The first two stages amplify the microphone signal and provide an output impedance of 500 ohms. The third stage is bridged across the 500 ohm output and serves as a monitor amplifier for the continuous monitoring of the signal being recorded. The unit also provides an amplified version of what the microphone is gathering to enable the operator to "aim" the parabolic reflector more accurately. In addition, it is possible to monitor the signal put on the line back to the car and thus two-way communication can be maintained. With this preamplification setup, Dr. Kellogg has been able to record over an open-wire line a mile long.

When Dr. Kellogg starts "stalking" his prey, he carries 25 pounds of equipment and drags shielded cable from the 500-foot reel. For greater distances, he uses Army-type assault cable.

Recently Dr. Kellogg has been using his portable recorder which eliminates the necessity for using the cable back to the car. His "load" then becomes 17 pounds for the recorder, 13 pounds for the parabolic reflector and its microphone, and 8 pounds for the parabola's tripod.

His portable recorder measures only 11" x 10" x 7" and records at 15 ips. With frequency response of 50 to 15,000 cps, this recorder just about covers all of the primary tones and the harmonics that the human ear is capable of perceiving.

His unit will operate at any angle. Its mechanical "heart" is a spring-wound flyball-governor-controlled motor. The small flashlight-type batteries are rated at 100 hours. An improved version, due shortly, incorporates a second amplifier and head for monitoring and playback.

Back in the lab, Dr. Kellogg uses two Ampex 300 recorders for the re-
The "Testuner"
(Continued from page 59)

ing the a.g.c. to ground at a point where it entered the tuner. The hum disappeared! This solved the problem of why the hum was present with the regular tuner, but not with the "testuner." The "testuner" uses a fixed bias that it obtains from its own power supply; it does not get a.g.c. from the set. However, the receiver was still not working properly.

Since it had been established that with the a.g.c. grounded at the input to the tuner the hum disappeared, the source of trouble looked like the a.g.c. amplifier. So, the a.g.c. amplifier tube was changed, but the hum still persisted. Next, the tube socket was examined for a possible short. Sure enough, pin 3 had shorted to pin 7 at the terminals, thus tying the heater to the cathode and introducing the hum into the a.g.c. system. Since the a.g.c. voltage is fed to the grid of the r.f. amplifier, it was modulating the incoming signal, and affecting the picture.

While the "testuner" mentioned and described in this article consists of a v.h.f. tuner and power supply, it is possible to use a combination u.h.f. and v.h.f. tuner in such a test setup.

It is hoped that the reader will be able to use such a device as the "testuner" to his advantage in servicing both u.h.f. and v.h.f. sets. The number of conditions presented here falls far short of those that can be solved by the use of this gadget. However, as with other test equipment, the more it is used by the service technician, the greater utility he will find for it. —[80]

MILWAUKEE HAM CLUB

The Milwaukee Radio Amateurs' Club, Inc., has named Emil R. Felber, W9RH, president for the 1955-56 season with Kenneth Eggert, W9MOT and Raymond T. Peschen, W9JLU as first and second vice-presidents respectively.

Vernon L. Fahishak, W9IDH is the new secretary while Charles C. Dawson, W9CUW will serve as treasurer.

Directors are Fred Zolin, W9NY; E. Belanger, W9MDG; Frank Seboth, W9NL; Douglas Pavek, W9FDK; Ed. Buchholz, W9VBY; Dr. J. J. Waldman, W9RXS; and W. E. Herzog, W9LXK.

August, 1955

www.americanradiohistory.com
What's New in Radio

I.F. FILTER ADAPTER
A simple mechanical i.f. filter adapter which fits snugly between two i.f. cans in the "Super Pro-600" communications receiver is now available from Hammerlund Manufacturing Co., Inc., 460 W. 34th St., New York 1, N. Y.

This sealed unit consists of an input transducer, a resonant mechanical section comprised of a number of metal discs, an output transducer on which is mounted the replaced i.f. tube, and an amplifying tube.

The unit, which is available for bandwidths of .8, 1.2, 3.1, and 6 kc. at 6 db down, can be completely installed in a matter of seconds by simply pulling an i.f. tube and replacing it with the permanently tuned mechanical filter adapter.

SATELLITE TV EQUIPMENT
Adler Communications Laboratories, 1 Le Fevre Lane, New Rochelle, N. Y., is now offering a line of low-power transmitting equipment which provides practical television service for isolated communities of 50,000 population or less.

Three basic systems are available. The Type A system is an on-channel satellite/booster, employing direct amplification and re-radiation of the original signal on the same channel. Type B system is an off-channel satellite/booster with a crystal-controlled translator which shifts the original signal without demodulation to a new channel. Type C system is a complete low-power television broadcasting system which can be programmed locally, off-the-air and/or via a network signal.

Further details, descriptions, and illustrations of this equipment may be secured by writing for the new bulletin entitled "Low Power Television Broadcasting Systems."

PHENOLIC COIL FORM
Cambridge Thermionic Corporation, 445 Concord Ave., Cambridge 38, Mass., is offering a new phenolic coil form designed especially for printed circuitry.

Available in two diameters with four terminals each, the Type SPC is designed to be dip soldered after mounting. This feature is available as a form alone or wound to the required specifications of the user. The unit comes complete with a threaded slug. The terminal collar is securely fastened to the form.

The unit mounts through four holes, as required by the number of terminals. When mounted, the smaller unit is ⅜" high by 219" diameter and the larger unit is ¾" x .285" diameter.

Further specifications, application information, and prices are available from the company on request.

INDOOR TV ANTENNA
All Channel Antenna Corporation, 47-39 49th St., Woodside 77, N. Y., has just put a new type, patented indoor television antenna on the market. Tradenamed the "Rembrandt," the antenna operates on a unique electronic principle. It selectively directs circularly polarized, electromagnetic radar loops and inductively couples them to bi-metallic resonant dipoles.

The antenna utilizes a nine-position, low-loss electronic orientation switch. It is currently available in three finishes: gold, ebony and gold, and mottled mahogany.

BEAM POWER TETRODE
Bitel-McCullough, Inc., of San Bruno, Calif., has announced development of the 4X5000A, its first ceramic radial-beam power tetrode.

The new tube is constructed entirely of ceramic and metal, thereby offering greater electron-tube reliability and increased immunity to damage from thermal and physical shock.

With a plate dissipation rating of 5000 watts and a power output of 16 kw. in class C telegraphy service through 30 mc., the new tube fills a power gap in the tetrode field. Especially suitable for single-sideband operation, the new tetrode delivers 10 kw. output in class AB service and handles high inputs without going into the positive grid region.

The simple coaxial structure allows low lead inductance and an integral finned anode permits improved cooling with low air pressure. For further information on the Eimac 4X5000A, write the company's Technical Services Department.

RESISTANCE SOLDERER
Vermalone Products Company, P. O. Box 222, Hawthorne, N. J., is now offering a new resistance-type soldering unit which has been especially de-
The GENERAL has a closely spaced screen (7 inches) to minimize pick up off the rear. With more and more stations coming on the air, on the same channel, this is a major problem of today and tomorrow.

The GENERAL is completely pre-assembled. By simply tightening three wing nuts, the antenna is ready to mount.

The GENERAL is light in weight with low wind resistance. Not only easy to put up, but easy to KEEP up.

The GENERAL is packed in a small carton. This makes the antenna more economical to ship, store, and handle.

The GENERAL sells for less than comparable products. This gives YOU a better mark up and faster moving merchandise.

Some Exclusive Territories Available To Aggressive Jobbers.

The GENERAL is low enough in price to use in the most competitive market and is recommended for all locations.

The GENERAL combines 6½ dipoles in a phased collinear array for super gain on channels 7 to 13 and features an interpolated dipole arrangement on channels 2 through 6 for a small physical size, high gain array on these channels. The GENERAL has peak gains of over 15 D.B. and is recommended for use in the most difficult reception areas.

LIST PRICE 24.95

World's Finest TV Antennas and Towers

WAYCO, Inc., manufactures a complete line of antennas and towers, priced from $1.98 list, up. Write for free literature.

SUPER FRINGE MASTER. Unconditionally guaranteed to out-perform all other UHF antennas or your money refunded. Available in 16 or 32 element arrays. Completely assembled or knocked down.

WAYCO, Inc.
WAYNESBORO
TENNESSEE

P. O. Box 115
Phone 7-2981

August, 1955
Superior's New Model 670-A

SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/760/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/10,000 Ohms 0 to 10 Megohms
CAPACITY: 200 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: 15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to —18 +14 to +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged, craddle-finished steel cabinet complete with test leads and operating instructions.

$28.40 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.
✓ R.F. Signal Generator for F.M.
✓ Audio Frequency Generator
✓ Marker Generator

R.F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Megacycles to 60 Megacycles on fundamental, from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 500 cycle sine-wave audio, the Model TV-50 Genometer provides variable 500 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50 produces an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-151 3849 Tenth Ave, New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Model 670-A $7.40 within 10 days — $1.00 monthly for 6 months. Total Price $42.40

Model TV-50 $11.50 within 10 days. Balance $6.90 monthly for 6 months. Total Price $47.50

Name __________________________ Address __________________________
City __________________________ State __________________________

✓ Model 670-A
✓ Model TV-50

RADIO & TELEVISION NEWS

www.americanradiohistory.com
Superior's new Model TV-11

TUBE TESTER

SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyatron, Miniatures, Sub-Miniatures, Novals, Sub-miniars. Proximity fuse types, etc.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having taped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

SUPERIOR'S NEW MODEL TV-40

C. R. T. TUBE TESTER

A complete picture tube tester for little more than the price of a "make-shift" adapter!!

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test such tubes; that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

EASY TO USE:
Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (fan trap need not be on tube). Throw switch up for quality test read direct on Good-Bad scale. Throw switch down for all leakage tests.

Tests all magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

SPECIFICATIONS:
• Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
• Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
• Tests for inter-element shorts and leakages up to 5 megohms.
• Tests for open elements.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-151 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance, interest, or any other charges provided I send my monthly payments when due. If further understood that should I fail to make payment when due the full unpaid balance shall become immediately due and payable.

Model TV-11
Total Price $47.50
$11.50 within 10 days. Balance $6.00 monthly for 6 months.

Model TV-40
Total Price $15.85
$1.85 within 10 days. Balance $4.00 monthly for 3 months.

August, 1955

SHIPPED ON APPROVAL
NO MONEY WITH ORDER—NO C. O. D.
**NEW MULTIPHASE**

**“Rejuva-Tube”**

**CRT REJUVENATOR**

**brings “dim-outs” back to life**

A SENSATIONAL MONEY MAKER

COMPLETE KIT $4950

Factory Wired $5950

Fully 80% to 90% of tubes that have gone dim in service can be reactivated to furnish up to years of “bright as new” service.

**GOODBYE “Rejuva-Tube”**

“Rejuva-Tube” isn’t just a gadget to give picture tubes a temporary shot in the arm — even most tubes that have gone “flat” using a booster can be rejuvenated.

**PORTABLE**

It’s compact, light weight and easy to use. Check and rejuvenate picture tubes right in the set in a few minutes.

**DEALERS!**

Now you can sell those “dim-out” trade-ins at a good profit.

**SERVICEMEN!**

Sell rejuvenation service — it’s a real money maker. Test and quickly rejuvenate picture tubes in the customer’s home. An inexpensive instrument that protects your profit on service contracts.

**PROVEN - TIME TESTED!**

Tubes rejuvenated experimentally over three years ago are still showing good pictures.

*Comparing These Features*

Welds Open Elements

**TESTS — REPAIRS**

TV Picture Tubes

Without Removing Tube From Set

- Restores cathode emission and brightness.
- No guesswork — only device that meters cathode activity during rejuvenation. Tells you when to stop rejuvenation to prevent damage to cathode emitting surface. Built-in current limiter prevents accidental cathode ribbon burn-outs!
- Complete tester — detects open or shorted elements and leakage as high as 3 meghoms between elements. High quality lab instrument style construction.
- Has special metered circuit to remove “particle” shorts between heater and cathode.
- Checks cathode emission and grid cut-off characteristics.
- Predicts approximate life expectancy of tube — identifies gassy tubes.

*PATENT PENDING*

Condensed Instructions

Printed Inside Case Lid

WRITE FOR MANUAL ON REJUVENATION WITH THE

“REJUVENATION TUBE”

**Within the Industry**

(Continued from page 24)

community TV operators... CHEM-ETCHED CIRCUITS INC. has been formed at 121 S. Cowen St., Garrett, Indiana to design, develop, and manufacture etched circuits by the photogravure method. SOUTHCO DIVISION of SOUTH CHESTER CORPORATION, Lester, Pa. has purchased the working assets of LION FASTENER, INC. which will continue as a wholly-owned subsidiary with headquarters in Honeye Falls, N.Y. ZIM PRODUCTS, manufacturer of record brushes, has been purchased by PERMO, INC. of Chicago which will add this line to its present Fidelitone and Permo record brush line. TEXAS INSTRUMENTS INCORPORATED, Dallas has purchased the business and assets of RARELL CORPORATION of Indianapolis. Operations of the precision resistor firm will be transferred to Dallas in the near future... FAIRCHILD CAMERA AND INSTRUMENT CORPORATION has acquired all the voting stock of FREEZED ELECTRONICS AND CONTROL CORPORATION of New York, which will be operated as a subsidiary, maintaining its separate corporate identity. All divisions of Hycor Company, Inc. have now become subsidiaries of INTERNATIONAL RESISTANCE COMPANY of Philadelphia. CORNELL-DUBILIER ELECTRIC CORPORATION has formed a Printed Wiring Division at South Plainfield, N.J. which will be devoted exclusively to the design, development, and manufacture of printed circuitry. The Board of Directors of both Stromberg-Carlson Company and General Dynamics Corporation have approved a merger which will result in the continuance of the Stromberg-Carlson identity within the division framework of the parent company... HENRY HINZ ASSOCIATES, a firm of design engineering consultants, has been formed by Henry Hinz, former chief mechanical engineer for CBS-COLUMBIA. Headquarters have been established at 1888 Grant Avenue, East Meadow, Long Island, N.Y.

ARTHUR L. MILK has been elected a vice-president of Synthina Electric Products Inc. He was formerly the company's director of government relations, a post he will continue to handle. Audio & Video Products Corp. has announced the election of R. E. HADADY to the post of vice-president in charge of field engineering and JAMES U. LEMKE as vice-president and chief engineer of its Audio Corporation. California... WALTER W. SLOCOM has been named assistant to the president of Daystrom, Inc. His activities will include research of new products and fields of expansion as well as special assignments relating to the operations subsidiary companies... ALBERT BENJAMINSON is the new chief engineer of Granco Products Inc. ... Airborne Instruments Laboratories, Inc. has promoted LAWRENCE J. TORN to the post of chief elec-
WHAT'S YOUR SERVICE PROBLEM?

FM Radios • Amplifiers and Tuners • Auto Radios • Record Changers

Photofact helps you solve it
Faster, easier, better, more profitably!

The world's finest service data

Photofact Service Data is the only service information based upon first-hand examination of the actual production-run receivers and equipment. It is authentic, uniform data developed through actual study and analysis by service engineers in the Howard W. Sams Laboratories. Photofact is the only data prepared from the practical point of view of the Service Technician.

Thousands of Service Technicians use Photofact daily for time-saving, profit-boosting service operations. If you've never used Photofact, you've never realized your full earning power—you've never given such complete customer satisfaction. So get the proof for yourself. Try Photofact—use it on any job. Your Parts Distributor has the Folder Sets you need for any of the 17,000 TV and radio receivers, changers, recorders, etc., covered in Photofact. Once you use this great service, we know you'll want the complete Photofact Library.

Only $25 Down

Puts a Photofact Service Data Library in Your Shop. Ask Your Photofact Distributor—He Has the Full Easy-Pay Details.

Free Photofact cumulative index

Send for it! Your guide to virtually any model ever to come into your shop; helps you locate the proper Photofact Folder you need to solve any service problem on any model. Once you have the make and chassis number, it takes just 60 seconds to find the applicable Photofact Folder. Send coupon now for your free copy of the valuable Cumulative Index to all Photofact Folders.

Howard W. Sams & Co., Inc.
2201 E. 46th St., Indianapolis 5, Ind.

Name
Address
City... Zone... State...

August, 1955

These great features are exclusive in Photofact—they help you earn more daily, help insure customer satisfaction

Full schematic coverage
1. Famous "Standard Notation" uniform symbols are used in every schematic.
2. The same standard, uniform layout is used for each schematic.
3. Diagrams are clear, large, easy to read, easy to handle.
4. Wave forms are shown right on the TV schematics for quick analysis by scope.
5. Values appear on the schematics for speedy voltage analysis.
6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

Full photographic coverage
9. Exclusive photo coverage of all chassis views is provided for each receiver.
10. All parts are numbered and keyed to the schematic and parts lists.
11. Photo coverage provides quicker parts identification and location.

Alignment instructions
12. Complete, detailed alignment data is standard and uniformly presented in all Folders.
13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

Tube placement charts
14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement charts.
16. Tube charts include fuse location for quick service reference.

Tube failure check charts
17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.
18. Series filament strings are schematically presented for quick reference.

Complete parts lists
19. A complete and detailed parts list is given for each receiver.
20. Proper replacement parts are listed, together with installation notes where required.
21. All parts are keyed to the photos and schematics for quick reference.

Field service notes
22. Each Folder includes time-saving tips for servicing in the customer's home.
23. Valuable hints are given for quick access to pertinent adjustments.
24. Tips on safety glass removal and cleaning.

Trouble-shooting aids
25. Includes advice for localizing commonly recurring troubles.
26. Gives useful description of any new or unusual circuits employed in the receiver.
27. Includes hints and advice for each specific chassis.

Outstanding general features
28. Each and every Photofact Folder, regardless of receiver manufacturer, is presented in a standard, uniform layout.
29. Photofact is a current service—you don't have to wait a year or longer for the data you need. Photofact keeps right up with receiver production.
30. Photofact gives you complete coverage on TV, Radio, Amplifiers, Tuners, Phonos, Changers.
31. Photofact maintains an inquiry service bureau for the benefit of its customers.

Helps you earn more daily
A NEW PRODUCT
by the makers "No Noise"
TUNER-TONIC

No Noise Volume Control and Contact Restorer
with PERMA-FILM

Cleans, lubricates, restores all tuners including wafer type. Won't change or affect capacities, inductance or resonance, nor harm insulations or precious metals, nor attack plastics. For television, radio and phono. Eliminates all noise, oxidation and dirt indefinitely.

Non-toxic, non-inflammable, incurs trouble-free performance.

Net to service men $2.25
2 oz. Bottle Net $1.00

Also available in 8 oz. bottles and quart cans.
Nearest distributor or write direct today.

$3.25

SNOOPER GEIGER COUNTER

Supersensitive! Only 1/2 lb. fits pocket, uses flashlight battery. Find a fortune in your area. Order now! Send $5.00, balance.

C.O.D. MONEY BACK GUARANTEED. FREE CATALOG—electrolier and longwave band-wlre enthusiasts. DEALERS WANTED.

PRECISION RADIATION INSTRUMENTS
4223 82nd St., Los Angeles 16, Calif.

RADIO and TELEVISION ELECTRONICS
in all Technical Phases
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If the letters received by this magazine are any criterion, every third person in the United States is interested in uranium prospecting—or perhaps professionally or as an added filling weekend outing or annual vacation.

To this fraternity we can now say—here is your book! Before its appearance the serious "hunter" had to assemble and digest material from widely scattered and often too-accessible sources. The author has performed a real service by collating the available material and presenting it in a thoroughly usable and highly readable form.

The text is divided into ten chapters and five appendices and covers atomic structure, atomic radiation and its effects, radiation detection devices, commercial Geiger counters, scintillation counters, home-built counters, dosimeters, the applications of nuclear science, Civil Defense, and prospecting. The appendices list manufacturers' directories, a product directory, a listing of standard abbreviations, definitions of terms, and an extensive bibliography.

The readers of this magazine are familiar with the author's lucid style evidenced by the articles he has prepared for this magazine. This same attribute characterizes the text material in his book. Those with a background of high school physics or elementary electronics will experience difficulty in comprehending the subject matter.

The build-it-yourself fans will find several tested circuits from which to choose the instrument for their expeditions.


The third volume in the publisher's "Tell-A-Fault" series covers impedance-coupled video i.f. amplifiers, transformer-coupled video i.f. amplifiers, single-stage video amplifiers, and two-stage video amplifiers.

By means of actual scope traces the authors have presented a means of identifying most of the common faults that occur in video i.f. and video amplifier circuits. Once the technique of locating and identifying circuit faults by means of scope traces is mastered, the technician can simplify and expedite his job, thus enabling him to handle a larger service volume per day. Those who have used the earlier volumes of this series will welcome the

**FAIR RADIO SALES**

132 SOUTH MAIN ST.
LIMA, OHIO

August, 1955
addition of the present book as covering
other important receiver circuitry.
Newcomers to this method should find
the material helpful.

"TV FIELD SERVICE MANUAL WITH
TUBE LOCATIONS" edited by Harold
Alsbeg. Published by John F. Rider
Publisher, Inc., New York. 132 pages.

This particular volume in the cur-
rent series covers "General Electric,
Hallicrafters, and Hoffman television
receivers produced during the years
1947-1953. Like the preceding volumes,
this book is intended merely as an ad-
junct to in-the-home service techniques.
It carries tube location guides on each
set, details on the picture tube adjust-
ments, front and rear control locations,
and drive cord assemblies when such
are used.

The possible service faults and symp-
toms for each set are listed in tabular
form with reference to the appropriate
service procedure for that particular
receiver or to the master listing of
troubleshooting procedures.
The book itself is pocket sized and
spiral bound to open flat for easy use.
The outside technician whose work
consists mainly of home repair calls
will find this new volume invaluable.

THE NEW HIGH FIDELITY HAND-
BOOK" by Irving Greene & James R.
Radcliffe. Published by Crown Publish-
ers, Inc., New York, 185 pages. Price
$4.95.

The lay audiophile who has been
staggered by the complexity and tech-
nical level of most texts on the sub-
ject will welcome the appearance of
this authoritative yet easy-to-read
treatise.

There are no prerequisites to an un-
derstanding and enjoyment of this
book. Mathematical treatment has
been eliminated in favor of ex-
planatory text material. The book
itself is divided into fifteen chapters,
each a hard-hitting exposition of some
phase of the subject. One of the most
encouraging things to the lay reader
is the authors' realism regarding hi-fi
systems. While they set high standards
for the assembling of the components
of the ideal hi-fi system they are realis-
tic enough to appreciate the fact that
not all music lovers have unlimited
funds to expend on nothing but playing
their records. To this end both moder-
ately-priced and high-priced units are
analyzed and described.

The budget-minded music lover will
also appreciate the large and detailed
section covering the construction of
speaker enclosures and the techniques
required to assemble such cabinets.
Troubleshooting, servicing, and main-
tenance procedures for the owner are
also covered in some detail, along
with information for building simple
test equipment with which to make the
requisite checks.

One especially valuable feature of
the book is a buyers' guide covering
manufacturers and distributors of hi-fi
equipment of all types.

This book meets the real need ex-
pressed by that large segment of the
audio "fraternity" that enjoys its
music but does not have a string of
impressive engineering degrees to back
up its interest.

"TELEVISION SIMPLIFIED" by Milton
S. Kiver. Published by D. Van Nostrand

When any technical publication runs
into a fifth edition it is pretty strong
endorsement since publishers are rarely
in business for their health! The con-
tinuing popularity of Mr. Kiver's basic
text is fully justified.
The presentation of his subject is crys-
tal clear, simple, and complete.

Written at the senior high-junior col-
lege level, this text is suitable either as
a textbook or as a home-study volume.
The material has been divided into sec-
tions that roughly correspond to a sin-
gle classroom lesson so that the entire
subject can be handled during a ten-
week period. For the student studying
on his own there are review questions
and problems accompanying each chap-
ter. Mathematical treatment of the
subject matter has been resorted to
only when absolutely necessary and, in
those cases, the processes are ex-
plained and described.

Twelve appendices are included to
oviate the necessity of additional ref-
ence books. These appendices cover
such subjects as color codes; wire
sine, cosine, and tangent tables;
electronic abbreviations and symbols;
the Greek alphabet, etc.

For the beginning student this is a
well rounded work that should find
an enthusiastic acceptance.
with the Tinnerman Products Corporation. It does not require special sockets for mounting, requiring only two round holes to be snapped into place. In addition, solderless connectors are available for making electrical contact to the rectifier.

PHOTOCONDUCTIVE CELL
Canadian Marconi Company, 2442 Trenton Ave., Montreal 16, P. Q., Canada, has announced the availability of a new photoconductive cell capable of handling power up to .3 watt.

The new design eliminates the electronic amplifier, the vacuum photocell, and the d.c. power supply. It is designed to operate relays and other devices on voltages from 110 volts to 1.5 volts a.c. or d.c. with incident light values from daylight (1000 footcandles) to moonlight (.020 footcandle). The sensitivity is .4 ampere-per-lumen.

Write Mr. F. Hasell of the company for further information.

"SERVI-SPOT" LIGHT
General Electric Company’s Tube Department is offering a new aid to radio and television technicians in the form of a “Servi-Spot” light that plugs into the dashboard cigarette lighter. Available from the company’s tube distributors, the new light throws a powerful beam a quarter of a mile and is invaluable in night emergency calls where outdoor antenna and lead-in work is required. The lamp can also be used to spot house numbers and for other purposes.

A twelve-foot cord permits use of the lamp around any part of the service vehicle. When not in use, the cord is wound around the lamp reflector case and the plug snaps into a space provided on the handle. The light draws only .5 amp. from the car battery.

COLOR CONVERTER
Color Converter, Inc. of Columbia City, Indiana is now offering a relatively inexpensive unit which may be added to any present black-and-white television receiver to provide reception of color telecasts.

Known as the “Col-R-Tel,” the new unit causes the monochrome picture to be resized and converted to a fine-textured 14” color picture when color programs are being transmitted. One of the two parts of this system is a small electronic chassis which is per-

August, 1955

What’s New in Radio
(Continued from page 78)
SENSATIONAL CHANGER SALE
Repeated by Popular Request
Our Lowest Prices Ever...

WEBSTER (NEWEST MODEL): Automatic shut off. Hi-f ceramic cartridge with dual sapphire stylus. Heavy duty 2 pole motor. Plays 7-10-12" records. Reg. $54.50 $237

VM TRIOMATIC: 3 speed intermix with dual sapphire stylus. Reg. $44.50 $227

WEBSTER 1121: 3 speed hi-fi changer with Ge. Reluctance RXF-650 cartridge. Heavy duty 4 pole motor. Automatic shutoff. Reg. $84.00 $277


with plug-in head. Reg. $50.00

630 FA4. For 21" TV tubes. Fringe area 12" RCA speaker included...

21" Sylvania Aluminized Picture Tube...

Send for catalog sheets on 630 FA4 and 630-9 chassis.

RECORD CHANGER BASES & BOARDS

Bases-$5.49 Mounting Boards-$1.97

WEBSTER, COLUMBIA, Gramophone, RCA Victor, Beam. Sent Upon Request.

All merchandise is brand new, factory fresh & guaranteed. Mail & phone orders filed on receipt of certified check with deposit. Balance C.O.D., P.O.B. Factory N. Y. Prices & specifications subject to change without notice.

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Type Writer. After the alphabet and most common phonetic combinations are learned, learn the few combinations of sounds most commonly of interest to the home operator or advanced student. Variable speed and to make learning and mastery possible without further assistance. Thousands of successful operators have made previous operators, written and have written for convenient rental and purchase plans.

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JEWEL-3 Way portable. 5 tube...

JEWEL-5 tube Super Het—Red, Ivory, Walnut and Ebony...

RECORD PLAYERS

Manual 3 speed record player single...

Manual 3 speed with flip-over cartridge...

Automatic 3 speed with VM changer...

PENTRON TAPE RECORDERS

Model 648...

Model 76...

Model 902...

Model 760 (catalogue on request)


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RADIO & TELEVISION NEWS

www.americanradiohistory.com
vertical amplifier has a voltage-calibrated, frequency-compensated 3-to-1 step attenuator. Other features include built-in calibration for peak-to-peak voltage measurements; vertical polarity reversal switch for "upright" or "inverted" trace display; sturdy one-piece probe with built-in switch for low capacitance or "direct" operation; pre-set "vertical" and "horizontal" sweep positions for TV troubleshooting, etc.

**JFD "ZIP" ANTENNAS**

JFD Manufacturing Co., Inc., 6101 16th Avenue, Brooklyn 4, New York, has unveiled a new line of twelve "Zip-assembled" deluxe conical antennas.

The new antennas' dipole-heads "zip" the pre-assembled dipole elements into place and lock them there. Absolutely no tools are required. Unbroken electrical continuity from the dipole element through the dipole head to the lead-in insures the maximum transfer of energy.

With this new line there is no "friction" contact between the feed points and no accumulation of dust or moist-

capacitor--resistor analyzer

**TELECAP® tubulars**

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CR "PIN CUSHION"

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N.Y., has designed a new protective cap which fits over the base pins of a TV picture tube and reduces accidental damage to base pins on such tubes.

The "Pin Cushion" is now being used exclusively on the firm's picture tubes. The device is made of plastic, is lightweight, durable, easy to handle, and fits snugly on the picture tube base. The cap prevents bent or broken pins as the base pins are kept in perfect alignment, especially during shipment. In addition, the cap keeps the pins clean, thus assuring maximum electrical contact. It also facilitates installing the ion trap magnet over the tube base.

**IRE SUMMER SEMINAR**

The Emporium Section of the Institute of Radio Engineers is again sponsoring its annual summer seminar on August 26, 27, and 28 in Emporium, Pa.

Further information on this session is available from Paul M. Bogart, chairman of the publicity committee for the Emporium Section.
Wireless Record Player  
(Continued from page 40)

of the wood tone arm. The writer used round-head wood screws about 3/8" long. A curved groove was filed in the nose of the arm to accommodate the ring of the cartridge. Note the two-way lug, as shown on copper, and screw-fastened to the right-hand side of the arm. This lug serves as the junction for the needle lead, and the lead running back along the side of the arm. The pickup's plate lead is soldered directly to the end of the mounting bracket.

The photograph of Fig. 13 is a view of the right-hand side of the pickup, showing the #38 gauge wire lead from the needle to the two-way lug, and the #28 gauge lead running from the lug back along the side of the arm. The latter is cemented in a groove serbed along the side of the arm near the top, as shown.

The two 2-way soldering lugs, cut from sheet copper, and screw-fastened to the side of the wood arm near the swivel's U-bracket, are shown in Fig. 5. These two lugs serve as junctions for the leads from the cartridge, and the flexible leads running up to the small radio's oscillator. Figure 10 shows how the brass L-bracket is mounted in the back of the cabinet by means of two 9/16" diameter bolts 1 1/4" long. The swivel mounts in the large hole in the L-bracket and is secured by means of a hexagon nut to fit the threaded shank of the swivel, as shown. The swivel's U-bracket is placed to provide the best tracking-angle for the pickup on the record, and the counterweight is placed to give a needle pressure of 5 or 6 grams.

Mounting the Radio

Fig. 10 also shows how two 6 3/4" by 3 1/4" chrome-plated shelf brackets are mounted on the back of the cabinet by means of 9/16" bolts 1 1/4" long. These brackets, sold in hardware stores, hold the radio about 3 1/2" above the top of the record player cabinet, or about 1 1/4" above the top of the wood tone arm, resulting in short leads from the arm to the radio's oscillator. The two metal strips, seen on the tops of the brackets, were bent by the writer to fit the bottom of the radio, and the strips were spot-welded to the brackets, as shown. Obtain a length of steel band 3/8" thick, and 5/8" or 3/4" wide, bend to fit the bottom of the radio you use, and then either solder or rivet the brackets to the shelf brackets. The location of the shelf brackets on the back will depend on the length of the small table radio you use.

The flexible leads from the pickup plug into the phone tip jacks mounted on the bottom of the radio. These tip-jacks connect to the tuned circuit of the oscillator in the small radio, as shown in Fig. 1. Use small gauge flexible stranded copper wire for the two leads from the pickup to the radio, and keep the leads as short as possible without interfering with the free movement of the tone arm. The tip-jacks mount in "U" shaped holes drilled in the bottom of the radio's cabinet, and when you want to take the chassis out of the cabinet it is only necessary to remove the two outside nuts from the tip-jacks and pull the jacks out of the holes from the inside.

Make the lead from the tip-jack to the oscillator's grid as short as possible. If an a.c.-d.c. table radio is used as the oscillator for this record player, it's wise to isolate the pickup from the radio's chassis to do away with possible shock hazard. Use two .01 mfd. tubular capacitors connected in series across the grid and plate leads as shown in Fig. 1A. Mount the capacitors inside the radio, connecting them to the tip-jacks and the oscillator.

The photograph of Fig. 18 shows the front-end of a typical a.c.-d.c. superheterodyne table radio. The pencil points to the stator lug on the oscillator section of the capacitor gang, which is the grid side of the oscillator to which the needle of the capacitance pickup is connected. Easily spot the oscillator section as it has the smallest rotor plates, or the least number of plates. Also, the stator plates of the oscillator section are the most sensitive to the touch of the finger, which is another way of checking.

Operating Hints

The small radio used as the oscillator should be placed as close as possible to the receiving radio. Reverse the line cord of either or both radios if the a.c. hum is bothersome. Operate the receiving radio on a quiet spot on the high-frequency end of the broadcast band. The frequency-modulated signal from the record player should be tuned-in for best quality, this will be a little to one side of resonance. If your receiving radio uses a "magic-eye" tuning meter, switch it! Switching the receiving radio's tone control to "treble" as the capacitance pickup will give plenty of bass! Too wide a spacing between the needle and the plate will result in a weak signal. On the other hand, if the air-gap is too small, you may have some trouble holding the signal with badly warped records or records with off-center spindle holes. Experiment for best results. Pushing the needle farther into the rubber plug results in less compliance and slightly reduced "hiss"; on the other hand, if the needle is too far out of the rubber plug the needle will be too compliant and will have too little damping. With some phono motors, you may hear a "scratching" noise with each revolution of the turntable resulting from metal-to-metal friction of the turntable shaft in its socket, picked up by the phono pickup and radiated by the oscillator. The writer killed this noise at the source by turning out a duplicate of the turntable shaft from fiber or plastic, using a metal-to-metal lathe.
mixed and rectified resistor in series. The two signals are then fed in parallel across a common 1000 ohm resistor (Rm). The signals are then mixed and rectified by the 1N34 crystal diode. The three higher frequency components are bypassed to ground by capacitor Cm. The lower frequency audio component is unaffected by Cm and is fed through coupling capacitor Cc to the grid of an ordinary two-stage amplifier utilizing a 12AT7. The gain of the amplifier, i.e., the loudness of the beat note, is controlled by potentiometer Rm. The output of the amplifier is fed into a pair of high-impedance phones plugged into Jack J1.

Using the frequency measurement adapter is quite simple, but there are a few precautions which must be observed to get accurate results. Since the audio signal is a product of the two signals fed into the device, the strength of these two signals will determine the volume of the audio beat note. If either one is weak then it will follow that only a weak beat note can be heard. Thus when using the adapter turn the amplitude control on the signal generator to maximum output.

Similarly, if the unknown signal is coupled very loosely, the beat note heard in the phones will be very weak. The actual physical placement of the pickup loop in relation to the unknown frequency source depends largely on the source. For example, if the source is the oscillator of a broadcast set, the loop can be placed within an inch or so of the oscillator coil. On the other hand, if the unknown source is a transmitter, the loop can probably be placed three feet away and still get enough coupling into the adapter. A little practice with the adapter will tell more than words here.

As with all heterodyne frequency measurement adapters, the sound of the signal is somewhat poor. You can always restore "new amplifier" performance to the Fairchild 255, even if tubes age unequally, by Fairchild's simple, exclusive distortion-cancelling balance control.

**COMPACT:** Only 6" x 9½" base and 4½" high
**INPUT IMPEDANCE:** 100K
**POWER GAIN:** 42db
**HIGH SENSITIVITY:** Less than one volt input required for 1W output

**and it's only $89.50**

When you need full 50 watts of power, get the Fairchild 260 only $149.50

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**FAIRCHILD 255**

**HIGH QUALITY | LOW COST POWER AMPLIFIER**

Here's a mighty twin to Fairchild's big-power 260 Professional Amplifier. The new 255 delivers a full 25 watts of undistorted power for the finest sound, best reproduction!
meters, a beat will be heard at any harmonic relationship between the unknown signal and the signal generator. The loudness of the beat note depends on the amplitude of the harmonics that may be beating together. If the signal generator is harmonic free and the unknown frequency is also free from harmonics, then only one beat note could be heard. However, this is a very unrealistic case. Most service-type signal generators are quite rich in harmonic output. However, since the fundamental frequency signals are much greater in amplitude than their harmonics, it follows that the loudest beat note heard in the earphones will be when the fundamental frequency of the signal generator and the fundamental frequency of the unknown signal are beat together in the adapter. This plus the convenient fact that the frequency of the unknown signal is never truly "unknown" should prevent any real confusion resulting in this manner.

The frequency measurement adapter is coupled to the unknown frequency source by means of a loop at the end of a coax cable. As stated previously, the amount of coupling depends entirely on the strength of the unknown signal. The loop is soldered to a BNC type coax single-hole-mounting chassis fitting. This enables the loop to be changed to fit the physical conditions of measurement. For example, at v.h.f. a smaller loop might be desired to couple into a tight spot in a chassis—such as a TV tuner. Just as conveniently, the loop can be exchanged for a capacity probe to slip into a cavity or waveguide to v.h.f. and up. Then, again, an antenna can be substituted for pick-up from a more distant transmitter. Thus, the frequency measurement adapter can be made to perform in many situations over an extremely wide range of frequencies, the range being limited by the frequency range of the signal generator with which it is used.

Little need be said about the construction of the adapter, since it is quite straightforward. Almost any layout suit the constructor's fancy can be used. Just keep the grid leads and leads in the r.f. input circuits reasonably short. The layout shown in the photographs can serve as a guide.

Certified Record Revue
(Continued from page 55)

winds have smooth rather than "breathy" intonation, brass is bright but not overly crisp (in the "Divertimento") is cleanly articulate. A very natural "over-all" type of sound, enhanced by the excellent acoustic paaay works is better than any other pianist, who have discs in the LP catalogue.

PRELUIDOS AND INTERMEDIOS
Orquesta de Camara de Madrid conducted by Ataulfo Argenta. Montilla LD6, RIAA curve. Price $4.98.

PRELUIDOS AND INTERMEDIOS
Orquesta de camara de Madrid conducted by Ataulfo Argenta. London International TFW91020, RIAA curve. Price $4.98.

No, you are not seeing things! This is a prime example of some of the intricate tie-ups that exist in the record business, and how occasionally things can go awry. These are absolutely identical discs as to material, orchestra, and conductor. How come the two different labels? Who stole whom? Why, nothing like that at all. No connection exists between Montilla Records and London. But it seems the Montilla disc was released in the U. S. first, and then the Record's people sold the rights to the recording to a division of London Records, called London International. What happened, I don't know. Some of the distribution tie-ups between the different companies border on the fantastic. For instance HMV used to sell Mercury records in England; Columbia and Victor were once bedfellows in England under the EMI banner, and so on. In any case, the "Music of Spain" can now be had on both the Montilla and London International labels.

Curiously, although the discs were made from the same master, one can detect a slight difference in sound quality. The London processing gives a very smooth clean sound, with evidence that the acoustic perspective was somewhat altered from the original. The Montilla disc processed in this country (either by Victor or Columbia) sounds a shade more brilliant and close-to. Sounds like a little mid-range equalization was used. The music itself is derived from eight of the most famous Spanish zarzuelas and is quite fascinating. As to which version you would find preferable...

SCHUMANN
CARNIVAL
CHOPIN
SONATA #2, OPUS 35

This disc is notable mainly for the splendid piano sound. Which is not to say that the performances are not good. Mr. Cortot does quite well in the main, but it is obvious he is showing his 78 years, with missed notes and a general lack of vigor. His essayal of these difficult works is better than many younger pianists, who have discs in the LP catalogue,

RADIO & TELEVISION NEWS
but cannot stand comparison with several others, notably the Novaes/Voz disc. However, many of you probably will already have forgone Mr. Cortot's occasional lapses from grace, for the superb piano reproduction. No harshness or ringing here. Just smooth, "big-boned" piano, with notable lack of wow or flutter. Transients are the bane of much piano recording and it is a pleasure to hear them reproduced so cleanly. Frequency and dynamic range are quite wide and groove distortion was not noticeable. If you want to hear something impressive, listen to the famous "Funeral March" from the Sonata. It never sounded so grim and so big!

ADAM

GISSLER (COMPLETE BALLET)


The 4th version on LP and the most complete, best performed, and best sounding of them all. Fistoulari has been around ballet scores for a long while and the fluency and easy grace of his performance attests to this familiarity. His pace is just, his dynamic shadings not overblown, and he maintains a superb balance between his various choirs. The reproduction is the best I have heard of the Capitol International series. Strings are smooth, brass is nice and bright. Woodwinds are well recorded but lack color in places. Frequency response is broad, but not extremely so—dynamics are more similar. Little or no pre-echo was present and acoustic environment was reasonable. A very good buy of a standard classic.

BARTOK

BLUEBEARD'S CASTLE


This is an absolutely fabulous recording. The music is one of the late great Bela Bartok's most thrilling and compelling scores, the performances of all participants are outstanding, and the sound quality is simply phenomenal. I guarantee that those of you who own big, high-quality speaker systems, will be stunned by the fantastic realism of this sound. This realism plus the tremendous emotional content of the score makes for one of the most thrilling musical experiences possible. This quality of course stems from the loving care lavished on every phase of the recording process by Bartok's devoted and dedicated engineer son, Peter. If Peter Bartok's standards of quality prevailed throughout the recording industry, we would have fewer records, that is true, but we would have recordings which could be truly labeled "high fidelity." Which is not to imply that this gun is any less than the rest—only that there are other ways of recording as good as those made by Peter. Bartok, for there are many, but few have achieved his stellar results consistently. The odd thing about this recording is that there is very little of the so-called spectacular hi-fi effects which seem out of place here. One is not conscious of a striving for an effect, yet the blast and impact of the bass drum in this recording is quite the most impressive I have ever heard. The same may be said of the high percussion, the organ and even the voices! I think a large part of the answer lies in the extraordinary acoustic perspective with which Mr. Bartok clothes his recording. I have never believed in the pursuit of that elusive will-o'-the-wisp, "concert hall sound." Even with stereophonic techniques, it just ain't the same animal. Actually (and if this be blasphemy, sue me) really high quality recorded sound can be better than what is heard from the average seat in the average concert hall! I feel like this, and yet I must admit that this August, 1955

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Quick Hot Electronic Soldering Gun

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-Longest life

-Most dependable

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New Model #199

New patented design delivers AMPLE heat fast on 110-120 V. A.C.

60 cycle, 1.1 Amp. Max. Cools quickly too. It's light, (1/4 lbs.)—

handy, beautifully balanced and smaller—to dip readily into tool

kit or pocket. Molded red plastic handle and case. Gun made to

withstand

HUNDREDS OF HOURS CONTINUOUS OPERATION

Almost indestructible in ordinary use. New-type, steel, extra

long reach tips readily replaceable and inter-changeable with

special purpose tips. Gun fully guaranteed. And that PRICE

Only $7.95

FOR HEAVY DUTY you want

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MODEL #250

Greater volume of heat obtained solders relatively heavy materials.

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PRODUCTS, INC. CHICAGO 31, ILL.

(Export sales, Scheel International, Inc., Chicago)

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Here, in one complete, easy-to-understand volume is the whole fascinating story of Telecasting operations. Whether you are a Chief Engineer, Production Director or Technical Director; if you are now working in or planning to work in TV, or if you are simply interested in Telecasting, this book is meant for you. Here is practical, useful information that makes you familiar with the equipment and techniques used in Telecasting, tells you everything—answers all your questions about TV production and transmission. If you work or are interested in Telecasting, you'll want this vast wealth of reliable information—you'll want this book in your library. Order your copy today!

600 Pages. 450 Illustrations. 6" x 9". Hard Covers. $7.95
dynamics. The only barb I can throw is the old bug-a-boo of pre-echo which seems to be plaguing everybody. A minor fault in a recording which gave me a great deal of pleasure to review and which will command the attention of my ear frequently. My recommendation is to try it for yourself.

Tape Reviews

Here are a few of the new AV-Vanguard tape recordings I spoke about earlier in the column.

BACH

CANTATA #78
CANTATA #106

Choir and Orchestra of the Bach Guild conducted by Felix Prohaska, AV-1037. 7½ ips, dual track, Approx. 1 hr.

Choral music, something which has always been pretty miserable on pre-recorded tape is finally heard with high-fidelity sound. Of course we all begin with, the Bach Guild has been noted for turning out some very superior discs of Bach cantatas, so the fact that the tape is good is not too surprising. A comparison with the disc reveals that the tape has certain distinct advantages over the disc. Probably the most immediately apparent are the extended frequency response and the vastly superior dynamic range. Good as many cutters are, and good as many phono pickups are, you just can't commercially cut a disc and expect to equal the dynamic range of a good tape. Another rather noticeable feature is the excellent transient response, in this case unlimited by the restrictions of groove cutting. These and other more subtle factors are convincing evidence on behalf of tape. The voices on the tape have a brighter, more natural sound, the instrumental definition is greatly enhanced. For instance, the characteristic hoarse "breathiness" of the Elizabethan recorder is much more discernible and truer than on the disc. A little choral blast and fusion was the only distortion throughout the tape, and of course this occurs in the disc as well. The signal-to-noise ratio was at sufficiently high levels, so that background tape hiss was not noticeable. All in all, this is one of the most "hi-fi" sounding tapes I have yet to hear from a commercial source.

SIR CHARLES THOMPSON SEXTET


Jazz comes in for its share of the glory in these new tape releases. This is from the highly successful Jazz Showcase Series on Vanguard, and features a red hot crew gathered around Sir Charles on the piano. This tape will really make you jazz aficionados flip! This is the first time I've heard a commercial tape that sounded as good and "live" as the prime stuff we get at recording sessions. Recorded close-to, but with a little reverb treatment, the various instruments are heard with precise accurate intonation. The sax has that mellow resonant liveness of a "live" session, the trumpet and trombone are nice and gutty, bright and boisterous. The clean sharp articulation of the traps is really something to hear as well as the solid thud of the bass fiddle. Sir Charles' piano is properly percussive with clean transients. The dynamics and frequency response are far ahead of comparable material on discs and we aren't bothered with pre-echo at all! Through a high class speaker system, this tape sounds like the real thing, and I predict its happy usefulness as a demonstration special.

I'll review more of these new tapes as I receive them, and now that the sound quality seems to be well established, pay attention to the musical values as well. So brace yourselves, there is more to come.

August, 1955
1955 G-E Test Points
(Continued from page 42)

to the a.g.c. which is fed to the first video i.f. amplifier and also (through a front-panel area switch) to the r.f. stage of the tuner. The a.g.c. voltage is derived entirely from the second detector; hence, a.v.c. at test point II will serve as a relative signal strength indicator.

The usual germanium diode is employed as a second detector, followed by a 12BY7 video amplifier. The 4.5 mc. audio is picked off at the output of the 12BY7 through a double-tuned 4.5 mc. transformer and fed to the audio section. Composite sync is also picked off at the 12BY7 plate circuit and fed to a 6CS6 which operates as a combination noise canceller and clipper. A three-position front-panel area control switch varies the bias voltage on the control grid of the 6CS6 to prevent sync pulse clipping on strong signals. A second section of the switch also applies a sync voltage to the tuner in the "local" position to prevent overload in this section of the receiver.

Test point VII is tied directly to the plate of the 6CS6 and is very useful for checking clipper action by an oscilloscope. A .01 µfd. or larger capacitor should be used in series with the clipper to reduce the test point to block off the 130 volts d.c. which is present.

One-half of a 12AU7 inverts the sync pulse from the 6CS6 for application to the 12BH7 vertical oscillator output stage. If it becomes necessary to improve the vertical sync stability, connect a 100,000 ohm, ½ watt resistor from the sync grid of pin 6 of the first video i.f. tube to ground, using the shortest lead possible. This reduces the screen voltage and prevents any tendency toward sync compression in this stage.

The horizontal deflection section employs one-half of a 12A7T as a phase detector which, in turn, controls a 12AT7 cathode-coupled multivibrator. Test point VI is useful, as indicated in Table 1, to set the optimum operating conditions of the oscillator circuit by means of the rear apron horizontal stabilizer control. The remainder of the horizontal circuit is conventional and uses a 6BQ6GA horizontal output stage, 6AX4GT damper, and 1B3G'T high-voltage rectifier.

The low-voltage supply is also conventional, employing the usual power transformer and 5U4GT rectifiers.

Fig. 3 is a block diagram of the "K" chassis, including tube line-up and block location of the eight designated test points. Table 1 indicates the exact location of each test point in the circuit, the normal voltage or waveform found at each test point, and the various ways in which the test point can be used for troubleshooting, measuring, aligning, etc.

It is important to note that voltage and waveform indications given for the receiver will be tuned to a station and adjusted for normal brightness, sync, contrast, and sound. Obviously, if the receiver has failed, all of these conditions cannot always be met. In this case, the operating controls should be set in the approximately correct position. The three position front-panel area switch should be set in the appropriate position to prevent signal overload, and any erroneous waveforms may result in the video and sync circuits.

A study of Table 1 will show that some test points serve many functions; for example, the second detector point,
test point III, can be used for signal tracing, for oscilloscope connection, for AM trap and sweep alignment, and for signal injection to test the video amplifier. Although space limitations prevent listing all possible uses of designated test points, the experienced technician will no doubt be able to add to the practical uses that can be made of these points as his experience grows.

OLOFSSON WINS NATIONAL COMPANY CONTEST

CURT OLOFSSON of San Francisco has been named winner of National Company, Inc.'s international amateur contest in which hams were asked to submit their ideas as to the features that an "ideal" amateur receiver should embody.

Thousands of hams around the world submitted suggestions for the receiver since the contest opened last October. Monthly prizes of NC-38 receivers were awarded to Richard R. Pugh of Johnstown, Pa.; Laurence P. Monohan, Ann Arbor, Michigan; Mel E. Buechel, Chicago, Ill.; and Bernard H. Zweifel, Lausanne, Switzerland.

Mr. Olofsson, who topped the field, was awarded the grand prize of a $1000 ham shack which included a National HRO Sixty with matching speaker, a transmitter with semi-automatic key, a microphone, and a rotatory antenna.

He is a member of the Brass Pounders League and received his Advanced Class License in May 1952.

As a result of the amateurs' suggestions, the company is now designing a "dream" receiver incorporating the "most-wanted" features.

TRI-STATE AMATEUR RADIO SOCIETY HAMFEST

THE Tri-State Amateur Radio Society will hold its 9th annual Hamfest on Sunday, August 28th at Bowers Grove, located 8 miles north of Evansville, Ind., and 2 miles west of "Grumpy Pals" on highway 11. Transmitters on 10 and 75 meters will direct rompers to the grounds.

Registration fee is $2.50 per person. For other information, contact Callie Jones, W9UHV.

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TV ANTENNA ACCESSORIES

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- New, improved tube is semi-flexible - bends without breaking for easy insertion into wall openings drilled out of lino!
- Neat, Convenient, Efficient! Appeals to ALL TV Owners because it's Practical!
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Ask your Parts Jobber or write direct for your Free copy of the new MOSLEY Catalog 54-55.

MOSLEY ELECTRONICS, Inc.
8622 St. Charles Rock Rd., St. Louis 14, Missouri

August, 1955

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RCA INSTITUTES
COLOR TV

HOME STUDY COURSE
trains you in the "why" and "how" of Color TV Servicing

Study Color Television Servicing from the very source of the latest, up-to-the-minute Color TV developments. Train under the direction of men who are experts in this field. Take advantage of the big future in Color TV through RCA Institutes' Home Study Course, which covers all phases of Color Servicing.

It is a practical down-to-earth course in basic color theory as well as how-to-do-it TV servicing techniques.

This color television course was planned and developed through the efforts of instructors of RCA Institutes, engineers of RCA Laboratories and training specialists of RCA Service Company. You get the benefit of years of RCA research and development in color television.

Because of its highly specialized nature, this course is offered only to those already experienced in radio-television servicing. Color TV Servicing will open the door to the big opportunity you've always hoped for. Find out how easy it is to cash in on Color TV.

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350 WEST FOURTH STREET, NEW YORK 14, N.Y.

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August, 1955

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"VITASCAN"*

for Color TV

A flying-spot scanner with phototube pickup simplifies color TV studio equipment.

COLOR television was given another boost recently with the announcement of the Du Mont Vitascan Color Studio Scanner. The Vitascan utilizes a beam of light from a cathode-ray tube "flying spot scanner" to scan persons, objects, or action and then picks up the reflected scanned light by means of photomultiplier tubes. These tubes convert the light into an electrical signal which may be passed on to a regular standard color transmitter for broadcast.

Color pictures produced by this equipment are electronically identical with standard color pictures produced by other methods, and result in a standard NTSC color signal. Therefore, any regular color studio or transmitter equipment may be used to broadcast the signal.

The Vitascan principle can best be described as a conventional television pickup system in reverse. Here the light source is a flying-spot cathode-ray tube which develops an extremely bright raster—much brighter than that in cathode-ray picture tubes used in television sets. This light source replaces the camera in a conventional pickup system.

Light from the flying-spot tube is directed by means of a mirror and lens system into the studio and onto the scene being televised and focusing is accomplished in much the same manner as with a regular camera. As this light travels over the scene, point-by-point and line-by-line, it is reflected at each instant from the point on which it is shining. This reflected light is picked up by clusters of photomultiplier tubes which are arranged in groups of four throughout the studio.

To separate the light into three primary colors, the photomultiplier tubes are equipped with selective filters which allow only the desired color to pass. In each cluster of four tubes, one is equipped with a green filter, one with a blue filter, and two with red filters. Two are used for red because the light source is deficient in this end of the spectrum and the phototubes are less sensitive to red than to the other colors. The photomultiplier tubes convert the three colors into electrical signals, amplify these...
signals many thousands of times, and pass them on to conventional color transmitting equipment.

Color registration is no problem with this system, because the scanning operation has already taken place before the light is split up into its three colors.

Since the Vitascan system operates by picking up reflected light from the object being scanned, the light source must be rigidly controlled and very little ambient or stray light can be allowed to reach the pickup tubes. Such light would cause "noise" in the picture. Thus, there is no longer any necessity for the heavy lighting load now required in color television studios. Actors and actresses perform in much greater comfort, and the air-conditioning load is reduced tremendously.

However, some studio lighting is necessary, because the light from the flying-spot scanner is insufficient for normal illumination. To solve this lighting problem advantage is taken of the vertical retrace blanking period, when the flying-spot scanner is blanked out. Stroboscopic studio lights are employed, and are synchronized with the system in such a manner that they flash on only during blanking periods and are turned off when scanning is taking place. In this way, over-all studio illumination is achieved without interfering with the scanning process. Intensity of this illumination can be adjusted to any value.

As mentioned before, several groups of photomultiplier tubes are employed in a studio. Each group of four is assembled into a "scoop" or "bucket," as shown in Fig. 1. The outputs of these scoops are fed to a central control panel, where they are mixed in the proper proportions to produce the desired picture.

These scoops perform a function very similar to that of studio lights used with conventional equipment. In other words, most of the various lighting effects can be obtained by proper scoop location and orientation, and by mixing the scoop outputs in the correct proportion.

Vitascan is expected to fulfill the urgent need of TV stations throughout the country for a dependable means of originating their own live color programs and commercials at minimum expense. In addition, it provides an easy, inexpensive method for producing live closed-circuit telecasts in color, such as televising of sales meetings. The equipment may also be used as a monochrome pickup for black-and-white studio programs, thus providing standby facilities for stations having a limited number of cameras.

Du Mont emphasizes that this system is intended to be an invaluable supplement to live color pickup equipment, and should not be compared point-by-point with conventional TV. Each has its own advantages. Vitascan uses a controlled light source; therefore, in its present form, it is not intended for use where light cannot be controlled.

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Apply Your Electronics Experience

ENGINEERS AND PHYSICISTS WITH ELECTRONICS TRAINING ARE NEEDED TO CONDUCT CLASSROOM AND LABORATORY PROGRAMS ON ADVANCED SYSTEMS WORK IN THE FIELDS OF RADAR FIRE CONTROL, ELECTRONIC COMPUTERS, GUIDED MISSILES.

The proper functioning of the complex airborne radar and computer equipment produced by Hughes requires well-trained maintenance crews in the field.

At Hughes Research and Development Laboratories in Southern California engineers assigned to this program are members of the Technical Staff. As training engineers they instruct in equipment maintenance and operation for both military personnel and field engineers.

Prior to assignment, engineers participate in a technical training program to become familiar with latest Hughes equipment. After-hours graduate courses under Company sponsorship are available at nearby universities.

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Scientific and Engineering Staff

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

August, 1955
A NEW TAPE MACHINE FOR OFFICE USE

Over-all view of DeJur's new lightweight, compact tape recorder for dictation.

A simplified type of tape recorder now offers increased flexibility to meet all office dictating requirements.

A NEW TYPE of magnetic tape dictating machine which has been especially designed for dictation or transcription was recently unveiled by DeJur-Amresco Corporation of Long Island City, New York.

Tradename the "Stenorette," this push-button-operated machine weighs only eleven pounds, 10 ounces. The unit includes a combination microphone-speaker and enough tape for 30 minutes of continuous recording.

The machine employs tone and volume controls to produce a high degree of fidelity for this type of application. Five push-buttons provide simple automatic control of the tape for recording, listening, forward and reverse speed winding, and stopping. Dictation corrections or playback are facilitated by an automatic scale indicator which gives accurate positioning when winding the tape backward or forward. The microphone-speaker is equipped with a "start-stop" button to control the tape during pauses or interruptions while dictating.

The tape can be used and re-used repeatedly for the life of the machine. The microphone used with the recorder is of new design. It can be used as a hand mike or by moving its chrome legs downward, it becomes an equally effective and attractive desk microphone. Located at the side of the microphone and in the most natural position is the "stop-start" control bar. The user merely squeezes or presses the bar lightly to start recording and releases it to stop the recording. There is no lag or coast as the action is instantaneous.

For continuous recording or continuous playback the button above the stop-start bar is pressed in and to the left. To review previous dictation after an interruption or to erase an error, the microphone control bar and "review" button are pressed simultaneously. In this way the last few words or last sentence are repeated. To make a correction or a change, the user re-records the same area. To dictate, the user presses the "record" button and begins talking in a natural tone of voice. When the dictation is completed, the rewind button is pressed, the tape is removed and placed in the transport folder pocket together with related correspondence and the log page, and sent for transcribing.

For use as a transcribing machine, one of a choice of listening devices is placed in the outlet on the right side of the machine. A choice of either a typewriter or foot control is placed in the outlet at the left side of the machine. Listening devices may be used on either or both ears. The foot and typewriter controls have facilities for starting, stopping, and backspacing.

The "Stenorette" used for transcription. Either foot or hand control is available. The earphone is a small, lightweight unit.

Yes, you can have a sharper, clearer TV picture -- a picture with all the depth and detail you enjoy on the movie screen.

The Tung-Sol "Magic-Mirror" Aluminized Picture Tube gives you deeper blacks, more brilliant highlights and in-between tones that will make your picture come alive. So treat yourself to new TV viewing pleasure with a Tung-Sol "Magic-Mirror" Aluminized Picture Tube.

The finest TV sets are factory-equipped with receiving and picture tubes made by Tung-Sol -- one of America's leading electron tube manufacturers.

TUNG-SOL ELECTRIC INC., Newark 4, N. J.

Sales Offices: Atlanta, Chicago, Columbus, Culver City (Los Angeles), Dallas, Denver, Detroit, Montreal (Canada), Newark, Seattle.

A NEW TYPE OF MAGNETIC TAPE DICTATING MACHINE WHICH HAS BEEN ESPECIALLY DESIGNED FOR DICTATION OR TRANSCRIPTION WAS RECENTLY UNVEILED BY DEJUR-AMRESCO CORPORATION OF LONG ISLAND CITY, NEW YORK.

TRAIDENAME THE "STENORETTE," THIS PUSH-BUTTON-OPERATED MACHINE WEIGHS ONLY ELEVEN POUNDS, 10 OUNCES. THE UNIT INCLUDES A COMBINATION MICROPHONE-SPEAKER AND ENOUGH TAPE FOR 30 MINUTES OF CONTINUOUS RECORDING.

THE MACHINE EMPLOYES TONE AND VOLUME CONTROLS TO PRODUCE A HIGH DEGREE OF FIDELITY FOR THIS TYPE OF APPLICATION. FIVE PUSH-BUTTONS PROVIDE SIMPLE AUTOMATIC CONTROL OF THE TAPE FOR RECORDING, LISTENING, FORWARD AND REVERSE SPEED WINDING, AND STOPPING. DICTATION CORRECTIONS OR PLAYBACK ARE FACILITATED BY AN AUTOMATIC SCALE INDICATOR WHICH GIVES ACCURATE POSITIONING WHEN WINDING THE TAPE BACKWARD OR FORWARD. THE MICROPHONE-SPEAKER IS EQUIPPED WITH A "START-STOP" BUTTON TO CONTROL THE TAPE DURING PAUSES OR INTERRUPTIONS WHILE DICTATING.

THE TAPE CAN BE USED AND RE-USED REPEATEDLY FOR THE LIFE OF THE MACHINE. THE MICROPHONE USED WITH THE RECORDER IS OF NEW DESIGN. IT CAN BE USED AS A HAND MIKE OR BY MOVING ITS CHROME LEGS DOWNWARD, IT BECOMES AN EQUALLY EFFECTIVE AND ATTRACTIVE DESK MICROPHONE. LOCATED AT THE SIDE OF THE MICROPHONE AND IN THE MOST NATURAL POSITION IS THE "STOP-START" CONTROL BAR. THE USER MERELY SQUEEZES OR PRESSSES THE BAR LIGHTLY TO START RECORDING AND RELEASES IT TO STOP THE RECORDING. THERE IS NO LAG OR COAST AS THE ACTION IS INSTANTANEOUS.

FOR CONTINUOUS RECORDING OR CONTINUOUS PLAYBACK THE BUTTON ABOVE THE STOP-START BAR IS PressED IN AND TO THE LEFT. TO REVIEW PREVIOUS DICTATION AFTER AN INTERRUPTION OR TO ERASE AN ERROR, THE MICROPHONE CONTROL BAR AND "REVIEW" BUTTON ARE PressED SIMULTANEOUSLY.
Oscillator Troubles
(Continued from page 49)
quence. This detuning of the oscill- 
tor reduces the i.f. signal and cuts 
down the a.v.c. voltage. The "B" volt-
age now drops to normal, and the oscil-
lator tuning becomes correct, causing 
the signal to revert to normal. The 
cycle of change now starts once more. 
A flutter in the sound results from this 
process. The trouble is largely initiated 
by the high-amplitude variations that 
are produced in the current of the au-
dio output tube. These variations are 
not properly filtered out in the "B" 
supply, and are consequently fed back 
to the oscillator plate. Motorboating, or 
a "putt-putting" sound, may be heard 
in severe cases of such feedback. The 
source of the trouble is generally a 
loss in the capacitance of the output 
filter capacitor. A loss in the capaci-
tance of the oscillator anode decoupling 
capacitor (C1 in Fig. 3) may also be 
responsible.

In the rare instances when restora-
tion of the normal filter or bypass cap-
acitance does not cure the trouble, 
smaller coupling capacitors may be 
used in the audio amplifier section, to 
reduce the receiver's low-frequency re-
sponse, and thus cut down the ampli-
fication of the low flutter frequencies 
to a point where feedback is elimi-
nated.

Motorboating or siren-like sounds in 
TV sets when the receiver is first 
turned on are generally due to a de-
fective oscillator or converter tube.

Drift, or slow changes in oscillator 
frequency (necessitating set retuning), 
sometimes presents troublesome prob-
lems to the service technician, particu-
larly in the servicing of FM sets. 
There are two basic reasons for drift. 
The first is the heating of the oscilla-
tor tube and its socket (causing 
changes in interelectrode capacitance in 
the tube); the duration of such drift is 
short. The second cause of drift is 
the heating of other circuit compo-
nents (producing expansion effects) as 
the chassis temperature rises.

Possible specific causes of drift in-
clude bad oscillator tube; oscillator 
coil which may have absorbed mois-
ture; defective or inferior socket (a 
mica-filled socket used in place of a 
Bakelite one will reduce socket-caused 
drift); or a defective, too small, or 
improperly positioned negative tempera-
ture-compensating capacitor. The pre-
ferred positioning of such a capacitor 
is directly over the socket (see Fig. 1), 
where it can respond most accurately 
to the heat generated in the tube and 
socket. 

Some mechanical troubles may re-
sult in symptoms similar to those 
caused by drift. Changes in the dial 
setting of a radio, due to an excessive-
ly tight dial cord, or detent backlash 
trouble in a TV set (too much play 
in the detent shaft of loose oscillator 
slugs in TV turret tuner coils (cement-
ing these in will help) are examples of 
this.

August, 1955
Receptacle, NEW, make 6DME DICTATING MACHINES
Above Inverters

CONNECTOR DISPLAY
Jervold Electronics Corporation, 23rd and Chestnut Streets, Philadelphia 3, Pa. is now offering a new self-service dispensing display for its line of solderless coax cable connectors, line-tap impedance matchers, and crimping tools. Utilizing tested merchandising techniques, the new display shows the product, sells the product, and keeps inventory, all without attention from jobber personnel.

The entire display measures only 9"x18" and may be hung on a wall, a post, or stood on a counter. When fully loaded, the display holds over 50 colorful packages of the company's cable system accessories. One of each of the 12 different products is in full view at all times.

PHONO NEEDLE DISPLAY
Jensen Industries, Inc., 7333 West Harrison, Forest Park, Illinois is introducing a new phono needle for the "junior set" which is being merchandised via a gaily-colored "Rumpus" display card.

The new "Rumpus" needle is guaranteed not to bend or break and is especially designed to meet the demand for a sturdy needle to be used by the small fry or the overly enthusiastic teen-ager on their recreation room phonographs.

The needles are packaged a dozen to the display card and full details are available from the manufacturer on request.

RCA "TREASURE CHEST"
A new, improved carrying case for electron tubes is being offered to the radio-TV service industry by Radio Corporation of America.

Known as the "Treasure Chest," the new case is larger and holds more tubes than previous models and is built for rugged service. Dealers may obtain the chest by turning in to distributors a total of 20 RCA "Treasure Notes." One of these "Notes" is given to dealers with each purchase of 25 RCA receiving tubes or one picture tube.

For five "Treasure Notes," the company is also making available through distributors a "Multicord," a practical time-saving device for the technician. The device consists of a harness which includes cord connectors to fit all TV receivers; a three-way power output which can be brought up to the chassis for test equipment, soldering gun, and other tools; and a clamp-on work light with "on-off" switch.

Details on the "Treasure Chest" promotion are available from all local RCA tube distributors.

TRANSISTOR KIT
General Transistor Corp. of Jamaica, New York is offering a kit of transistors which includes an assortment of seven of the most commonly used diffused p-n-p junction types.

The assortment of double-sealed transistors covers types for use in radios, automation, hearing aids, computers, Geiger counters, and instruments. The kit, which is packaged in a functional plastic box, is now being offered at a special introductory price.

Write the company for full information on this kit.

PICNIC-BBQ SET
A consumer promotion featuring a 10-piece picnic and barbecue set to be given away with the purchase of one of its TV models has been announced by the television and broadcast receiver division of Bendix Aviation Corporation.

The utensils, worth $35 at retail, include a charcoal grill, insulated carry-all bag, ice chest, beverage jug, and six grill-cooking implements. A colorful set of window streamers, posters, showcase cards, and ad mats for dealer use has been included in the promotional package.

The company's distributors have complete information on this promotion.

"X-RAY" DEMONSTRATOR
The Magnavox Company, Fort Wayne 4, Indiana is now offering a new and effective selling tool—an "X-ray" demonstration cabinet.
MAMMOTH CRYSTAL CLEARANCE SALE!

SAVE MONEY—ORDER IN PACKAGE QUANTITIES!

Write For FREE Tube List—Order Blank and FREE Sample Tube Carton. Y-0-0 On Our Mail-List.
SUN BATTERY DISPLAY

International Rectifier Corporation, 1521 East Grand Ave., El Segundo, California has recently introduced a self-service merchandising unit for its line of B2M "Sun Batteries."

ASTATIC "TWELV-PAK"

The problem of "which cartridge to stock" has been neatly solved for the average dealer by The Astatic Corp. of Conneaut, Ohio.

The new "Twelv-Pak" cartridge replacement kit consists of the 12 units found most in demand in everyday servicing, as determined by actual sales records. Included with the kit, at no extra cost, are two "bonus" extras: (1) a jeweler's screwdriver which is offered as a time and temper saver when working with tiny cartridge knob and needle set screws, and (2) a newly compiled eight-page master cross-index replacement chart which lists every cartridge ever made by all manufacturers, along with its current replacement.

Dept. TP of the company will supply full details on this kit upon request.

TV ALIGNMENT CRYSTALS

To make the distributor's selling of crystals easier, quicker, and more profitable, Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y., has designed and distributed to jobbers a package display merchandiser for its Eico TV alignment crystals. Printed in blue and red, the display holds five each of the company's 4.5 and 5 mc. crystals, applicable to practically all TV sweep generators and marker oscillators. The display measures only 7" x 10" and may be placed on the counter or hung on a wall.

WESTINGHOUSE MOVIE

The Film Division, Westinghouse Electric Corporation, P. O. Box 2278, Pittsburgh 30, Pa. has produced a new 30-minute movie which shows historic scenes from Atomic Energy Commission plants in Idaho and Pittsburgh.

Entitled "A Dawn's Early Light" and filmed in both color and black-and-white, the picture stars Fred MacMurray and features Fay Wray and Jack Diamond. Actual scenes of the construction of the nuclear power plant for the U.S.S. Nautilus are included in the film.

The movie is suitable for showing to social, service, and school groups; civic organizations; and professional groups. It is available on loan without charge or can be purchased outright. Information on booking or buying the film is available from the company.

The lucite cabinet permits the dealer salesman to point out the salient features of the company's television chassis. The demonstration cabinet is shipped completely assembled with a lamp in place. The user installs the safety glass and mask in the lucite cabinet frame and mounts the speaker on top of the cabinet. The demonstrator will house the company's standard MV or U121LC chassis.

For full details and ordering information, write T. C. Wyatt of the Advertising Department.

SPRAY DISPLAY

General Conent Mfg. Co., 919 Taylor Avenue, Rockford, Illinois has developed a complete package deal which includes 25 different products and colors in pressurized spray cans plus a self-service display rack.

Such products as the company's "Spray-Kleen," "De-Ox-Id" contact cleaner, "Spra-Koat" high-gloss enamels, varnish, and other finishes, and printed circuit resin are available in this compact rack dispenser which holds 156 cans.

For full information on display Deal No. 3612, write the company direct.

Do you want them?
from 2½V—24V or from 1 amp. to 30 amps.

We have them in stock
see your jobber for immediate delivery.

The Film Division, Westinghouse Electric Corporation, P. O. Box 2278, Pittsburgh 30, Pa. has produced a new 30-minute movie which shows historic scenes from Atomic Energy Commission plants in Idaho and Pittsburgh.

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The movie is suitable for showing to social, service, and school groups; civic organizations; and professional groups. It is available on loan without charge or can be purchased outright. Information on booking or buying the film is available from the company.

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The problem of "which cartridge to stock" has been neatly solved for the average dealer by The Astatic Corp. of Conneaut, Ohio.

The new "Twelv-Pak" cartridge replacement kit consists of the 12 units found most in demand in everyday servicing, as determined by actual sales records. Included with the kit, at no extra cost, are two "bonus" extras: (1) a jeweler's screwdriver which is offered as a time and temper saver when working with tiny cartridge knob and needle set screws, and (2) a newly compiled eight-page master cross-index replacement chart which lists every cartridge ever made by all manufacturers, along with its current replacement.

Dept. TP of the company will supply full details on this kit upon request.

TV ALIGNMENT CRYSTALS

To make the distributor's selling of crystals easier, quicker, and more profitable, Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y., has designed and distributed to jobbers a package display merchandiser for its Eico TV alignment crystals. Printed in blue and red, the display holds five each of the company's 4.5 and 5 mc. crystals, applicable to practically all TV sweep generators and marker oscillators. The display measures only 7" x 10" and may be placed on the counter or hung on a wall.

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The unit consists of an attractive 4"x6" card which displays the B2M in a protective transparent plastic bubble.

The reverse side of the card gives full information, specifications, and typical applications for the battery. The company has also designed a self-service counter display for this item. **

** "BELL COW" PROMOTION
Raytheon Manufacturing Company of Chicago has initiated a unique promotional program which has been nicknamed the "Bell Cow." The series provides hard-selling, factory-created, factory-paid, page-dominant newspaper advertising which each distributor may assign to run over the logotype of his "Bell Cow" dealer. The term is the company's designation for the leader of the herd chosen to wear the bell.

The advertisements in the promotion feature the company's new "StarMonic" all-metal 17" and 21" tube model TV sets. The first ad in the series promoted the low end of the "StarMonic" line while the second ad promoted the top end of the line.

ANTENNA DISPLAY
Snyder Mfg. Co. of Philadelphia, Pa., has developed a colorful new antenna display board for merchandising its line of top cowl auto antennas. Decorated in blue, black, fluorescent green, and white for counter and window display, the new board will fit the company's TC3, TC3B, TC8, and TC9 models, all 1955 antenna designs, which are currently available.

EGYPTIAN CLUB HAMFEST
The Egyptian Club Radio Club, Inc. of 700 S. Chouteau Slough Road, Granite City, Illinois has announced that its Annual Hamoree will be held this year on September 25th.

Special attendance prizes will be awarded out of town guests. Those wishing additional details can contact Elmer Ford, WGMF, at 7013 Page Blvd., St. Louis, Mo., either by mail or by giving him a call. All hams will be welcome.

August, 1955
most cases without the intervention of Washington. And I am sure that you will continue to do so in the future.... In those areas where we in the Commission have been given the responsibility of assisting the industry for the public good, we pledge our wholehearted cooperation and assistance. With very little help, you have come a long way toward reaching the common goal of all of us; of providing a broadcasting service that fills the needs and desires of the American people."

Continuing his appraisal of the nation's broadcasting industry, the FCC's headman said: "Yours is a young, virile, rapidly changing industry. Your opportunities to render a great public service to the people of America are fabulous. I am positive that I bespeak the sentiments of the members of the FCC and the staff when I say that we not only consider it our duty, but a privilege to work with you to the end that this country will continue to enjoy the greatest broadcasting service in the world."

BROADCASTERS AND set makers at the annual Washington conclave were not only privileged to listen to the members of the Commission, but for the first time, the President of the United States, appearing in person. Twenty-four years ago, a President had addressed the group—Herbert Hoover—but by remote control.

On this historic occasion, the President faced the television with faces of the former Presidents, and to this President, therefore, can afford to take them quite seriously. Actually, not only here to stay, but a mighty force in our civilization; one that is certain to grow and . . . be more powerful in its influence upon all of us.

Commenting on the freedom of the air, the President said that "...to remain free, the government does have to interfere or to intervene, possibly in your industry more than it does in the industries of other countries.... After all, there seems to be only one canopy of air over the United States and the rest of the world, and so there must be some means of deciding who is to use the various channels available. We shall always hope, of course, that this can be done fairly and without any relationship of partisan politics or any other inconsequential factor, so far as this great medium and problem is concerned. . . . But beyond that one necessary intervention and the decision . . . of the rules of decency . . . my only plea is this: That you take thought and counsel among yourselfs to insure that this medium . . . remain free . . . completely free of domination of any unfair kind."

In his message, over two decades ago, on the occasion of the ninth annual convention of the broadcasters, the President had reviewed the development of national politics, but of course, in relation to radio and the official rules that had been issued then to halt chaotic conditions. Emphasizing that the decisions reached at that time had been fundamental, the former chief executive stated: The determination that radio channels were public property and should be controlled by the government; the determination that we should not have governmental broadcasting supported by a tax upon the ears, but that we should give license to use of these channels under private enterprise where there would be no restraint of programs, has secured for us far greater variety of programs and excellence of service to the listener . . . This decision has avoided the pitfalls of political and social conflict in the use of speech over the radio which would have been involved in government broadcasting. . . . It has preserved free speech in the country . . . .

Describing the significant importance of radio, the ex-President resident said that radio's . . . "dissemination of entertainment, of knowledge, and of public opinion and topics of public welfare, has become an essential element in the intellectual development of our country . . . . It has brought most of the supposed values, which were formerly available exclusively to life in the cities, to every home throughout the land; for the treasures of music, entertainment and information have been brought to the lonely farm and the most remote hamlet . . . It is an incalculable extension of happiness and contentment."

THE DOMINANT ROLE that automation will play in radio, which was highlighted at the Washington session of broadcasters. On display were several types of tape equipment that make it possible to program automatically for up to eighteen consecutive hours per day.

In one demonstration, two playback magnetic units were operated; one contained all of the program material, while the other was used to supply commercial material. In another instance, when the tapes were employed; sub-audible tones, impressed on the tapes, served to activate controls which switched program information on the air.

In describing the virtues of this new approach to broadcasting, a representative of a tape manufacturer said: "Automation will make it possible for an announcer to record a day's announcements in but a few hours, freeing him for other duties. The system would also permit a disc jockey to record an all-night show, spend the day, and allow him to relax during the wee hours of the morning."
a LIVE-WIRE'S check-list of prospects for RCA SOUND

- BOWLING ALLEYS
- CONSTRUCTION JOBS
- BUS TERMINALS
- DANCE HALLS
- EXCURSION BOATS
- FAIR GROUNDS
- GARAGES
- LAUNDRIES
- LODGES
- LUMBER YARDS
- SWIMMING POOLS

Your RCA Distributor has everything you'll need in matched sound products to do the kind of job you and your clients will be proud of. One stop, one quality—RCA—the name that's known the world over. You can recommend and install it with confidence.


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SPLINED TUNING KNOB FOR 274N RECEIVERS
An exclusive O-Ring, manufactured for us. Fits BC-453, BC-454 and other 274N receivers. This is a really hard-to-beat item. Only .39c ea.

COMMISSIONED ELECTRONICS CO.
2160 Champlain St. N.W.
Washington 9, D. C.

August, 1955

INEXPENSIVE method for equalizing and stabilizing the voltage characteristics of cold-cathode gas diodes, such as neon indicator lamps, found to be ideal for electronic computers, has been developed by two data-processing-system experts at the Bureau of Standards.

The cold cathode diode was selected for the program because it was found to require a power meter, can handle large currents momentarily, and is small, light, rugged and cool in operation. Life for the normal indicator operation was said to be over 10,000 hours. In electronic computers, with few passive elements, the tube can be used as an and-gate, an or-gate, an indicator-type memory bit, a flip-flop, an oscillator, or an indicator. It lends itself to visual or photoelectric output, as well as electrical output of either polarity.

Up to now, four major defects in the operation of this component limited its use. Because the tube is manufactured as an indicator, only one characteristic—the maximum firing voltage—is controlled, and this can have a large tolerance. This leads to the first defect; in a batch of tubes, a wide range of firing and holding voltage has been common. Selection might be used to overcome this difficulty. And here is where the second defect appears. The characteristics of any one tube vary unpredictably with use. The other two major defects have been found to be associated with use and circuitry. The normally-long de-ionization time limits speed of operation, and the need for continuous path to maintain ionization has been found to make the selection circuits a very difficult problem to the engineer.

The circuit for the equalizing process consists of a large number of tubes in parallel, connected to a pulse power source through a common resistor. Pulses are continually applied until the firing potentials and holding potentials of all the tubes rise to common terminal values. Further processing procedures no additional change. In the stability check, all of the tubes are subjected to identical conditions. Providing a separate resistor for each tube was found to minimize mutual interaction, while the power supply and environmental changes are common to all tubes.

In this system, the characteristics of the potential to be considered was the firing voltage—all minimum voltage necessary to start conduction in a tube which has been subjected to a long time compared to its de-ionization time. The second was the holding or maintaining voltage—the voltage drop across the tube when it is carrying its rated current. For the tubes investigated (the...
NE-2 and NE-51), the values were found to be about 90 and 75 volts, respectively, for the first tube, and about 5 volts lower, for the second tube.

Since equalizing the tubes consists mainly of operating them beyond their normal operating range, some means of obtaining pulsed operation was required. Two methods were used here. For very large overloads, a relay pulser was employed. The length of the pulse was determined by the break time of a pair of relay contacts. When desired, this time could be lengthened by the use of an RC circuit, but usually it was held to a minimum. The "off" time was set by a timing relay, also operated with a variable RC circuit. Two relays were used to obtain fail-safe operation, inverted so the tubes were concerned. For tests at higher cycles, full or half-wave 60-cycle voltage is used. To keep the over-all duty cycle low, a clock-driven switch was used to maintain 25 or 75 per-cent duty cycles over approximately 100-second periods.

It was said that many tubes can be equalized at the same time, as long as not too much current is drawn by one or a few tubes. To prevent such an overload, a power supply with poor regulation was used to operate both tubes and relays. A high current load was used to lower automatically the duty cycle and the pulse voltage.

THE OFFICIAL SENATORIAL ultra-high investigation, dogged by delays since Congress convened this winter, will finally sweep into action during the late summer months, according to the chairman of the committee charged with the study: Senator Warren G. Magnuson.

The hearings, which are expected to begin soon after the first session of the 84th Congress ends, will, it is expected, convene with the FCC as the opening witness. The committee expects to explore not only the high- and low-band situation, but the state of competition in the industry, and the complete allocation plan. A parade of engineering talent will be called on to testify, present plans indicate.

The see-saw debate continued to nettle those planning to enter the TV arena, and as a result station-grant schedules were slim once again. Those authorized, as we went to press, appear in table above. L.W.

TEXAS ELECTRONICS FAIR

THE third annual radio and TV service clinic and electronics fair sponsored by the Texas Electronics Assn. will be held at the Gunter Hotel in San Antonio on August 26, 27, and 28. As at the two previous clinics, there will be a varied program of technical and business talks designed to improve both the technical efficiency and the business acumen of radio and TV technicians and dealers. Subjects to be presented are color TV, transistors, service management, and test equipment. There will be plenty of exhibits as well.

HAMFESTERS' PICNIC

THE Annual Picnic and Airmobile Meet of the Hamfesters Radio Club, Chicago has been set for Sunday, August 14th at Mance Park, 1/4 mile east of Route 45 and 1/4 mile south of Route 66 (Stinson Airport). This 21st annual get-together will follow the pattern of the successful affairs of other years. Food, ice cream and beverages will be available at the picnic grounds. Games and contests have been arranged for both adults and children. There will be plenty of tables and free parking space. Donations are $1.00 in advance and $1.25 at the gate. Tickets are available from Jesse P. Markham, W9YNV, 37 N. Lotus Ave., Chicago 44, Illinois.

Those flying to the meet can home on WTAQ (1300 kc.) as the four towers at the station are 190 feet tall. Free parking for planes but pilots must bring their tie-downs.
Applying Variable Damping  
(Continued from page 33)

remedy for acoustical resonances is to attack them acoustically, by correct design of the enclosure for the loudspeaker unit, and vice versa. As most readers probably do not want to get into this problem of loudspeaker and enclosure design, by far the simplest solution is to pay somewhat more for the loudspeaker, and get a good one in which the acoustic problems have been adequately solved by the original speaker designer. When such a unit is tested on an amplifier adapted in the manner described, the effect of damping control is extremely difficult to detect, and it is considered that an average amplifier with a damping factor somewhere between 3 and 10 is suitable for driving a unit of this type.

What About Commercial Claims?

Before leaving this interesting subject, there are a couple of further aspects of it, not covered in Mr. Hafler's article, that the author would like to draw to the reader's attention.

The first concerns the circuitry used by most of the variable damping amplifiers presently on the market. The modification described gives true variable damping. Admitted, it does not provide for going into the negative region, but Mr. Hafler's article showed good reasons why this is seldom necessary. Most of the circuits employed by commercial amplifiers do not take the precaution, which this circuit takes, of maintaining a constant total amount of feedback. They only adjust the current feedback over a range extending from negative into the positive region, while not varying the voltage feedback directly. Actually, the negative feedback re-adjusts itself, due to interaction between the two kinds of feedback, the loop being inside the other loop. But this means that the stability criterion of the amplifier will alter at different settings of the damping control, although the over-all gain may not noticeably change. And consequently the frequency response will vary with the setting of the control, in a manner that is not too easy to predict, especially when a loudspeaker load is used in place of the dummy load used for testing the amplifier.

Another variant of this departure from true damping control occurs in some designs where, to avoid interference with the stability criterion, especially at the high end, the effect of damping control is restricted to the low frequencies. This is achieved by making the current feedback frequency selective, and only feeding back the lower frequencies in the vicinity of the fundamental resonance of most loudspeakers. The argument given for doing this is that this range of frequencies is where damping controls the movement of the loudspeaker diaphragm. At the higher frequencies,
ARROW SALES

SPECIAL TELEVISION TRANSMITTER
13 tubes, UHF. Used in aircraft. Frequency range: 200 to 500 kc. Has built-in RF amplifier, IF amplifie, rabbit dog, 2 oscillators, 5 power amplifiers. For use on boats and planes. Complete with transmitter, condenser, weight 14 lbs. $5.95

BENDIX DIRECT FINDER
MN-216C, 10 tube, single unit. Radio Navigation Dif- 3-446, 110.120 mc. Receives and transmits a modulated RF carrier which is gen- 3-707, 450 -600 mc. Receiver Sensitivity: 3 Mod- erated receiver. Has 110 and 220 volt plug. No. 64: AMPLIFIER. MC. 3-446, 110.120 mc. Receives and transmits data. Excel. cond. Weight 14 lbs. $3.95

APL-13 UHF TRANSMITTER-RECEIVER
Free field and Frequency modulation unit with IF amplifiers. Complete with RF, IF, and P. F., sections. Output power 1000 watts, tube size, weight and size, complete with tubes, exc. cond., weight 14 lbs. $16.75

APS -13 SPECIAL TELEVISION TRANSMITTER-RECEIVER
FL-8, FL-240. Double-conversion receiver. Complete with IF amplifier. Has 110 and 220 volt plug. 5.5 volt rectifier. Has selectivity tuning unit. Isolating line transformer. Has no tubes. Two video tubes. Freq. ranges 195. 730, 375 and 1.200 mc. Has 200 to 500 volt power supply. Complete with tubes. Has very little difference in performance as the damping factor is changed. $5.95

The circuit described in this article will prove that a good loudspeaker sounds very little difference in performance due to damping factor at all, but due to the effect of the control on frequency response.

Loudspeaker Distortion

Finally, a claim made in respect to variable damping, particularly as it is termed ultimate damping, needs clarifying: that ultimate damping eliminates distortion due to the loudspeaker. Mr. Hafer's article tackled this in some measure, but there are further aspects he did not cover.

The most obvious source of this kind of distortion in the cheaper loudspeakers is the nonlinear distribution of the magnetic flux in the air gap through which the voice coils travel. This nonlinearity means that the same current will not produce the same driving force on the diaphragm at different positions in the air gap. Consequently a sinusoidal driving current will not produce a sinusoidal driving force applied to the diaphragm and the diaphragm will not move with true sinusoidal motion.

Let us assume, however, that the diaphragm does move faithfully according to the driving force applied to it, although not sinusoidally: because the movement of the voice coil is in the same nonlinear magnetic flux which is producing the driving force, the back e.m.f. induced in the voice coil will be subject to the same nonlinear influence; and the two effects will cancel, so the back e.m.f. produced by the voice coil will still be sinusoidal. This means that any amplifier can possibly have any means of telling, through ultimate damping or any other kind of device, that the voice coil is not moving in an undistorted fashion. Such distortion cannot possibly be eliminated by any purely electrical means.

Mr. Hafer's comments relative to nonlinear motion due to other causes, such as nonlinear compliance of the cone edges, will apply in respect to the restoring force produced by feedback—the effect just described only complicates matters a little further, and shows that any form of damping control circuit can produce all kinds of effects on distortion originating in the loudspeaker itself.

By far the safer approach is to get a good design of loudspeaker, in which distortion has been reduced to the minimum to start with, and forget about trying to improve the loudspeaker's distortion by means of the amplifier.

REPAIRING TV TUNER CONTACT SPRINGS

By H. E. HERMAN

SHOWN in Fig. 1 is a method of repair- ing the contact springs used in turn- type television receiver tuners. These contacts, being made of brass, lose their springiness with repeated use, flattening out and causing poor contact between the slug contacts on the drum of the tuner and the rest of the circuit.

To effect a lasting repair, insert a piece of polyurethane spaghetti tubing, 1/4 inch in diameter, through the center of the spring contacts after the latter have been brought back to normal shape with long-nose pliers. The spaghetti tubing prevents the contact springs from flattening out again.

If any of the contact springs are found to be broken, the entire contact plate should be replaced and the spaghettii inserted through the contact springs before installation.

It is good practice to remove all unused channel slugs so that the springs can "stretch" between channels.
WHILE looking through some collected junk recently, the author unearthed the device shown in Figs. 1 and 2. A friendly radio oldtimer explained that this device was used to check the speed of turntables in the long gone days of single-speed players.

This ancestor of the present-day strobe-scope disc operates by the centrifugal force created by spinning a weight mounted on one end of a pointer about a central axis. At a certain speed the weight will move a certain distance.

This moves the horizontal indicator or pointer down until it aligns itself with a fixed point over the axis of the circle. When it is in perfect alignment the table is going at the correct speed of 78 rpm. When the moving indicator is above the fixed point the table is slow and when it is below the table is fast.

This device could be expanded to operate on three-speed turntables but it certainly would clutter up a service kit.

There are less involved ways of handling this little chore!

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**PLATT ELECTRONICS ANNOUNCES**

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PHONE: FLoral Park 2-4087

We would like to express our appreciation to our many customers and friends who have made this expansion possible. Be sure to watch our next ad for the best buys ever! Or better still, why not pay us a visit at our new home.

**HOW TO GET TO NEW PLATT HEADQUARTERS**

BY L. I. RAILROAD—34th St. Pennsylvania Station to New Hyde Park Station. Short taxi ride to building.

BY AUTOMOBILE—34th St. Midtown Tunnel to Queens Blvd., turn right to Grand Central Parkway, turn left to Cross Island Parkway, turn right to Jericho Turnpike. Proceed to Lakeville Road, turn left 1 block to No. 141.

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Supreme TV manuals have all needed service material on every popular TV set of every important make. These books are helpful, practical, factor-prepared data that will really make TV servicing and adjustment easy for you. Only low-priced manual for each year from 1947 to 1955. These giant TV manuals have complete circuits, alignment facts, test patterns, response curves, service hints, all recommended changes, voltage charts, waveforms, and many double-page diagram blueprints.

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IMPROVED TRANSISTORS ANNOUNCED BY G-E

Versatile component's usefulness extended by new process which increases the frequency range, improves performance.

T HE Electronics Division of General Electric Company has announced the development of a revolutionary new method of producing the crystal "hearts" of transistors.

The transistors are now being produced by the new "meltback" process which enables them to operate efficiently at frequencies five times higher than ordinary transistors. At these high frequencies, according to the company, these new transistors show greatly improved power-amplification characteristics.

Developer of the new "meltback" principle is Dr. Robert N. Hall, the young G-E scientist who also developed the well-known "rate-growing" process for making junction transistors.

"Meltback," significantly improves the control of impurities in the thin layers of germanium or silicon crystals from which transistors are made. These crystals are smaller than a grain of wheat, and some layers must be as thin as 1/5000th of an inch for satisfactory performance at high frequencies.

In previous processes, crystals were formed from a pool of molten metal, and the layers created by cycling the rate of growth. Scientists have been faced with the problem of keeping materials in different layers from contaminating each other during the 20 minutes it takes the molten mass to solidify and cool to room temperature. This has meant thicker separating layers than are desirable for high-frequency use. In the new process, cooling time is greatly shortened, there is less mixing between layers, and the layers therefore can be thinner. Thin layers allow electrons to travel more quickly from one side of the crystal to the other, thus increasing the frequency at which the transistor can operate.

Commercial methods previously available for making transistors involved the production of cigar-sized crystals of germanium or silicon and cutting them into thousands of tiny pieces. The new method uses thin, wire-like crystals and because of the reduced cross-section, the melting back is accomplished quickly and cooling takes place in less than a second. Thus the entire cycle of melting, cooling, and removal of the finished pellet takes only a fraction of a minute.

These new units were developed by the company's Schenectady laboratory and can be used in TV, radar, short-wave radio, and other electronic devices for high-frequency use.
disconnected until the defect can be remedied.

The remedy for heavy primary cell flow is a shipyard operation, since the boat must be hauled out for underwater inspection. If the action has been taking place for long, etching on the affected parts will be visible to the eye. Sometimes, zinc "protector" plates, due to their increased susceptibility, could cause a heavy ground current, donating themselves to the action without any great loss in nearby fittings. Dissolution of "protectors" is normal, and indicative of their functioning in the manner intended.

If excessive primary ground current is measured, and no rapid etching is readily apparent, comparatively base, and therefore dangerous, fittings can be detected by testing with the setup of Fig. 1 while the boat is out of the water. Moisten the two sponges with salt water; press one to the ground plate and the other to the various fittings on the hull. By maintaining pressure, area of contact, and the cleanliness and moisture content of the sponges at a standard level, dangerously active metals can be spotted. The safest course is to remove any offending hardware before it drops off of its own accord at a very inconvenient time.

Primary-cell electrolysis usually takes months to advance to a serious stage but electrolysis due to the external application of a voltage between fittings can destroy a fitting in an hour! This dangerous condition occurs from the "cross grounding" of shipboard electrical equipment.

Usually, one side of the battery is grounded in the small-boat electrical system. Now, if some other device such as a radio connected to a ground plate or to a guy-wire antenna, is connected with the opposite polarity grounded, full battery e.m.f. appears between the engine ground (sea fittings, propeller and shaft, and bilge water) and the second grounded object. Current flow in anempees is common, and the positively-grounded end of the underwater circuit will disappear in a distressingly short time.

Equipment should never be cross connected, even if it does not require grounding. Too many times, a chassis or framework is accidentally grounded.

Fig. 1. Setup for detecting electrolysis paths between boat fittings. Sat-urate the sponges with salt water and apply to the underwater metal parts.

August, 1955
A TERRIFIC BUY!

**TS-100/3P 'SCOPE**
One of the most sensational values ever offered! Circular sweep, rate 1.6 microseconds per inch. Linear sweep, rates 12, 120, and 860 microseconds per inch. Sweep is contained in metal case (Continued from page 117). $34.50

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Fixed Capacitors

(Continued from page 36)

between two plates submerged in an electrolyte, a thin film will form on one side of the positive plate. This film is the dielectric. In actual manufacture, the electrolytic film is formed under high current conditions and then the unit is enclosed. Because the electrolytic film is so thin it is possible to roll long pieces of aluminum foil into relatively small cans and obtain large capacities. On the other hand, application of the electrolytic film at which points breakdown or internal arcing occurs. Once such a minute hole exists, the defect spreads and the capacitor usually goes bad.

There are other types of capacitor failure. Excessive shelf time or heat can cause the electrolyte to deteriorate so that the leakage between the two terminals becomes appreciable. Occasionally, the seal is not perfect and the electrolyte leaks out.

Fig. 12 shows some familiar types of electrolytics used in home instruments as well as commercial gear. The aluminum can, cardboard tube, and small metal tube units all operate on the electrolytic film principle. While some types use a liquid electrolyte, most electrolytic capacitors contain a paste or semi-dry material. For commercial equipment and government use plug-in type dry electrolytics are available which can be fitted into a regular octal socket. The use of plug-ins permits rapid replacement in case of failure.

Referring again to Fig. 1, the electrolytic capacitor suffers from a relatively large leakage, meaning a lowered shunt resistance, and also a high series inductance. In general, where two capacitors are used in a filter or for bypassing at frequencies higher than 10 kc, a small value paper capacitor should be shunted across the electrolytic to reduce the series inductance.
Sometimes, when replacing an electrolytic in a radio or TV set, the mounting tabs can not be bent back properly because solder has been applied. Heating the chassis in the area of the capacitor with a soldering iron will melt the solder sufficiently to permit straightening the tabs and removing the unit properly.

New electrolytic capacitor without observing the polarity. Be especially careful when using an electrolytic as a coupling capacitor for low frequency signals. A typical instance is in the output of a cathode follower where the cathode is positive and the positive terminal of the electrolytic must be connected there. A unit having a deformed can is likely to be defective or else will go bad soon. Excessive shelf life should be avoided. Heat destroys the electrolytic even faster when the capacitor is not used.

Occasionally, capacitors can be reformed when their leakage appears high. Simply connect across a high current source with about 1/2 of its rated voltage. A typical 40 μA, 450 volt unit can sometimes be reformed with 250 volts and 300 milliamperes applied for a few hours. The current will be greatly reduced after a short time when the film has formed again. If there is no change after a half hour the capacitor cannot be salvaged.

There are many other types of capacitors in use for special applications and many new varieties are being developed constantly. Typically of the new types is the mica glass-seal capacitor currently being introduced by Coming Glass. Other new types are the "Mylar" dielectric units and the tantalylite subminiature units permitting large capacity at low voltage in a very small space.

Components for the electronic equipment of tomorrow will be somewhat different from the capacitors and resistors we know today just as the parts used years ago are only rarely found in the sets now in use.

### HARVARD RADIO SYSTEM

**Peter Schneider**, chief engineer of Station WHRM, Harvard Radio Broadcasting Company, Inc., Cambridge, Mass., has written to say that Harvard's campus station serves a potential audience of 7000 and at times 3500 or so actual listeners.

Mr. Schneider points out that Purdue ("Campus Carrier-Current System," May, 1955) is not the only station to tie in its off-campus houses. Harvard has one in Lincoln House in Boston. It is several miles away and it is reported that Brown and Pennsylvania have, to a greater extent, tied in numerous fraternity houses with the campus signals.

He points out that this conflict in information is due, in part, to the fact that Purdue and Harvard belong to different and independent groups which do not communicate freely with each other.

From this and other letters we have received, it is implied that campus stations are really "big business."

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### TUBES PREMIER Unconditionally Guarantees ALL Tubes For One Full Year

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**10 for $7.50**

**TALK O' RADIO CONVERTER KIT**

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**TAPE DECK**

See ad in next month's issue.

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**TRI-STATE COLLEGE**

1685 College Avenue, Angola, Indiana
Hi-Fi Control Amplifier

(Continued from page 51)

pansion and compression, hence the circuit function is called “expression.”

The principle of operation is quite easily understood. A signal amplifier stage makes use of a remote cut-off, variable-mu tube. This tube characteristic is due to a special restriction of the grid. Very little stage gain is needed, so the tube is triode-connected by joining together the plate, suppressor, and screen. A rather stiff fixed-bias is supplied to the cathode from the voltage divider. Under these conditions, the tube (which is a 6SK7, incidentally) will act as a conventional low-gain audio amplifier.

To obtain the “expression” effects, an additional bias voltage is applied to the grid of the preamp. This bias varies in direct accordance with the signal, thereby changing the stage gain as a function of the applied signal. This control bias is generated by the remaining two tubes of the “expression” stage.

In addition to feeding the 6SK7 signal amplifier, the signal input is also applied to the 6SG7 side amplifier. This pentode operates as a high-gain stage to amplify the signal, which is then connected to a triode 6EF6 rectifier. The amplified signal is fed to the plate of one section and to the cathode of the other section of the 6H6. The remaining plate and cathode connect to the extremities of a center-tapped potentiometer, with the tap grounded. The signal is rectified by the triode diode, while the potentiometer allows selection of the resulting positive and negative voltage used as d.c. control bias for the 6SK7 tube. Positive bias counteracts some of the initial fixed bias, increasing the stage gain to provide expansion. Naturally, the negative control bias is responsible for compression when desired. The degree of expansion or compression is determined by the setting of the control arm, or the effect can be removed completely at the midsetting of the potentiometer. At this setting, no control bias will be fed to the 6SK7 stage.

The RC values in the control bias circuits are such that the bias follows the generator rather than the audio itself. The time constants of the circuit are rather critical and are best chosen by careful listening tests. The attack or “build-up” time is determined largely by \( R_a \) and \( C_b \), while the release or “fall-off” time is determined by \( R_m \) and \( C_m \) as well. The values indicated have been found suitable for the usual program material.

In addition to the phonograph equalization already covered, it is desirable to have control over the bass and treble portions of the audio spectrum, to adjust the response for room acoustics, speaker types and, of course, listener preferences. Both boost and cut are required at each end of the range, with independent control, so dual tone controls are needed. Boegli has discussed fully the degenerative-type tone control in the June, 1951 issue of Radio & Television News, and in fact has patented it in his “Improved Kappler Amplifier” which appeared in the October, 1953 issue of this magazine.

A degenerative tone control, with dual potentiometers utilizing Thordarson components, is included in this control amplifier. The circuit has been well covered in the literature, and will not be repeated here. Suffice it to say that 16 db boost to 28 db attenuation at 60 cycles is possible, and 18 db boost or 35 db cut at 10 kc is attained. At the midpoints, the frequencies the stage operates with unity gain from the half 6SL7 used in the control stage. This results in approximately one to two volts r.m.s. output at this point. The master gain control is provided after this control in order to improve the signal-to-noise ratio of the degenerative circuit.

Although miniature equivalents are available, metal tube were used in the control amplifier with the exception, of course, of a glass 6SL7 output tube. Metal tubes were considered more desirable because they have, in general, proved to be less microphonic, longer lived, less subject to gas troubles, and are shielded inherently.

The conclusion of the compression action may be questioned by some readers. As stated, expansion of the dynamic range is the logical use of the “expressor” for playback purposes. However, this control amplifier is occasionally used to feed a disc recorder, and for this mode of operation the compression is advantageous. It may also find application as an automatic volume control for late night listening or for background music when full dynamic range may be undesirable. However, such operation is definitely not to be misconstrued as “high fidelity” playback.

Construction

The complete control amplifier, as described, is a complete amplifier for development work. Reference to the photographs will show how this unit was built. A 13 x 5 x 3 inch aluminum chassis was used, attached to a 3/4 x 19 inch rack panel. Symmetrically spaced along the back side of the chassis are the tubes and controls. These are arranged in the order of their appearance in the circuit, i.e., 6S37, 6SK7, 6SG7, 6H6, choke, 6SL7. Four RCA phono connectors are used for the inputs, located on the front panel end of the chassis. A similar connector for the output, as well as a four-prong power connector occupies the opposite chassis end. Controls on the front panel are (from left to right): input selector switch, master gain control, expression potentiometer, treble control, and bass control.

Both the input and output strips are attached along the center of the open area between front and rear panels. No separate power lead is required. The chassis was also designed to accept a standard "N" pin plug for connection to the lamp circuits. The general layout of this unit was discussed in the August, 1951 issue of Radio & Television News. The circuit is not based on the Thordarson tone control, but the layout is one which could be adapted.
edges of the chassis. Most components going to ground are wired directly to the associated sockets, while the terminal boards support interstage coupling capacitors, plate resistors, decoupling networks, and the like. Parts placement is not too critical, although layout is directed toward short leads as much as possible. Shielded wire is used for the volume control and tone choke leads.

Operation

A few comments on operation of the control unit may be in order. Power for the unit is obtained from the power amplifier. Approximately 250-300 volts should be supplied, as well as 6.3 volts a.c. for the filaments. Current drain is low and no motorboating has been encountered with the usual well-decoupled supply. The tone control choke can pick up hum from power transformers or turntable motors, so it is advisable to keep it isolated from strong a.c. fields.

As previously mentioned, amplifier input levels should be correct for the proper "expressor" operation. Signals at the selector switch should be 0.2 to 0.5 volt, while at the phono pickup jack a voltage of at least 0.01 volt is required. Voltages less than these values will be insufficient to create enough control bias for maximum expansion. On the other hand, voltages in excess of the stated amounts may create such a great bias that distortion can be caused at extreme settings of the expression control.

Proper input levels can generally be obtained by use of the volume controls in the tuners and tape recorder, or the inputs may be padded down to the correct value. Alternatively, level-setting potentiometers could be incorporated into the control amplifier itself, if so desired.

With input levels of the required values, a maximum control bias of five to eight volts should be developed on peaks, which will act against the tone-volt fixed bias on the 6SK7. This will produce more than usable amounts of expansion without driving the grid positive. Likewise, the same amounts of additional negative bias are available for compression. It is quite possible to adjust the compression bias to produce a constant peak level at the output. This particular a.g.c. action might be of interest to hams, since much can be said in favor of compression rather than peak clipping for automatic modulation control for amateur transmitters.

The finished control unit has been more than satisfactory in its intended operation, and very definitely serves to increase the "presence" in reproduction of recorded program material. Most listeners have considered the expansion a desirable addition to the home audio system.

While this control unit might appear to be a rather elaborate unit—most audiophiles will agree that it's worth the time and trouble involved in its construction.——
COMPLETE TRAINING FOR BETTER RADIO-TV SERVICE JOBS

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

OUR biggest problem," a TV service businessman said recently, "is not in getting technicians capable of repairing sets. It is in finding men who are competent to deal with customers."

In another city, where receiving tube sales through drug stores are hurting the TV service business, one of the service reports added, "We needed a new salesman who could handle large hook-up orders."

"This development is part of the price we are going to have to pay for the thoughtless ways we have handled TV service customers in the past.

"We have dashed into homes," he continued, "quickly replaced one or two tubes which experience indicated were probably the reason for the set's failure, turned on the set and found it OK, collected $8.75 for the work ($5.00 for the service call and $3.75 for the tube), and hurried on to the next call. The total amount of time it required was probably less than fifteen minutes. We used no test instruments and did nothing to indicate to the customer that we were using profound knowledge in working on a highly complex piece of equipment.

"Our major objective was to complete as many service calls during the day as we could. We gave no thought to the customer's reaction to the apparently simple and easy way the set was fixed. That $8.75 paid her was important money to her and no doubt, she burned inwardly over having to pay so much for so little.

"After set owners discover that, in three out of every four times their sets need servicing, all that is needed is to replace a tube, they are apt to expect that every time something is wrong they will have to replace tubes."

"Most of the troubles of the TV service industry are due to our own carelessness and negligence. We need to study and understand the fundamentals of good customer relations and use them in every contact with our service customers."

"Most people are put out when they do have to buy service."

"An effective customer relations program starts at the telephone where service calls are received, and it is continued in all contacts with the customer in person, by phone, and by mail. Electronic servicing is not a technical business—it is a sales business."

"Good customer relations include the studied use of subtle showmanship, particularly in servicing sets in the home. Neat, attractive uniforms, a pleasant demeanor under the most exacting conditions, and a neat appearance are essential parts of studied showmanship. The regular use of complex looking test instruments, whether or not they are needed to locate the trouble, is excellent showmanship. The customer may think her TV set is a simple device, but she will have a feeling of respect for the man who knows how to use those, to her, mysterious looking gadgets.

"One can learn a lot about customer relations by listening to set owners talk about their experiences with TV technicians. Recently a visitor to your editor's office noticed a picture of a v.t.v.m. lying on a table. "My TV service technician uses one of these," she said. "The first man we called when our set needed service changed a tube and told us it was a $6.50 job. We told him the trouble was a burned-in tube and he replaced it for $1.25. He was a little man."

"The second man who was called brought a little machine like that with him and made all kinds of tests on our set. Since then we have always called him because he knows what he is doing."

"Cautious inquiry brought forth the names of the two men involved. The first one is a top-flight, "natural" electronics technician. He is an unusually competent circuit analyst who can spot the cause of a circuit failure quickly and apparently without effort. He is now out of business."

"The second man is the "plugger" type. He uses test instruments regularly because he needs the information they develop on the average service job. Unknowingly, he used good showmanship. He has built up an excellent business with loyal customers."

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A complete guide to the practical methods. For the beginner, it is a comprehensive training course. For the experienced serviceman, it provides the "brush up" on specific jobs, to develop improved technique or to find new approaches to servicing problems. Includes invaluable "step-by-step" service charts, 225 pages, 551 Illus., price $12.50 separately. (Ghirardi U.S.A. $7.25)

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A complete guide to troubleshooting methods. Fully illustrated. (Price $10.25—Mail order $7.75)

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In today's market, the first man, the "natural" technician, is too smart for his own good. He makes electronic service look too simple and easy. His customers do not think his services are worth the money that he charges for them.

To the service technician, technical "know-how" is important from a production standpoint. In the customer's eyes, it is the technician's dress, bearing, and what he does and says that determines whether he will be called the next time service is needed.

A warm, friendly voice to greet customers when they phone for service is one of the most important elements in building a following of loyal customers. Many service operators fail to realize the importance of this element in service business operation. A girl with a good telephone personality can pave the way for pleasant contacts for home service technicians. Properly coached on all of the information that is needed for efficient routing, she will get enough information about the location to make it easy for a technician to find the home without trouble. In short, a competent girl with a good telephone personality can help build a service business.

Cooperation

The nature of an independent service business is such that it is a rugged, individualistic activity. It uses parts, supplies, and equipment made by hundreds of manufacturers, and it services products made by hundreds of other manufacturers. There is no close liaison between an independent service business and one or even a small number of manufacturers.

Parts distributors on the whole do not concern themselves with the welfare of the legitimate service businesses in their trade areas. Although parts distributors have benefited greatly from the cooperation of their suppliers in building their businesses, few of them have realized the long-range insurance value in helping their customers—the independent service business—in building a healthier atmosphere for service in their communities.

These factors have led service businessmen to form service associations as a means of pooling their efforts to publicize their shops as honestly operated, competent service businesses. In some areas, associations have been highly successful in keeping their cities comparatively free from unethical and "gyp" service companies. This is especially true where association officers have been able and willing to devote a lot of their time to the planning and carrying out of programs and activities.

In our present economy, the independent business operator, working alone, wages a losing battle against the various forces that constantly threaten to change the character of the business. In service work, it usually is the activities of "gyps" who make easy conscience who play havoc with the ethically operated service business.

One of a series on what makes one magnetic recording tape better than another

Let's look at Soundcraft PLUS 50

50% Extra Playing Time Extra Strength Mylar® Base

Full Depth Oxide Micro-Polished®

Lubricated Both Sides... YET COSTS NO MORE!

PLUS 50 Magnetic Recording Tape—newest in the famous Soundcraft line—brings you a combination of superior qualities that no other tape possesses. Qualities that let you capture and hear the true sense of violin strings, all the brilliance of brass, the color of wood winds... that faithfully echo the human voice in all its varied subtleties.

Plus 50's uniform output, inherently low signal-to-noise ratio, its 50% extra playing time, added strength and flexibility... its dimensional stability in any climate. These are the special qualities that make it the choice of professionals and amateurs, alike, wherever tape recording perfection is required.

And Soundcraft Plus 50 adds this special bonus: Its "Mylar®" base assures virtually a lifetime of smooth, trouble-free service—at no more cost per foot than other quality tapes. Like Soundcraft "Red Diamond" Tape, Plus 50 is engineered and made by tape recording specialists. Get some at your dealer today.

*Trade-Mark for DuPont Polyester Film

The tape that has EVERYTHING!

For Every Sound Reason

REEVES SOUNDCRAFT CORP.
Dept. U 8, 10 East 52nd St., New York 22, N.Y.
For instance, the man that advertises home service calls at $1.50 or $2.00 and makes up the difference in inflated tube and parts charges, poses a real threat to the businesses that honestly charge each element of their service fees at their true values.

Many need to advertise low service charges and make up the difference in padded parts bills, defend their actions by claiming their total bills are no larger than those of shops that make a legitimate labor charge and get list prices for the tubes and parts needed to effect the repair. But many fail to realize that one dishonest act leads to another and that sooner or later, when they need money badly, they will start charging on the basis of "all the traffic will bear." Records of service shop failures indicate that the easy-con science operators lead the mortality parade.

When service dealers in Indianapolis found that some low-cost service advertisers were charging two and three times their regular service charges for replacement tubes, the Indianapolis Television Technicians Association employed a professional advertising agency to prepare a mailing piece for them that included the average list prices of the most commonly used receiving-type tubes. These attractive folders carried copy about the ITTA and what it stands for. Members bought varying quantities of these folders, imprinted with their individual names and telephone numbers for distribution in their servicing areas.

With these tube price sheets in the hands of thousands of TV set owners, any service technician who attempts to charge more than regular list for tubes might find himself in the tough spot of trying to defend his charges to a "price-wise"-set owner.

This type of action is only possible when a number of ethical service businessmen pool their efforts to fight for the mutual protection. While an individual service business man could do it on a small scale, the limited coverage he would achieve would not have the impact necessary for the plan to be effective.

Regional and national public relations programs have not been possible because the memberships of present associations have been unable to finance programs of that magnitude. It would be possible to put over a tremendous national campaign of interests of independent service shops if there was some way to get all ethically operated service businesses to participate in it. The cost-per-business would be very, very low.

Although the country is said to be going through a period of unusual prosperity, independent service shops generally have not been sharing in it. Service work has been far below par since the first of the year. This situation has in cooperation through association, with the result that dozens of new associations have been formed since the first of the year.

During this period, service attention has been focused sharply on the numerous factors that have been instrumental in bringing about the present highly unstable membership of his independent electronic servicing industry. The feelings of thousands of service shop operators were crystallized recently by Murray Barlowe, president of the Radio Television Guild of Long Island.

Writing to the membership of his organization in a hard-hitting, down-to-earth analysis of the problem facing his and other groups, Mr. Barlowe had this to say:

"In that competition, bait advertising, licensing, distributors' over-the-counter sales to consumers, and competent and ethical personnel leaving the profession, allowing the incompetent and opportunists to take over.

"Does this sound like the description of a healthy, up and coming young industry, where the dollar volume has reached new peaks (the predictions for '55 are staggering)—an industry that stands now on the threshold of a new era, color TV? Or does it sound more like the industry whose outward growth knows no bounds, but whose innards are slowly but surely being destroyed by an internal, cancerous growth?"

"Had public relations, cut-throat competition, bait advertising—these are the ingredients that have been poured into the pot over the years. Many of these were provided by the service technician himself, in his blind, disorganized approach to the problems that confront him. Where do we go from here? Where, in addition, the compensation that should be ours as members of a new and vital profession?"

"Let's step back and take a long look at ourselves. Many of us have been in this electronics business a long time. Many of us have spent long years at different schools learning this business. Quite a few of us have college backgrounds. We have a good sized investment in expensive equipment and parts. We still attend technical meetings regularly to keep abreast of the new developments. Why shouldn't our profession acquire its true stature as a respected element of the industry? The answer to this is simply:

"We are not organized!"

"We are too busy being 'small' men, fighting among ourselves. We have hundreds of small service associations throughout the country, instead of one 'American Television Association.' We have local chapters. We have too many personality clashes and too much petty jealousy which prevents us from joining together for our mutual objectives. We do not know who are our friends and we all know what we want. Lastly, we are afraid that we might get lost in the shuffle that would ensue in the formation of a new and powerful national group."

"We recognize the situation as it exists; let's read the handwriting on the wall; let's make this a worthwhile profession, where there is room for the competent and the ethical, rather than the present chaos that exists, where
August, 1955

the attraction and the rewards are greater for the shapy operator. And let's do it before the Color Era, or it will be too late!!

Summer Business

While the subject of organization for mutual help and protection receives the attention of a growing number of service businessmen, the immediate problem of getting a big enough volume of business to tide them through the summer months is of top concern to most business operators. The light volume of business during the winter and spring months prevented many service shop operators from building up the needed reserves to carry them through the summer. This makes it mandatory to keep harvesting hard for business throughout summer months.

While the larger TV service businesses have turned to air conditioner installation and maintenance as a summertime business cushion, smaller shops have taken a new look at the volume possibilities in servicing AM radios, battery-operated portables, and radio-phonographs. One TV service operator who was swamped with AM radio repair business when he ran a "special" last year claimed that radio service was far more profitable than TV service when the shop was geared up to handle it.

In the south, room air conditioners are changing the complexion of the TV service business in many areas. On hot nights people prefer to stay in their comfortably conditioned homes rather than drive around on crowded highways to stir up a breeze. The result is that TV service volume stays at a profitable level throughout the summer months. Perhaps it would increase if broadcasters kept top-flight shows going on the air throughout the summer months.

A fertile field for exploitation during the summer months is the maintenance and replacement of outdoor antennas. Many shops have discovered the possibility of fill-in volume by offering summertime inspections of outdoor antenna installations at special prices. Their sales of new antennas and replacement parts and accessories make this kind of a promotion worthwhile.

In offering an antenna check-up as a summer special, the service operator should do in outline in detail what the special consists of. Several years ago, TTLB editors prepared a step-by-step plan for a thorough antenna check-up program. Details of this plan may be obtained by sending a stamped, addressed envelope to: TTLB Special Services Dept., P. O. Box 1321, Indianapolis 6, Indiana, and requesting the "Antenna Check-up Plan."

Radio-controlled garage door mechanisms offer a new field for summertime business. Promotion-minded service shop operators can capture a lot of interest with dual promotions of radio controls for garage doors and their facilities for handling radio-TV service.

www.americanradiohistory.com
Headlight Dimmer (Continued from page 57)

the second-stage collector current, releasing the relay. However, when light strikes the photocell, the first stage goes toward a cut-off condition, and therefore the collector current of the second stage increases, and the relay is thrown on, dimming the lights. R₁ is made variable as a sensitivity adjustment. R₂, which together with R₁ comprise the base resistor for the second stage, protects the second transistor from burning out in case R₃ turned too low.

Another box housing the diode CR₁, which is biased backwards, does not affect the operation a bit at low photocell currents, but tends to limit the current at higher illumination levels. It is provided to lengthen the life of battery B, but can be omitted if desired. With it in the circuit, this battery will last close to its normal shelf life, despite the fact that it is conducting current 24 hours a day. Including a switch to shut off this battery when the unit is not in operation proved impractical, due to the long life of the battery.

Construction of the optical system, including the mounting of the photosensitive cell and lens, depends, of course, on the lens used, and the space available for mounting. Fig. 1 shows the author's unit, with one side panel removed, mounted on the front of his truck. Satisfactory results have been obtained mounting the same arrangement behind automobile grilles. A pattern typical of that produced by headlights is shown hitting the photocell at the rear of the plywood box. The best angle of tilt for the lens and spacing between lens and photocell is determined by experiment, keeping in mind the elongated pattern desired, and the light intensity. A small box housing the lens and photocell should have one side panel removable for final adjustments.

The photocell is most simply mounted by forcing it into a quarter-inch hole in the rear of the cabinet. The main job is to mount the transistor battery, the relay, transistors, resistors, and controls was mounted under the dashboard, as shown in Fig. 2, and wires run from this box to the photocell, and to the headlight circuit. Fig. 6 shows the layout of the central box. The wiring is straightforward, except that the transistors were adapted to fit into sockets, instead of being wired permanently into place. Soldering transistors is likely to overheat the junctions, leaving spots of impurities, on which transistor operation depends, diffuse from one element to another, thus ruining the standard. The leads are rather fragile anyway, and the best arrangement is to use transistor sockets. Pins 2 and 4 are pulled out of the socket, and one end is painted red to correspond to the red dot on the transistor next to the collector lead. The transistor leads are cut to about a quarter of an inch, with the base lead left slightly longer. The two transistor sockets fit snugly into one side of a power transformer mounting bracket, neatly and compactly.

The final adjustment of the position of the lens-photocell arrangement is essential. The easiest procedure is to park just off the side of a busy, straight, level highway some night, and remove the panel from one side of the box, so that the photocell is visible. Adjust the vertical tilt of the box so that the images of the passing head-lights and tail-lights go through the photocell. Then adjust the aim so that incoming cars about 1000 to 1200 feet away illuminate the photocell. Two or three adjustments may be necessary for this, each time testing it by driving. Only actual road-testing is reliable for this adjustment. Incidentally, it is a good idea while making this adjustment to have an indicator light of some sort to tell when the relay is on. Rather than run the lights of the unit actually dim the headlight.

The unit should operate pretty satisfactorily, dimming for cars about 600 feet away or so. Once in a while a car with dim head-lights, or with one burned out or out of adjustment, will get within 400 feet before tripping the relay. The relay differential not only delays re-brightening, but also holds the lights dim for a car just outside the sensitivity range. Both these features are desirable. In addition, operation in towns at night generally dims the lights because of the bright background illumination. Brightly-lighted highways and tunnels often dim the lights, too, so expect such operation.

The unit can be "fooled" under some circumstances. Cars coming around a curve sometimes don't hit the photocell until too late. A street light just visible over the top of a hill looks for all the world like a human eye, and the unit will fire on this. However, it does not seem to be sensitive to roadside signs, partly because most of them are neon, and the photocell is not too sensitive to red or yellow light. There are other situations where manual control is necessary or desirable: for instance, following another car too closely puts the lens in a shadow, and the unit will not work. Most states require dimming of lights while approaching an intersection, specifying certain distances, usually 400-600 feet. Commercial automatic headlight dimmers which satisfy this requirement cost anywhere upwards of fifty dollars, and the experimenter can build the unit described here for less than twenty dollars.

Needless to say, the builder can "dress up" his unit in any way he sees fit—making it match his paint job or contrast, according to his taste. The author's unit was used on his truck, no elaborate decorative schemes were deemed necessary but it would be a good idea to allow the device to "fade into the background" by a neat job of camouflage.
Capacitance Bridge
(Continued from page 82)

bration for each range. It was found, however, that it was possible to get adequate accuracy using ordinary ten per-cent tolerance resistors by checking through a batch of the required values with an ohmmeter. One can alternatively correct available resistors to the desired value by adding more resistance in either shunt or series. It is not necessary to use a bridge to select the correct parts, but the ohmmeter must be used as carefully and accurately as possible.

The balance arm potentiometer can be any reliable make with a linear taper.

The signal source for the bridge consists of an ordinary flashlight cell and a small audio output transformer. The battery is connected in series with a switch in the low impedance side of the transformer and the two remaining leads are fed to the bridge. Each time the switch is tapped, a click will be heard in the earphones. In use, the bridge is then adjusted for minimum volume.

The switch, of course, is a luxury and could be easily replaced by a simple probe arrangement. If a switch is used, it should be one that makes very little noise in operation as a mechanically noisy switch can be very annoying when the exact null is approached. A dime store push-button worked very well.

If the standard capacitor C1 and the five range resistors have been accurately chosen, it will be necessary to calibrate the bridge on only one range. This can be done very easily with an ohmmeter as follows: Connect the ohmmeter across Rs. Starting from zero resistance, turn Rs to the maximum position marking off each increase of 10,000 ohms on the dial face. The first mark is numbered one, the second two, and so forth up to ten. With S1 in the 100-ohm position, these marks will correspond to capacities of .1 µfd, .2 µfd, etc. When S1 is in the 1000-ohm position, the marks will indicate capacities of .01 µfd through .1 µfd. The other switch positions follow the same pattern, and multiply the dial reading by factors of .001, .0001, and .00001.

This method will be inadequate if the bridge components are not fairly exact, and it may be necessary in such a case to calibrate the dial separately on each range with capacitors of known value.

The parts layout is unimportant and can be arranged to suit one's taste. The author used a standard 3 x 4 x 5 inch metal box as a cabinet and dressed it up with a dime store handle. The dials are cardboard cemented to the panel and covered with plastic tape.

For the cash and energy expended, this bridge is a very rewarding construction project.
Don’t just say “capacitors”  
Ask For Sprague By Catalog Number

Know what you’re getting... get exactly what you want. Don’t be vague... insist on Sprague. Use complete radio-TV service catalog, C-610, for Sprague Products Company, 51 Marshall Street, North Adams, Massachusetts.

New Designs

AN INTERESTING sidelight on television receiver development is that circuit design has always been held back by the lack of tubes which would enable designers to achieve a maximum possible performance in a minimum number of stages. Within recent months, however, a number of modifications have been made in existing tubes which will render them more suitable for television receiver operation. The tubes have been strengthened mechanically while the electrical characteristics have been upgraded. The 6SN7-GT is a good illustration of the changes which have been made. This tube is the third in a line that started with the 6SN7-GT, proceeded through the 6SN7-GTA and is now at the newly released 6SN7-GTBA. Actually, the main difference between the A and B versions is the controlled heater warm-up time of the latter tube. Series heater operation has always been attractive to set designers because it permits them to eliminate the expensive power transformer. However, with conventional tubes, not all heaters reach operating temperature at the same time. This will cause temporary shifts in the distribution of the applied line voltage with the tubes having the shortest warm-up time developing higher instantaneous voltages than the tubes which take a longer time to warm up. As a result of these voltage stresses, tubes were found to fail quite frequently. By constructing tubes so that all those possessing similar voltage and current ratings had the same warm-up characteristics, the extent of the initial voltage and current surges were minimized and failure from this source was reduced.

The difference between the 6SN7-GT on the one hand and its A and B versions on the other include a significant number of mechanical (i.e., structural) and electrical changes. Here are the more important of these changes (these are keyed by the numbered points in the illustration):

1. Bumper point micas top and bottom. Mount is held rigid in bulb to reduce vibration and microphonics.
2. Slot in mica to reduce leakage between sections.
3. Cathode pinched above top mica for tighter mica cathode fit—lower microphonic level.
4. Short strong leads support mount at several points.
5. All plate tabs pinched or welded above mica and below bottom mica to strengthen mount.
6. Improved grid design for sharper cut-off.
7. High conductivity grid winding wire to eliminate grid emissions.
8. Short leads, direct to pins.
9. Strict control of plate diameters for uniform characteristics.

The change in physical characteristics may not be visually apparent to the technician but the effect electronically, is quite evident from an examination of the data charts for the 6SN7-GT and its A and B versions. For example, the maximum plate voltage rating of the earlier tube is 330 volts while the improved types carry a 450-volt rating. Plate dissipation of the 6SN7-GT is 2.5 watts per section; in the A and B types it is 3.5 watts. And so it goes, for many other ratings. As far as usage is concerned, the 6SN7-GTBA can be used wherever 6SN7-GT or GTA tubes are used. And the 6SN7-GTA can be substituted for the 6SN7-GT. But if replacements are to be made in the reverse order, then close examination of the circuit should be made or tube failure may occur.

The 6SN7-GT is one of a number of tubes for which improved versions are now available. These include such types as the 18CG, 5U4GA, 5U4GB, 5X3-GT, 6AX4GT, 6A5V-GA, 6BG6-GA, 6BQ6-GA, 6BXT7-GT, 6CD6-GA, 6J6, 138-7GTBA, 25BQ6-GA, etc. Whenever tube replacement is to be made, it might be a good idea to use an improved version, if one is available. This will not only benefit the customer, but reduce service call backs as well.

SECO GRID CIRCUIT TUBE TESTER

The condition of the control grid in a vacuum tube has an important bearing on the ability of the tube to operate properly. Circuit design is based upon a high grid-to-cathode impedance and any defect which lowers this impedance will lead to such troubles as poor picture contrast; twisting, bend-
The Seo "Vacuum-Tube Grid Circuit Tube Tester" was designed to enable the service technician to locate any tube in which the grid-to-cathode impedance is not as high as it should be. A high lead resistor is placed in the control grid circuit of the tube to be tested and the voltage which develops across this resistor is applied to a d.c. amplifier which, in turn, drives an electron-ray tube indicator. Any condition which lowers the grid-to-cathode impedance, such as leakage, grid contamination, or gas, produces enough voltage difference across the grid resistor to cause the indicator cyst to open.

The use of a d.c. amplifier makes this a sensitive instrument which enables it to bring to light tubes which might otherwise be overlooked in normal tests on conventional tube testers. In using this instrument, it is suggested that the tube be well heated because in a number of instances the defect does not appear until the tube has reached full operating temperature.

Operation of the tester is quite simple. There are only two controls to be set. Initially, the tester is allowed to warm up for about half a minute. Then a "Zero" set knob is adjusted until the indicator eye just closes. Next, the filament selector switch is turned to the proper voltage setting. The tube to be tested is then plugged into an appropriate socket, as indicated by the listing associated with that socket. If the grid-to-cathode impedance is below its normal value, the eye will gradually open. If the tube is good, the eye will remain closed. If the eye flashes as the tube is tapped, it indicates that the tube has an intermittent short. Finally, if the green light of the tube flashes out, the tube has a short to "B plus."

The instrument is small and compact so that it may be carried, along with other service tools, on outside calls. It does not check cathode emission or mutual conductance. Its chief concern is with the condition of the control grid in its relation to the cathode. However, it will also reveal cathode-to-heater shorts, plate-to-suppress or plate-to-heater shorts. The latter defects occur infrequently but the instrument designers found that these tests could be incorporated along with the control grid tests.

**PICTISHAM FEAST**

The South Hills Brass Pounders and Modulators will hold its 17th annual hamfest on Sunday, August 7th at the Totem Pole Lodge in South Park, Pittsburgh, Pa.

Tickets are $2.00 each and may be obtained by writing William E. Guthrie, 4949 Roberts Dr., Pittsburgh, Pa. All ticket holders will be eligible to compete for the various valuable prizes. Attendance is not required to win.

Contact W3PIQ, the club station, for full details.

August, 1955
tensions on the controls, the loop could even be installed in the attic or on the roof.

Choice of the impedance-controlling capacitor, \( C_s \), depends upon receiver-input impedance. This figure is given in the engineering data for the receiver. If a means of measuring the actual impedance is available, the value should be verified. Impedance is usually given a wide tolerance and depends upon the frequency setting and other things. As an example, the instruction book for the author’s receiver puts its input impedance at 400 ohms. Measurement shows the actual value to vary between 210 and 500 ohms. To match this, a triple-ganged 365 µfd. capacitor with all sections in parallel, is used in the unit shown, with an auxiliary fixed capacitor of 1000 µfd., \( C_h \), which may be shunted in as required.

Although an exact match is not essential, a decent approximation improves performance enough to make some experimenting with different values of \( C_s \) desirable. As a starting point, give capacitor \( C_s \) a value having a reactance at the desired frequency which is the square root of the impedance figure which we desire.

Taking 3.5 mc. as the desired operating frequency, \( C_s \) would thus have a capacity of slightly over 200 µfd. for a 400-ohm input. Part of the desired value can be made up of fixed capacitors with a large-size variable taking it from there.

If it is desired to use the loop circuit as additional tuning for the input when operating on the regular station antenna, it is only necessary to provide terminals at the back of the unit, connected as shown in Fig. 1D. A doublet, or a quarter-wave antenna, would be connected to the terminal marked “low-Z,” while an end-fed Hertz or any wire of random length would be connected to the “high-Z” terminal. The added selectivity will then help image rejection, and the degree of impedance matching afforded should greatly improve receiver performance. If loop reception alone is desired, the external antenna is disconnected.

It may be necessary to doctor the receiver a little if the power-input or headphone circuits are not adequately filtered. In this case, signal pickup will occur from the power line; or the operator and headset may act as a small antenna. “Back-door” signals are not good with any type of antenna —with a loop, this goes double. A small “brute-force” r.f. filter can be installed, but we advise you to make sure that the only signal getting inside the box comes through the antenna wire.

Conventional r.f. chokes may be used in the headphone line, but the power-input chokes must be of heavy enough wire to pass the receiver a.c. current without voltage drop. If desired, they may be home-wound of #10 wire, or commercial chokes such as the Mallory RF-583 may be used.

A welding shop down the street used to have me licked every time the welders struck their arcs. My loop antenna can be set so the welders are in the null, and the stations that otherwise would have been obliterated now roll in clean as a whistle.

So, if local QRM has you stopped—
get looped!

10 MASTERPIECES
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Mail the coupon below and you can have these 10 complete Masterpieces, FREE—no obligation to buy any records from us ever! We want you to hear these brilliant performances by world famous artists reproduced with amazing fidelity on our distortion-free discs. Best of all, with these selections you receive a Trial Membership to the Masterpiece Society with all privileges.

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Chopin
Fantasie-In trying, Opus 66

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Dukas
Sorcerer’s Apprentice

Brahms
The Academic Festival Overture

Mozart
Symphony No. 25 in G minor, K. 183

Wagner
Tannhäuser Act II

 Mussorgsky
Night on Bald Mountain

Berlioz
Symphonie Fantastique, Opus 14

Vivaldi
Concerto in C for Two Trumpets and organ

The motel owners, whose prices are plenty high, were in the service business out there. They went to the office or the bulk plant. At first, every time I saw a center-loaded whip, I snapped to attention and blasted out a CQ on the horn, thinking I was meeting another ham; but after getting a few puzzled stares from drivers who would not know CQ from Dixie, I stopped. I bet you, though, that maintaining mobile equipment is quite a thing in the service business out there.

“Ah and oh, one other thing,” Barney went on. “I found out what happens to the small-screen TV sets that are traded in. They go into motels. Several places where we stopped had TV sets, and the largest screen I saw was seventeen inches. Some of the others were ten and twelve inches. The fact of the matter is that those small screens are plenty big enough. In the average small motel room you can’t get very far away from the set if you try, and a large screen simply exaggerates the line structure. The motel owners, though, would do well to realize that a TV set that performs poorly is worse
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At Home with the New Improved PROGRESSIVE RADIO "EDU-KIT" Offered ONLY $19.95 Complete
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WHAT THE PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU
You will learn how to identify Radio Symbols and their meanings. You will learn how to build radio schematics; how to wire and solder in a professional manner. You will learn how to build radios. We will teach you the basic principles involved in radio receiving and transmitting. In addition, if you purchase the "EDU-KIT" instruction book, you will be able to use it to hold and maintain a simple radio. Gradually, in a progressive manner, you will add your construction more advanced tube radio sets, and doing work like a professional Radio Technician. The "EDU-KIT" instruction Books are excellently clear in their explanations. Illustrations and diagrams. These sets operate on 110-125 V. AC/DC. For use in foreign countries having 210-250 volt AC/DC, a transformer will be required.

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Trouble-shooting and servicing are included. You will learn how to recognize and repair troubles. You will be able to do many repair jobs for your neighbors and friends and derive fees which will more than pay for the cost of the "EDU-KIT"

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lowest hum, lowest noise, high-gain input Pentode on the market.

About the Z729...

- Total hum voltage infinitesimal... actually less than 1/10 microvolt.
- Exponentially designed for use on first stage of high gain amplifier or tape recorder.
- Internal shield completely surrounds tube elements.
- Fits standard 9 pin miniature socket.

Quality Endorsed Product of the British Industries Group.

[Address and contact information]

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Write for Catalog 17-J5

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P.O. Box 312, Venice, California

TRANSISTOR CIRCUITRY

SYLVANIA ELECTRIC PRODUCTS INC., 1100
Main St., Buffalo 19, N.Y., has issued a
new manual covering the practical applica-
tions of junction transistors, enti-
tled "28 Uses for Junction Trans-
istor.

The 48-page booklet is designed pri-
marily for the experimenter and hobb-
yist but several of the circuits will be of
interest to engineers and techni-
cians.

The contents of the booklet are di-
vided into five chapters covering
elementary transistor theory, transis-
torized amplifiers, transistorized oscil-
lators, transistorized control devices,
and transistorized instruments. The
text is profusely illustrated with
charts and diagrams.

The price of the manual is 25 cents and
orders should be sent direct to the
company.

TV ALIGNMENT GEAR

Hickok Electrical Instrument Com-
pany, 10524 Du Pont Avenue, Cleveland
8, Ohio is making a limited-time offer of
an 8-page booklet covering TV
alignment equipment.

Of special interest to service tech-
nicians are the reprinted articles on
the use of the Model 691 Marker Adder
and the Model 650 Marker Generator in
TV alignment and conversion of the
Model 650 video generator to the
color-compatible Model 650C.

The booklet is free to those who
make their requests prior to August
31st.

PRINTED CIRCUITRY

Cornell-Dublitzer Electric Corpora-
tion's Printed Wiring Division, South
Plainfield, N.J., has published a
new 8-page booklet entitled "Printed
Circuitry."

The new 8½"x11" illustrated booklet
describes in detail the application,
uses, and advantages of printed cir-
cuits in various electrical products and
equipment, as well as technical infor-
mation to aid in the design or plan-
ing of printed circuitry.

The booklet explains simply and au-
thoritatively the different types of
base material, laminate characteristics,
and circuit designs. Other chapters ex-
plain how to prepare master drawings,
soldering techniques, and pricing vari-
able.

PYRAMID FLIP CHART

A new 21-page flip chart which de-
scribes its new "Kool-Sel" selenium
rectifier line in detail is now available
from Pyramid Electric Company, 1445
Hudson Blvd., North Bergen, N. J.

The chart is available for sales
meetings in a 16" x 24" size and in
pocket-size form for use by representa-
tives, jobbers, and jobber counter
men. The chart is printed in black,
yellow, and white for maximum visi-
bility.

The company's representatives are
handling distribution of the chart or it
may be obtained by writing Jack K.
Poff, jobber sales manager of the
company.

TRIAD CATALOGUE

Triad Transformer Corporation, 4055
Redwood Ave., Venice, California has
just issued two new catalogues of in-
terest to the industry.

The general catalogue, TR-55, lists
685 items, 79 of which are new to the
line. Included among the new items
are a series of subminiature audio
transformers, several additions to the
series of high-fidelity output trans-
formers, power components, geofor-
mers, replacement power and audio
transformers, dry disc rectifier trans-
formers, and TV replacement items.

The second publication, TV-159, lists
the correct replacement transformer
for television use, showing Triad items
recommended for replacement in over
5000 models of TV sets.

Copies of either or both catalogues
are available from the company's job-
bers or from the company direct.

RELAY CATALOGUE

Relay Sales, 4721 W. Madison Street,
Chicago 44, Illinois has announced the
availability of its new 18-page 1955-C6
catalogue which lists the specifications
and prices of hundreds of types of
standard brand relays which are im-
mediately available from stock.

The catalogue carries data in tab-
ular form for easy reference with pho-
tographs of the relays and contact
diagrams included for additional in-
formation.

RESISTANCE DATA

International Resistance Company,
401 N. Broad Street, Philadelphia 8,
Pa. is now offering comprehensive data
on the construction, dimensions, ma-
chinability, electrical characteristics,
resistance values, power and voltage ratings,
temperature coefficients, voltage co-
efficients, etc. of its resistance strips
and concentric disc resistors.

A copy of Catalogue Day's Bulletin
T-1, a 4-page publication containing
charts and graphs, is available without
charge on request.

EQUALIZERS

Cinema Engineering Company Divi-
sion of Aerovox Corporation, 1100
Chestnut Street, Burbank, California
has issued a 16-page catalogue, No.
12E, completely illustrated with re-
sponse charts for its equalizers and
wave filters.

The 20-page catalogue covers all
applications of this type of equipment in
sound and sound recording with more
than a score of items outlined. A novel
adaption in the compilation is the sec-
tion devoted to equalizers and their
ability in concrete problems, with solutions.
are given. The data was selected from actual case histories furnished by the company's customers.

**METERS AND PYROMETERS**
Assembly Products Inc., Chesterland, Ohio is now offering copies of its new panel meter and pyrometer catalogue, Bulletin G-9.

The new 8-page publication lists various types of clear plastic case panel mounting meters as well as black Bakelite case styles. Also shown are some of the new ruggedized and sealed models.

Indicating pyrometers, both panel mounting and portable types, are also included.

**TUNING LOCK DATA**
A special bulletin describing the "Trak" automatic tuning lock, an auxiliary device designed for frequency-shift communications receivers, has just been published by the manufacturer, COS Laboratories, 931 Ludlow Street, Stamford, Conn.

The new tuning lock automatically maintains a frequency-shift signal in tune despite drift from any cause, receiver temperature changes, or any other contributing factor, and in effect provides greater efficiency in reception from a poorly stabilized receiver.

**RECEIVER BROCHURE**
Hammarlund Manufacturing Company, 460 West 34th Street, New York 1, N. Y. is now offering a new brochure which describes the company's new amateur and professional communications receiver, the Pro-310.

This 2-color, 4-page booklet describes in detail the specifications, design, and performance characteristics of this receiver. The instrument, which makes use of a rotary turret and has continuously calibrated bandspread from 550 kc. to 35.5 mc., is available in a choice of two cabinet colors.

**COAX USAGE**
Microdot Division, 1826 Fremont Avenue, South Pasadena, California has issued a four-page illustrated folder entitled "This is Microdot."

The new publication explains in detail how to use the company's micro-miniature coaxial cable. Photographs and line drawings are included along with complete specifications on the line.

**ASTRON CAPACITORS**
Astron Corporation, 255 Grant Avenue, East Newark, New Jersey has just released a new four-page bulletin, No. AB-21, on its "Comet," the first molded plastic tubular metallized paper capacitor to be developed.

Printed in two colors with illustrations and tables, the new publication contains full details, descriptions, performance characteristics, and test specifications.

**SCINTILLATION SYSTEM**
A new two-color, eight-page brochure describing the DS-7 Scintillation Counting System for aerial or ground
NEW! IMPROVED!
AM/FM PLUG-IN TUNERS
for your CAR or HOME

$13.95 FM BROADCAST TUNER
88 to 110 MC MUSIC

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- 30-50 MC
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DRY CELLS AND BATTERIES
The National Bureau of Standards has issued a new circular covering specifications for dry cells and batteries.
This 17-page publication which includes 5 halftone illustrations and 19 tables is available from the Government Printing Office at Washington 25, D. C. for 25 cents in cash.
This is the sixth edition of this standard publication which was approved on August 19, 1954. It supersedes the previous specification which was approved in 1947.

RETMA-BBB BOOKLET
Publication of the third edition of its consumer-education booklet which is designed as a guide to the purchase and service of black-and-white and color television receivers has been announced by the Radio-Electronics-Television Manufacturers Association and the Better Business Bureau.

The booklet, "Things You Should Know About the Purchase and Servicing of Television Sets," was prepared by the Association's Service Committee in cooperation with the radio-television committee of the Association of Better Business Bureaus.

Distribution of the booklet is being made through local television sales and service organizations and Better Business Bureaus.

SHIELDED ENCLOSURES
Ace Engineering & Machine Company, 3644 N. Lawrence Street, Philadelphia 40, Pa. has issued a comprehensive catalogue covering engineering and application data on r.f. shielded enclosures.

Every type of screened and sheet metal standard enclosure is covered individually, with insertion loss or attenuation curves for each room and complete construction details illustrated by cutaway drawings. Engineering specifications and standard room size availability are presented in simple, easy-to-use form.

Copies of this catalogue, of special interest to the electrical, medical, electronic, architectural, and dielectric heating fields, are available on request.

EIMAC DATA SHEETS
Eitel-McCullough, Inc., San Bruno, California has published revised editions of its Eimac 4-400A radial-beam power tetode and 4-400A/4000 air-system socket data sheets and Application Bulletin #3, "Pulse," dealing with pulse applications of the company's tubes.

The material has been mailed to Eimac catalogue holders but is available to others on request. Write the Technical Services Department of the company.

NEW TAPE RECORDER
James Instrument Laboratories, 9110 S. 52nd Court, Oak Lawn, Illinois, is in production on a new tape recorder, the V-12.

The new unit features a three-motor mechanism with a two-speed hysteresis synchronous motor for flutter-free tape drive. It will handle reels up to the 10½" NARTB size without adapters and employs electrodynamic braking for smooth and safe stoppage.

All tape motion is controlled by electrically interlocked push-buttons with automatic stop in case of tape breakage or run-out. The tape guides automatically release the tape from contact with the heads and accidental erasure is prevented by an electrically interlocked "Record" button. Tape speeds are 7½ and 15 ips with three speeds available on special order.

The recording amplifier has separate circuits for recording and playing back, permitting monitoring from tape while recording, standard NARTB playback equalization, 10-watt push-pull monitoring and playback amplifier, cathode-follower output for external amplifier, mixer for two inputs, and a 4-inch vu meter. Over-all frequency response is 40 to 15,000 cps at the 7½ ips speed.

BROCINER 10-WATT AMPLIFIER
Brociner Electronics Laboratory, 344 East 32nd Street, New York 16, N.Y. has added the "Mark 10" to its line of amplifiers.

The unit includes in one compact
housing a rugged power amplifier, bass and treble controls, selector switch, record compensator, and phonograph preamplifier. The equipment is suitable for use with AM, FM, and TV tuners, all types of high-quality phonograph pickups, and for tape recording and playback. A simplified record compensator affords convenient selection of record equalization and includes a special provision for noisy records. A rumble filter, controlled from the front panel, permits the use of record changers, without background noise.

The use of printed circuitry permits an extremely compact construction. The amplifier measures only 4½’’ high, 10½’’ long, and 8” deep from front panel to clearance over jacks on the back panel. It is adjustable for use on panels up to 3/4” thick.

"KNIGHT" AM-FM TUNER
Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois has released a new, low-cost Model 728 AM-FM tuner which has been designed especially for home music systems.

tuning of FM stations is made simple and accurate by an a.f.c. circuit that locks in stations as their dial setting is approached. This feature eliminates drift while the tuner is warming up. The Model 728 has only two controls; tuning and function selector, which makes it a good choice for use with amplifiers or preamps having full sets of controls.

A removable gold-finished escutcheon is provided for simple, behind-panel custom installation. For complete literature and specifications, write the company direct.

SPEAKER SYSTEMS
University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N.Y. recently demonstrated its new "Module Plan" for theater speaker systems.

Featuring exceptional flexibility, each of the "Module" sections is a deluxe three-way compression driven horn-loaded reproducing system. A front folded horn works in conjunction with a rear baffle chamber to effect a "compression type" low-frequency driver assembly, independent of auditorium acoustics and capable of reproducing bass notes with unusual efficiency and realism.

The speaker and network components installed in a single "Module" section are the company's C15W 15” woofer, "Cobreflex" 2/T30 mid-range speaker, HF-206 super-tweeter, and

August, 1955
the N-3 three-way LC dividing network. Crossovers are effected at 350 and 5000 cycles.

"CUB-CORDER"
Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio has unveiled its new portable, battery-powered, dual-track tape recorder, the "Cub-Corder."

Utilizing a rechargeable, non-spill wet battery and a 67½ volt "B" battery, the new unit will record for one hour at 3% ips or 30 minutes at 7½ ips on a single 5", 600 ft. reel of tape. The 7½ ips speed provides a wide frequency response. The machine is also available with capstans for ½ ips and 3% ips and, using the new long-playing tapes at 1½ ips, it will record three hours.

Housed in a handy carrying case, the "Cub-Corder" weighs only 12½ pounds and may be carried by a handle or shoulder strap. The entire operation is controlled by a switch on the microphone, permitting complete freedom on the part of the operator.

COMPACT AMPLIFIER

Newcomb Audio Products Co., Inc., 6824 Lexington Avenue, Hollywood 38, California is now offering a new line of amplifiers which has been designated as the "Compact 1000" series.

The new models incorporate both amplifier and preamplifier in a single decorator-styled, satin-gold cabinet which is small enough to fit on a chairside table. Currently the company is offering 10, 12, and 20 watt models.

The Model 1010 is a 10-watt amplifier-preamp which measures only 3½" high, 7½" deep, and 9¼" wide. Smaller than most preamp control units alone, it provides response from 20 to 20,000 cps ± 1 db with distortion below 1 percent at 10 watts.

Controls include a six-position recording curve selector, separate continuously-variable bass and treble controls, input and rumble filter selector switch, and loudness control and power switch. Six inputs are provided, in addition to an "output to tape" jack which permits recording while listening.

ASTATIC "DYNAMIKE"
The Astatic Corp., Conneaut, Ohio is now marketing a versatile, wide-range dynamic microphone which combines modern styling with low price.

The "Dynamike" is light, slender, and compact, measuring only 1¾" across the top and weighing only 7¾ ounces. The housing is die-cast alloy, with a glareproof satin black finish and brushed chrome trim.

Response of the microphone is 50 to 10,000 cps. It comes equipped with a standard 9/16"-27 thread which is readily adaptable for floor stand, desk stand, or hand use. It is available in either high or low impedance models with or without an "off-on" switch adapter.

FLUTTER BRIDGE

Telecrom Industries Corp., 35-18 37th Street, Long Island City 1, N.Y. is now offering a new "Flutter Bridge" which has been specifically designed to measure flutter and wow in turntables, tape recorders, wire recorders, and motion picture equipment.

Suitable for either service shop work or in the engineering laboratory, the instrument uses a unique sensitive bridge circuit and an accurate band-pass filter for the elimination of noise and hum. Accurate measurements of flutter and wow are taken as simply as voltage measurements. Measurements in either the 0-5 per-cent or 0-2 per-cent ranges are indicated clearly on the large 4" square meter.

The "Flutter Bridge" requires no external power source, is lightweight, portable, and rugged. It is housed in a 13" x 8" x 6" metal case.
Don't just say "capacitors"

Ask For Sprague By Catalog Number

Know what you're getting...get exactly what you want. Don't be vague...insist on Sprague. Use complete radio-TV service catalog C-610. Write Sprague Products Company, 51 Marshall Street, North Adams, Massachusetts.

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WORLD'S LARGEST CAPACITOR MANUFACTURER

0-1 3-INCH MILLIAMPS 270° Indication. By-pass shunt and add scale. Only. $1.95

100 MICROAMP METER 3" $3.49

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Here's a roundup of over 100 ideas, hints, tips and suggestions for making your photo chores easier, faster and a lot more fun—right out of the pages of POPULAR PHOTOGRAPHY—the top magazine among camera fans everywhere.

"PHOTO TIPS" will save you time, money and effort—particularly in the darkroom. It's full of "how-to-do-it" illustrations that will improve your technique—help you get more fun from photography. Send for your copy of "PHOTO TIPS" today—only 10c!

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August, 1955

areas of high noise level, adverse wind conditions, etc. The fiber glass construction of its main flaire assures lifetime durability under all climatic conditions.

Input impedance is 8 ohms, input power is 5 watts, and response is 400 to 9000 cps. Front opening size is 9¼ x 5¼" with over-all length 8¼" including the bracket.

NATIONAL AM-FM TUNER

National Company, Inc., Malden, Mass. is now offering a new model of its "Horizon Criterion" AM-FM high-fidelity tuner.

The new unit offers, among other features, calibrated AM-FM logging scales, "lock-in" tuning (broad and non-critical without meters, eyes, or other complicated tuning indicators), adjustable "Mutomatic" tuning which eliminates all hiss and noises, and bin- aurial or simultaneous AM-FM tuning.

The tuner's S capture ratio makes sensitivity usable for fringe area re- ception in areas formerly inaccessible to FM signals by rejecting all interfering signals up to 80 per-cent as strong as the desired signal, making signals ghost or reflection free.

"STATICMASTER"

Nuclear Products Company, 10173 E. Rush Street, El Monte, California has developed a special record brush especially for use with hi-fi discs.

The "Staticmaster" rotates over the record surface removing fine dust particles and eliminating the surface static electricity. This neutralization of the ever-present static prevents the attraction of other dust and lint. The ionizing agent, polonium, sealed in the brush ferrule, does the trick; the soft camel hair bristles gently remove the released dust.

Write the company direct for additional information on this equipment.

WIDE-ANGLE SPEAKER

A new concept in wide-angle paging and talkback speaker design has been

Become an ELECTRICAL ENGINEER

Major in Electronics or Power BS Degree in 36 months

Prepare now for a career as an electrical engineer or engineering technician — and take advantage of the many opportunities in these expanding fields.

You can save a year by optional year-round study. Previous military, academic, or practical training may be evaluated for advanced credit.

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You can be a radio technician in 12 months. In an additional 6-months you can become a radio-television techni- cian with Associate in Applied Science degree. Color television instruction is included in this program.

These technician courses may form the first third of the program leading to a degree in Electrical Engineering. Twenty-one subjects in electronics, electronic engineering and electronic design are included in these courses.

Courses also offered: radio-television service (12 mos.); electrical serv- ice (6 mos.); general preparatory (3 mos.).

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Kedman Co., 232 S. 5th W., Salt Lake City

developed by University Loudspeakers, Inc. of 80 S. Kensico Ave., White Plains, New York.

The Model CIB and the Model CMIL both feature a reflexed "cobra" air column for wide-angle horizontal dispersion of sound. Designed for paging and talkback with efficient "pickup and delivery" providing crisp, clear reproduction of music and speech, these speakers are designed to provide dependable operation in any sort of weather or in noisy, dusty, and wet locations.

The Model CIB is rated at 12 watts continuous duty with a response of 300 to 13,000 cps. The Model CMIL is rated at 3 watts continuous duty with a response of from 400 to 13,000 cps. A free illustrated brochure on these units is available from Department NR-1 of the company.

FAIRCHILD AMPLIFIER

Fairchild Recording Equipment Company, 154th Street and 7th Avenue, Whitestone, N.Y. has added a 25-watt power amplifier to its line of audio equipment.

The Model 255 provides full power output over the complete audio spectrum with minimum noise and distortion, good transient response and stability, according to the company. Intermodulation distortion at 25 watts is less than 2 per-cent and less than 5 per-cent at 22 watts. In addition the amplifier contains the company's exclusive distortion-cancelling control for balancing the output stages without the use of external test equipment. The Model 255 measures 6" wide by 9" long.

TAPE PREAMPLIFIER

Fenton Company, 15 Moore Street, New York 4, New York has recently introduced a tape preamplifier which is especially designed to provide record amplification and playback preamplification as well as a bias-crase oscillator stage for the company's "Motek Audiophile Tape Deck."

The TPR-1 consists of two separate chassis, one for the preamp proper and the other for the power supply. The two chassis are interconnected by a 7-conductor cable which permits remote installation of the power supply to reduce hum.

There is a special adjustable hum balance control. The equipment features two high-impedance inputs, one for mike and the other for the phono, tuner, radio, or hi-fi amplifier tape output. Tubes used include the 6E5, 6X5GTA, 6AQ5, 12AT7, and 5879, the last two being shock mounted.

The preamplifier is currently available in factory-assembled and kit form. Write the company for full details.

BERLANT RECORDER

Berlant Associates, 4817 West Jefferson Boulevard, Los Angeles 16, California is now offering a new model tape recorder, the BRX-1.

The new unit may be had with two speeds, 7½ and 15 ips or 3½ and 7½ ips. The unit consists of a separate matched drive mechanism and amplifier. Three motors are employed including a hysteresis synchronous drive motor for perfect timing accuracy and two continuous heavy-duty motors for take-up and supply.

Other features include a two-channel input mixer, Common connectors, tape motion regulator, single-track erase and record heads, and dual-track playback head to play both single and dual-track tapes.

UNIVERSAL TEST SPEAKER

Authorized Manufacturing Company, 919 Wyckoff Avenue, Brooklyn 27, New York is now in production on the Model #401 "Unispeak" universal test speaker.

Designed as a service aid in television and radio troubleshooting, the new unit incorporates a socket which provides speedy connection for most sets. An adapter cable is made up and plugs into the speaker and/or the set. This feature eliminates the need for pulling a speaker from the cabinet when a chassis is removed to the shop.

Single-ended or push-pull output

RADIO & TELEVISION NEWS

www.americanradiohistory.com
Don't just say "capacitors"

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Will pay cash or trade Hi-Fi or test equipment for old horn style phonographs made prior to 1906. Want Berliner, Victors, Columbia Graphophones, Pathe, Edison Models (Opera, Concert, Bal-moral, and Idelia), and coin machines.

Old cylinder and disc phonographs with outside horns.

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TRANSMITTERS/AMPLIFIERS/RADIO & TELEVISION NEWS, BOX 50, 366 MADISON AVE., N. Y. 17

transformer circuits are accommodated as well as direct voice coils through the "Vari-Z" switch. The transformer is a universal type and allows impedance matching of all tubes.

The "Unispeak" is housed in a gray hammertone case, 8" x 8" x 3 1/2" with a handle for easy portability.

TRIPLE-PURPOSE MIKE

American Microphone Company, an affiliate of Elgin National Watch Company, Pasadena, California has developed a new triple-purpose microphone for home tape recorders.

Smaller than a cigarette package, the microphone is tailored to fit comfortably in the hand. The speech opening has been designed at an angle for direct line-of-sound pickup whether the instrument is held in the hand, placed on a table, or fastened to the lapel.

The microphone is now available in beige, red, black, or grey and can be made in any color desired. The unit will be marketed to both the original equipment and replacement industries.

PERMOFLUX "STereo-VOX"

Permoflux Corporation, 4900 W. Grand Ave., Chicago 39, Illinois has developed a new unit which provides a stereophonic effect from a monaural source.

Known as the "Stereo-Vox," the new unit is designed to be used with present records, tapes, phonographs, and AM or FM receivers. It can be used with any type of sound reproducing equipment. The equipment is designed around a balanced acoustic delay system, which provides the requisite reverberation to give the "three-dimensional" effect even if this quality is not provided on the original source material.

ERRATUM

The article "A Most Unusual Oscillator" (May 1955) contains an error in the schematic diagram on page 54. The screen grid of the 6V6 (pin 4) was incorrectly shown as floating. Many of our readers have apparently failed to connect the screen grid in the circuit. Since the tube is used as a triode, pin 4 should be connected to the plate of the tube.

Alternatively, it could be connected to the control grid rather than the plate. In some cases the two grids together oscillate easier than with the screen grid tied to the plate.
**CENTRAL ELECTRONICS**

**Available and single 813, plugs the VFO proper to circuit**

**Variable frequency oscillator designed for Collins Model 312A.**

**Complete with tubes (less speaker).......................... $199.50**

**Model 312A-1 Control/Speaker for above in matching cabinet.**

**3.75.**

**NEW COLENSS**

**KWS-1 Transmitter**

**A top performing transmitter with the power input on CW or single tone for SSB, operating on cw with carrier and sideband.**

**Complete with antenna and matching cabinet. housed in Collins 32W-1 cabinet.**

**Price.......................... $3495.00**

**NEW ELDICO**

**VFO 10/20A**

**Variable frequency oscillator designed for Central Electronics 588 Exciters 10A, 10B and 20A covers 80 and 20 meter bands. Has 6-inch dial with 5 inches of bandwidth on 75 meter phase band and 3/4 inch on 20 meter band. Electromagnetic tuning circuit employs high-Q inductor and a precision tuning condenser. There are no tubes in the VFO proper to cause drift. An oscillator unit plugs into octal socket on C.E. Exciters. Single coax line connects exciter to transmitter.**

**Factory Wired 49.95 Complete Kit.......................... $39.95**

**Write for Harvey’s Free HAM CATALOG**

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August, 1955
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- Printed in U.S.A.
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*Patent Applied For