RADIO & TELEVISION NEWS

MARCH
1953
35 CENTS
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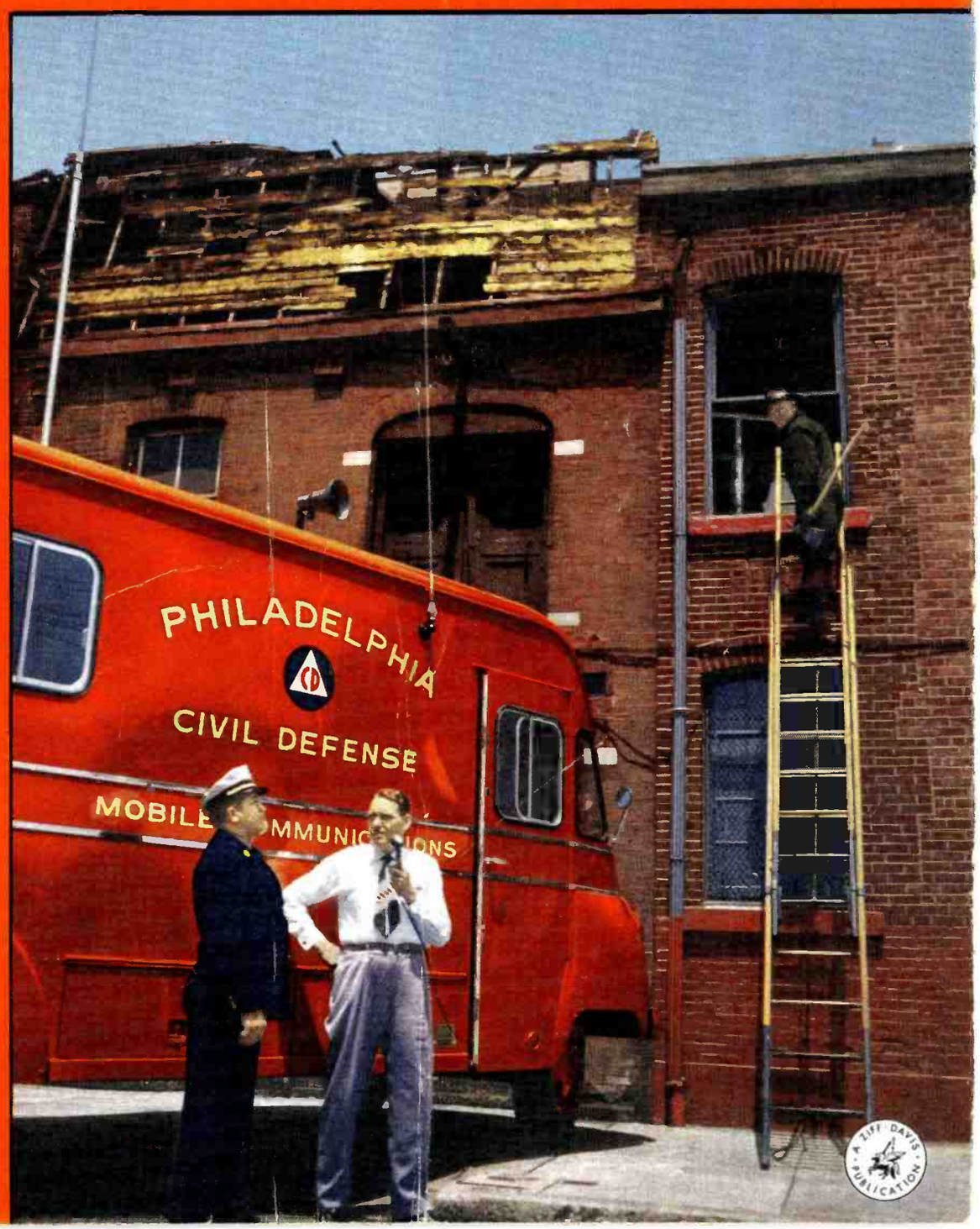
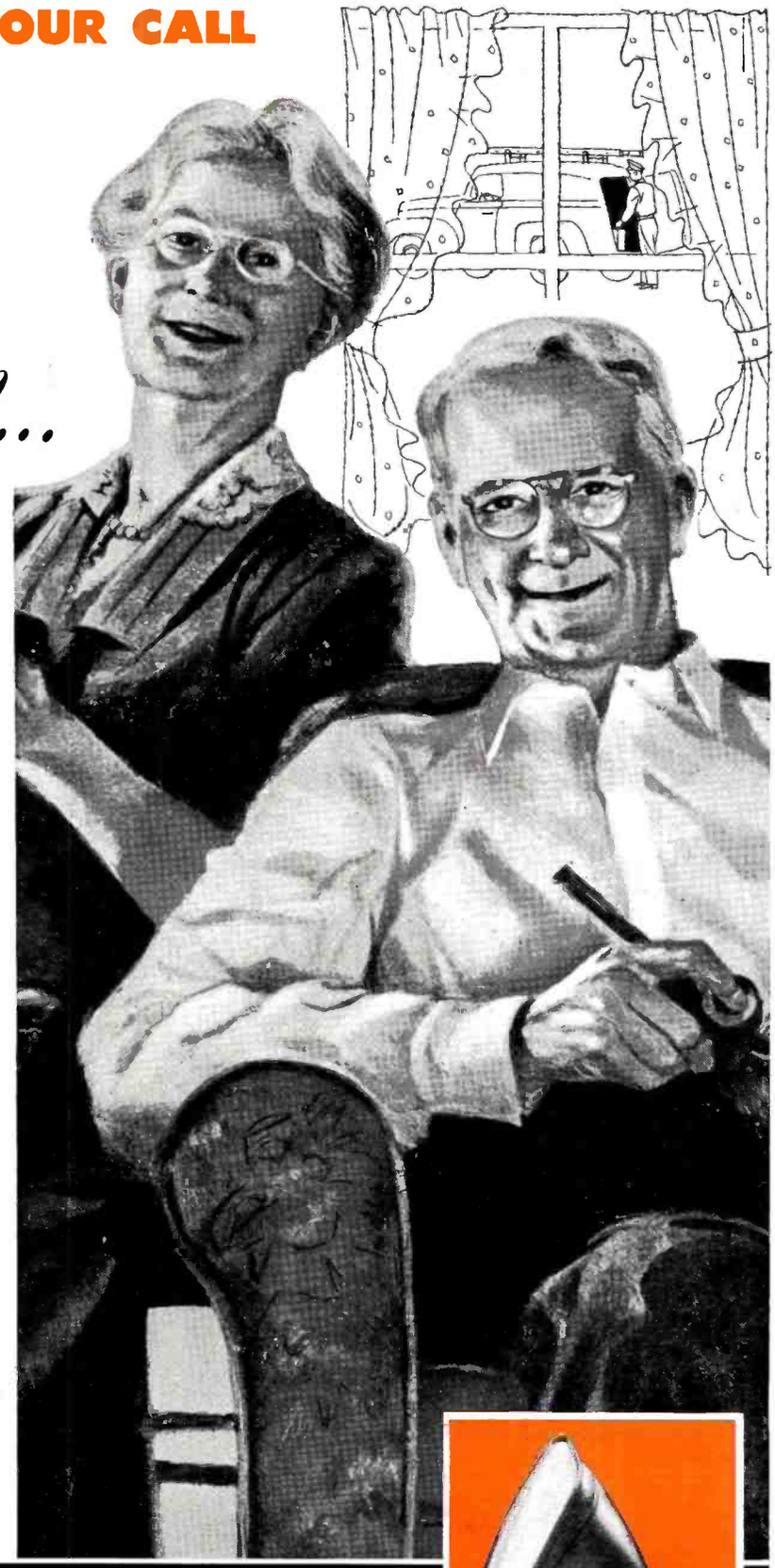
IN THIS ISSUE



AS A RESULT OF YOUR CALL

The show goes on...



YOU'VE just finished a routine call. Just a few adjustments . . . a couple of tubes . . . and the set works as good as new. Nice the way folks smile appreciatively when you bring that missing picture back to their screen.

Now you've got yourself another steady customer. You know they'll remember you . . . and recommend you to their friends . . . because they're enjoying the finest picture their set can produce. And the RCA Tubes you installed will continue to provide them with long, faithful service. The superior quality of RCA Tubes and Kinescopes is your best measure of protection against the costliness and inconvenience of premature tube failures. It's good to know you can service a receiver . . . and forget about call-backs.

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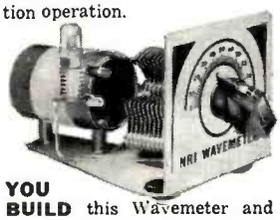
with parts I send. With this Transmitter you practice how to put a station "on the air." You perform procedures demanded of Broadcast Station Operators, conduct many experiments, make many practical tests.

LEARN COMMUNICATIONS by PRACTICING at Home in Spare Time

YOU BUILD this Transmitter Power Supply used in the basic experiments in RF and AF amplifiers, frequency multipliers, buffers, etc.

YOU MEASURE current, voltage (AC, DC and RF), resistance and impedance in circuits with Electronic Multitester you build. Shows how basic transmitter circuits behave; needed to maintain station operation.

YOU PRACTICE setting up code, amplitude and frequency modulation circuits (put voice, music, etc., on "carrier signals" you produce). You learn how to get best performance.



YOU BUILD this Wavemeter and use it to determine frequency of operation, make other tests on transmitter currents.

Get Practical Experience on Circuits Common to Radio & TV

Ever think HOW FAST Radio-Television Communications is changing, developing, growing? Have you considered what this amazing progress can mean to you?

Even without Television the industry is bigger than ever before. 105 million home and auto radios, 2900 Radio Broadcasting Stations, 108 TV Stations with 1800 more now authorized. Expanding use of Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio for buses, taxis, etc. makes opportunities for Communications Technicians and FCC Licensed Operators. New jobs, more jobs for beginners! Better jobs, better pay for experienced men!

Television Is Today's Good Job Maker

In 1952, over 18,000,000 homes had TV sets. More are being sold every day. The "Freeze" on building new TV stations has been lifted. The time to act is NOW! Start learning Radio-TV communications. America's fast growing industry offers good pay, a bright future, security. If you are a beginner, my course can help you get FCC License, prepare for the job you want. If you've had some training in Radio or Radar, or as a Licensed Operator, my course modernizes, increases the value of your knowledge.

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Send today! See what my Communications course is like. Find out how I get you ready for a brighter future, better earnings, more security in Radio-Television. Send coupon now in envelope or paste on postal. NO OBLIGATION, NO SALESMAN WILL CALL! My book, sent to you FREE, tells the full story. J. E. SMITH, President, Dept. 3CE, National Radio Institute, Washington 9, D. C. Our 39th year.

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"I am a technician at WTOP in Washington and I like it very much. Most of my radio knowledge was from N.R.I."—John Britto, Hyattsville, Md.

"My first job was with KDLR, obtained for me by your Graduate Dept. Now in charge of Radio Equipment for Police Dept."—T. S. Norton, Hamilton, O.

"A former employer recommended N.R.I. training. Now employed as transmitter operator at WKBO."—Albert Herr, New Cumberland, Pa.

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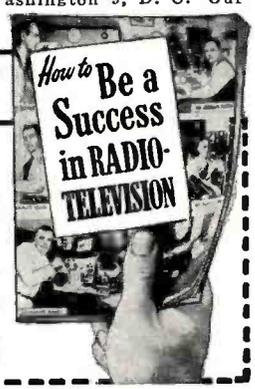

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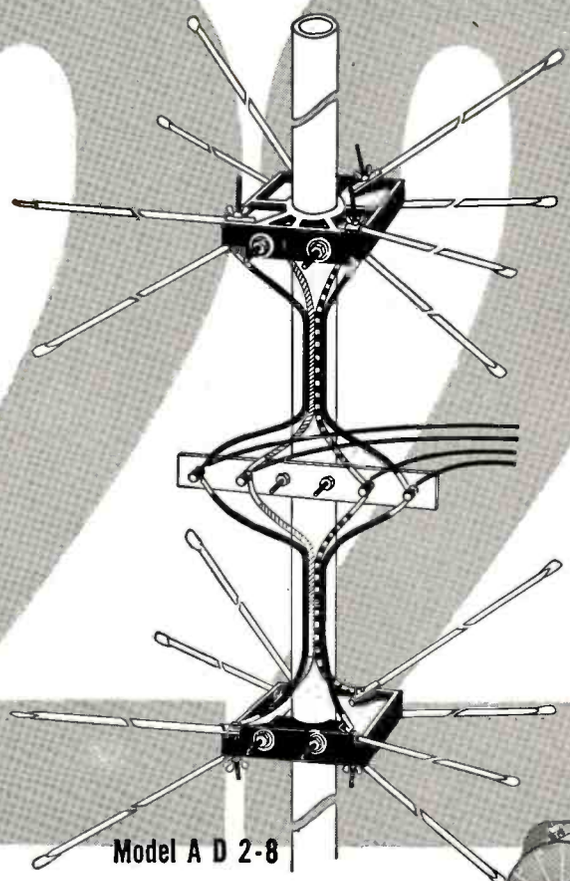

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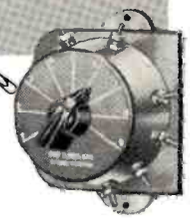

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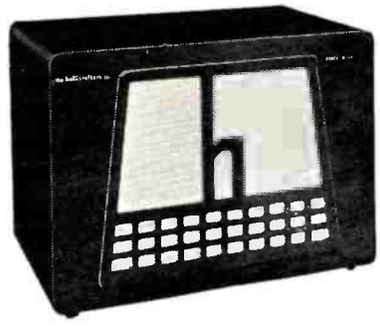

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For the RECORD

BY THE EDITOR

AN ANNIVERSARY CELEBRATION FOR REE

IN July our sister magazine, *Radio-Electronic Engineering* (affectionately known as *REE*) will celebrate its tenth birthday. This magazine, though well known in engineering circles, is probably unknown to our many newsstand readers. I would like to tell you something about it.

REE was started in July, 1943 to fill a long-felt and growing need among electronic engineers for a magazine which would present in simple, easily-understood language, all of the major developments in the broad field of electronics. The original goal was to bring to engineers practical, useful information in a form which would not require an excessive amount of "digesting" of the type required in so many highly technical articles. The steady increase in subscriptions to the present total of well over 20,000 is eloquent testimony that the goal has been achieved.

When first published, the magazine was called "*Radionics*" because we felt that this name vividly expressed the scope to be covered. However, further study and consideration led us to believe that such a name was entirely inadequate and in January, 1944 it was changed to *Radio-Electronic Engineering*. This new name is descriptive of the magazine's contents—the engineering aspects of radio, including television and communications, and of electronics, covering the broad fields of industrial and medical electronics, computers and many others.

You may not be familiar with *REE* because it is available only by subscription to electronic engineers and other qualified personnel. It appears as an insert in a limited number of copies of RADIO & TELEVISION NEWS. Subscribers to this special *REE* Edition get all of the material appearing regularly in RADIO & TELEVISION NEWS *plus* all of the material in *REE*—at a subscription cost only slightly higher than that of R&TN alone.

REE is a complete magazine in itself. It includes a minimum of five feature articles each month, along with various departments such as New Products, Personals, News Briefs, Technical Books, New Tubes, and a calendar of technical meetings. All material is carefully edited and screened to be of maximum interest and value to readers. Authors are well-known in their respective fields and are thoroughly qualified for their task of passing on useful information to other engineers.

REE has a broad coverage, enabling specialized engineers to keep abreast of developments in fields other than their own. In recent years, articles have appeared on such diversified subjects as microwaves, electronic computers, medical electronics, television, audio, and industrial electronics. We intend to continue and broaden further this diversified coverage.

The March issue of *REE* is a significant milestone of progress as it marks the appearance of the second annual special Microwave Issue. The first issue, which was published last May, was hailed as the most comprehensive survey of the microwave field ever published. It is still in wide demand. This second issue concentrates more on microwave relay applications in communications and TV, since these applications have been growing by leaps and bounds and show every evidence of continuing to grow. The directory of manufacturers of microwave equipment appearing in the first issue has been carefully checked and brought up to date and a cross-index of product listings added to increase the directory's usefulness. In the majority of cases, the name of the chief engineer, or the engineer responsible for microwave development, has been included for reference purposes.

A comprehensive bibliography of microwave articles appearing in 1952 periodicals is included along with a list of books which have been published in this field. The ten feature articles have all been prepared by engineers who are prominent in the microwave field. We believe that additional readers will find this issue as valuable as the previous one, if not more so. The special Microwave Issue is an annual feature and will continue as such. Other special issues are also being planned for the near future.

We are proud of the acceptance achieved by *REE* among engineers. A measure of this acceptance is the very low-mortality among subscribers. "Once a subscriber, always a subscriber" is apparently an axiom with our readers. We will continue to do our utmost to justify this faith by presenting each month the most complete and authoritative information which we can obtain, and by expanding the scope of *REE* to present information on such outstanding recent developments as transistors and magnetic and dielectric amplifiers.

We hope that you have found this thumb-nail sketch of *REE* interesting and informative. If your curiosity has been aroused, we feel that our purpose of acquainting you with *REE* has been achieved. . . . O.R.

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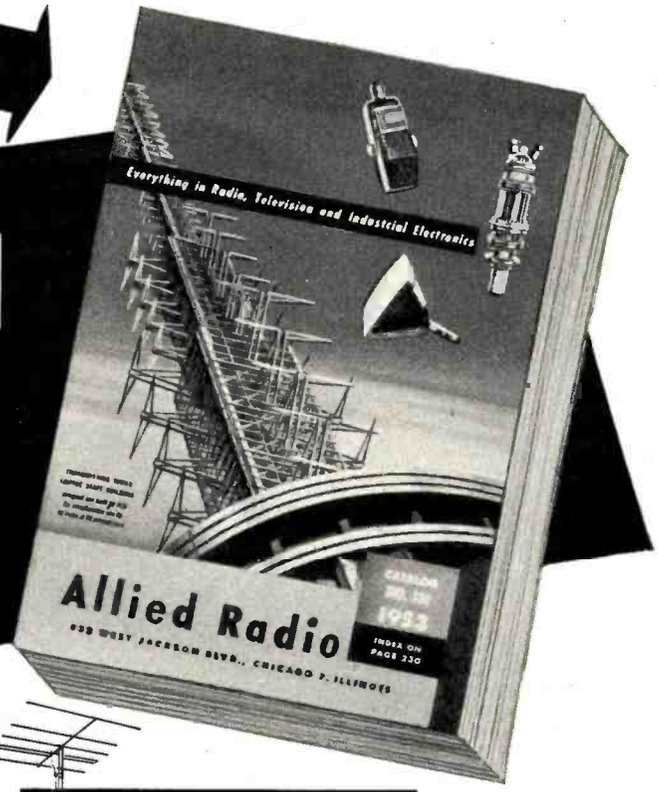

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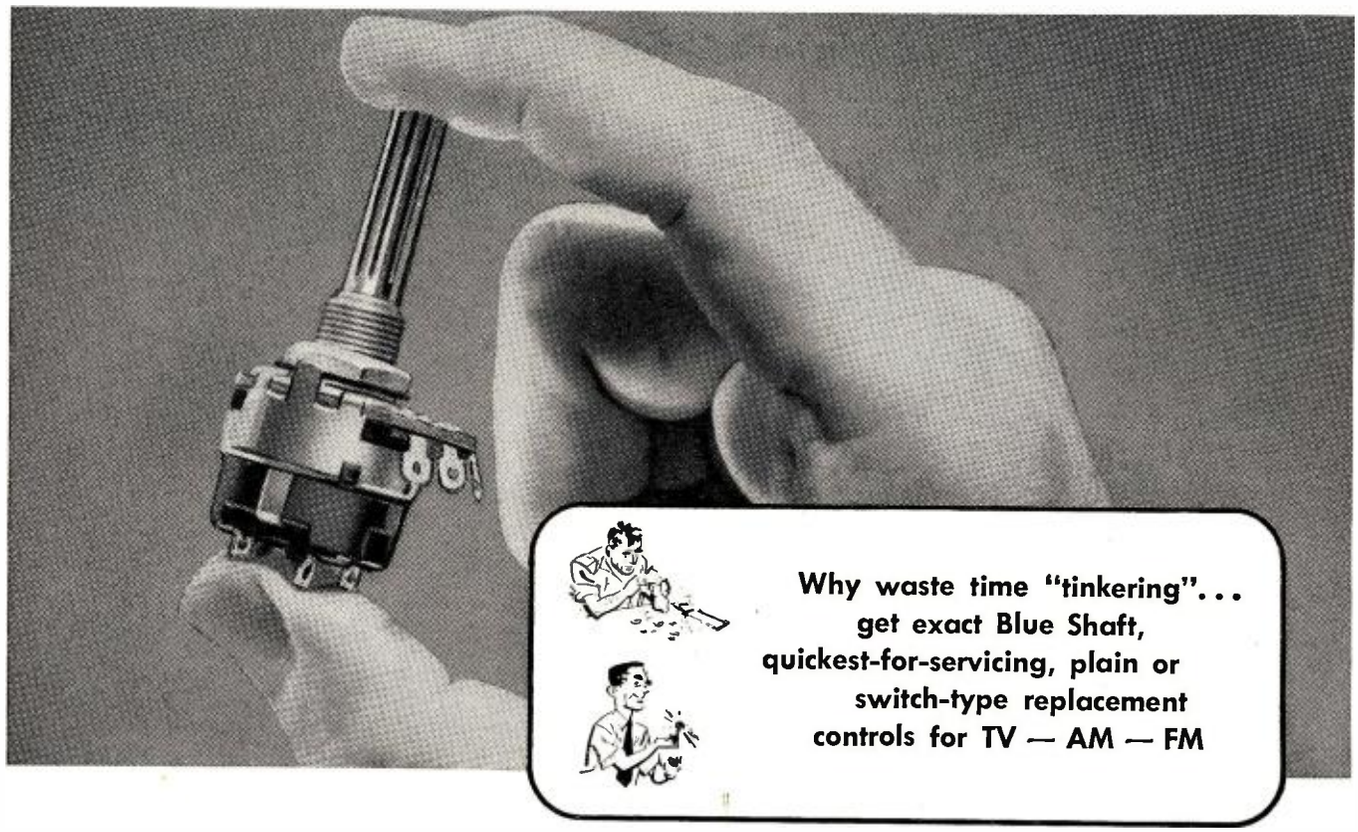

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- ☐ Analytical Chemistry
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- ☐ Pulp and Paper Making
- ☐ Plastics

CIVIL, STRUCTURAL ENGINEERING
- ☐ Civil Engineering
- ☐ Structural Engineering
- ☐ Surveying and Mapping
- ☐ Structural Drafting
- ☐ Highway Engineering
- ☐ Reading Blueprints
- ☐ Concrete Construction
- ☐ Sanitary Engineering

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Mine Surveying and Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Electrician
- ☐ Electrical Maintenance
- ☐ Electrical Drafting
- ☐ Electric Power and Light
- ☐ Lineman

HIGH SCHOOL
- ☐ High School Subjects
- ☐ College Preparatory
- ☐ Mathematics
- ☐ Commercial
- ☐ Good English

MECHANICAL AND SHOP
- ☐ Mechanical Engineering
- ☐ Industrial Engineering
- ☐ Industrial Supervision
- ☐ Foremanship
- ☐ Mechanical Drafting
- ☐ Machine Design-Drafting
- ☐ Machine Shop Practice
- ☐ Tool Design
- ☐ Industrial Instrumentation
- ☐ Machine Shop Inspection
- ☐ Reading Blueprints
- ☐ Toolmaking
- ☐ Gas—Electric Welding
- ☐ Heat Treatment—Metallurgy
- ☐ Sheet Metal Work
- ☐ Sheet Metal Pattern Drafting
- ☐ Refrigeration

POWER
- ☐ Combustion Engineering
- ☐ Diesel—Electric
- ☐ Electric Light and Power
- ☐ Stationary Steam Engineering
- ☐ Stationary Fireman

RADIO, TELEVISION, COMMUNICATIONS
- ☐ General Radio
- ☐ Radio Operation
- ☐ Radio Servicing—FM
- ☐ Television
- ☐ Electronics
- ☐ Telephone Work

RAILROAD
- ☐ Locomotive Engineer
- ☐ Diesel Locomotive
- ☐ Air Brakes ☐ Car Inspector
- ☐ Railroad Administration

TEXTILE
- ☐ Textile Engineering
- ☐ Cotton Manufacture
- ☐ Rayon Manufacture
- ☐ Woolen Manufacture
- ☐ Loom Fixing
- ☐ Finishing and Dyeing
- ☐ Textile Designing

HOME ARTS
- ☐ Dressmaking and Designing
- ☐ Cookery
- ☐ Tea Room Management

Name_____ Age_____ Home Address_____

City_____ State_____ Working Hours_____ A.M. to_____ P.M.

Occupation_____

Special tuition rates to members of the Armed Forces. Canadian residents send coupon to International Correspondence Schools Canadian, Ltd., Montreal, Canada

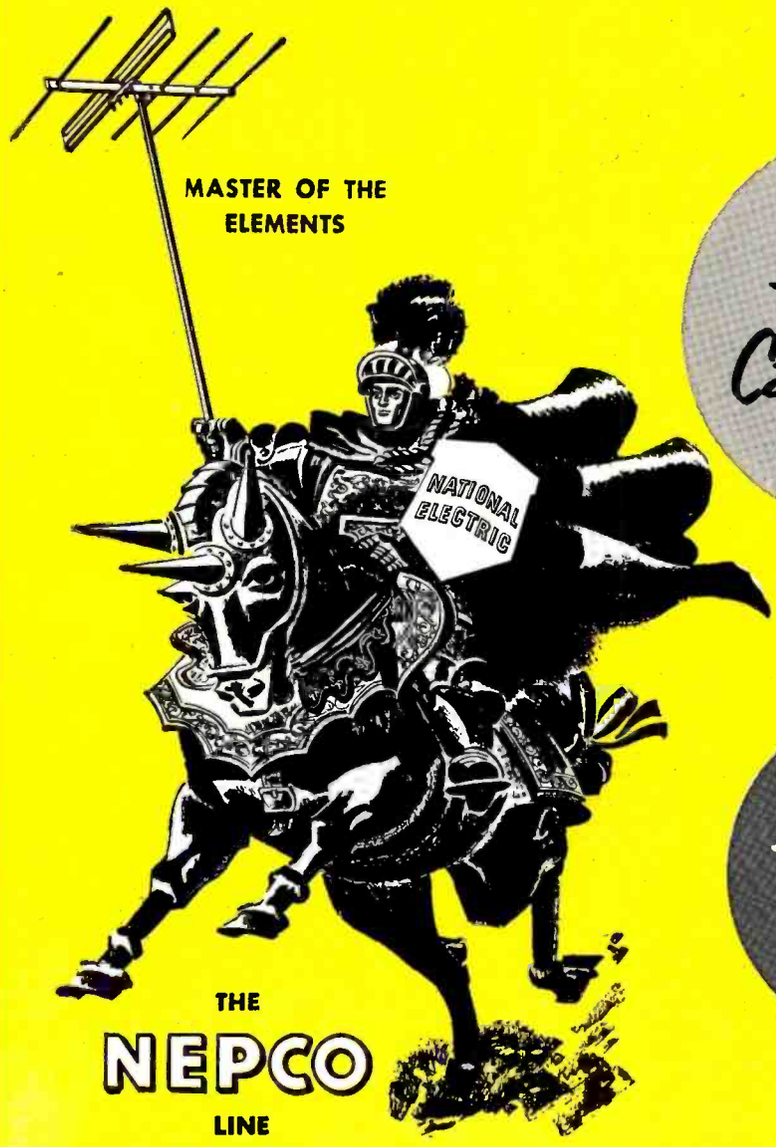
Dealers find the *NEPCO* line

Reduces Stocks

Reduces Call Backs

Increases Goodwill

Increases Profits



MASTER OF THE ELEMENTS

THE **NEPCO** LINE INCLUDES:

- YAGI ANTENNAS • CONICAL ANTENNAS
- UHF ANTENNAS • MASTING • EAVE MOUNTS
- WALL BRACKETS • VENT MOUNTS • ROOF MOUNTS
- CHIMNEY BANDING • CHIMNEY MOUNTS • GUY RINGS
- BANDING & MAST CLAMPS • ADD-A-TOWER PLATES • TV WIRE

National Electric Products

RADIO AND TELEVISION DEPARTMENT, PITTSBURGH, PA.

TV set owners want a better picture, longer

Here is the answer

Today, TV set owners are demanding better reception. Often the *trouble is in the antenna installation, not the set.* A corroded antenna (and most antennas are corroded if they have been up a while) or cracked and crazed down-leads (and most polyethylene leads *are* faulty after 10-12 months) can cause a deteriorated picture. *Nothing* you do to the set can correct this condition. A *new* and *better* antenna installation is the answer.

The NEPCO Line of antennas and TV installation materials eliminates this condition.

It was designed to meet the pressing demand for *better* electronic equipment—with more built-in ruggedness and corrosion-resistance than any line now known.

The NEPCO line was designed with YOU in mind:

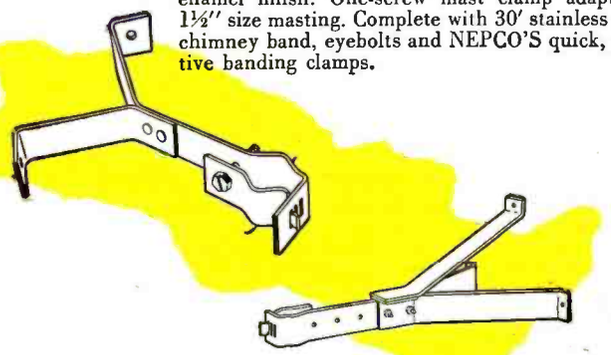
- Provides *maximum* number of installations with a *minimum* number of parts from jobbers. Your stocks are kept at a minimum.
- Its high quality eliminates costly call backs . . . saves you time, trouble and tempers . . . improves customer goodwill.
- Eliminates rust streaks—a common customer complaint.
- Provides *quicker* installations . . . goes up fast . . . easy to handle . . . easy to carry.

Remember, a better installation using better materials will insure more satisfied customers.

ORDER A BALANCED STOCK FROM YOUR JOBBER TODAY

CHIMNEY MOUNTS

Made of ⅛" x 1¾" steel, zinc-coated plus baked-enamel finish. One-screw mast clamp adapts to 1½" size masting. Complete with 30' stainless steel chimney band, eyebolts and NEPCO'S quick, positive banding clamps.

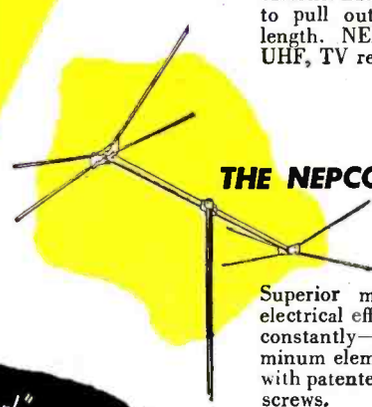


WALL BRACKETS

Fabricated of ⅛" x 1¾" steel, heavily zinc-coated with baked-enamel finish. One-screw mast clamp adjustable to 1½" masting. Hex head slotted bolts to speed erection time.

SPACE SAVER— BIG, FLAT BOXES FOR TV WIRE

NEPCO "Zee" Line comes in strong, flat cartons. Easy to stack, easy to handle, easy to pull out for cutting to any desired length. NEPCO "Zee" Line is low-loss UHF, TV receiving wire.



THE NEPCO CONICAL ANTENNA IMMEDIATE DELIVERY

Superior mechanical features maintain electrical effectiveness and performance—constantly—regardless of conditions. Aluminum elements are permanently secured with patented "vibration-proof" imbedding screws.

These other features will "spark" your TV sales:

- All parts heavily zinc-coated plus baked-enamel finish.
- All mounts made of rigid, heavy gauge steel.
- Unique adjustable mast clamp with one-bolt mounting.
- Two 15' stainless steel chimney bands with each chimney mount.
- Over 100 installation combinations possible with minimum inventory.
- Slotted, hex-head bolts standard equipment . . . all zinc-coated plus baked-enamel finish.
- Exclusive antenna mast clamp with positive alignment in all planes.
- Patented imbedding type screw for positive electrical and mechanical locking.

WHEREVER you see Service Dealers who are featuring the Raytheon Bonded Electronic Technician Program, you're looking at good businessmen who are as interested in tomorrow as in today. True, the cash-protection of the Raytheon Bond (backed by Continental Casualty Company) and the Raytheon "Code of Ethics" create initial customer confidence and thus stimulate sales right now. But, more important, the sound, sensible way *Raytheon Bonded Electronic Technicians* do business insures future profits from an ever-increasing backlog of satisfied customers.

Your Raytheon Tube Distributor will be happy to give you the whole story on the Raytheon Bonded Program, and tell you whether or not you can qualify for this double-barreled asset. Call him today.

RIGHT...FOR SOUND AND SIGHT!

RAYTHEON®

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division

Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

Excellence in Electronics

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

Spot Radio News

★ **Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

BIDS FOR NEW CHANNELS, which for many months were extremely staid documents, have suddenly emerged from this state of calm and splashed an unusual assortment of odd facts into the news hopper.

In a rare request for a merger of two quests for channels from applicants in Madison, Wisconsin, seeking Channel 3 now, it was indicated that the new bid was prompted by a consolidation of stockholders of both groups into A and B shareowners. And among the latter principals are those who will supply equipment and materials to the new station, such as office furnishings and supplies, paint and varnish, hardware and even auto facilities.

In another unique brief to the Commission, joint operators of two AM and FM stations in Macon asked that a bid for a low-band and their bid for a high-band station be considered simultaneously, even though the broadcasting stations are owned by the same officers. In their application, the broadcasters declared that they were aware of the . . . "policy considerations present when two corporations, each of which is a licensee of a station in a particular community join together as an applicant for a television station to serve that community." However, they added, at present there is no television station in Macon, and thus certainly the applicant for the low channel (13) would be granted a permit without hearing. If the parties to this application proceeded separately without a hearing, it was then noted, the public would have purchased regular-band receivers before the recipient of the high-band grant would be decided, and the problem of building an audience for the high-band station may prove insurmountable. Thus, it was emphasized, granting of this joint application will mean that v.h.f. and u.h.f. will arrive at the same time to Macon, and thus competition on an equal basis will exist. Even though both facilities will be jointly controlled, competition between them would be maintained, the applicants stressed.

Three of the Commissioners (Sterling, Merrill, and Bartley) felt that the grant should be approved, but Chairman Walker demurred declaring that the McFarland Act requires that the application be designated for hearing . . . "to determine whether a grant of . . . application would serve the public interest."

Commissioner Bartley said he was highly in favor of approval because it would provide competition at an earlier date, provide an opportunity for the high bands to commence operation about the same time as the standard band TV in a new market, and the broadcast stations would continue to compete as long as the conditions agreed upon are followed.

In still another unusual case on file, the *Missouri Broadcasting Corp.*, who own WIL in St. Louis, asked the Commission to refuse the request of WIBV in Belleville, Illinois, for Channel 42, because the application is not in order, since Channel 42 has been assigned to St. Louis and cannot be moved to Belleville, 15 miles away; in addition, Belleville already has an ultra-high channel, 54. Then WIL noted that if the Commission negates the Illinois application, the Channel 42 CP should be awarded to them without further contest; it seems as if the examiners passed over the application originally when they reached St. Louis because of the conflict of channel requests.

With over 1800 grants still to be issued and sizzling arguments due in scores of instances, the days and nights, too, of the Commissioners and examiners will be far from rosy during the new year and most likely, during the next few years.

FULLFILLING ITS PROMISE to speed allocations, the seven air chiefs ended the year with a record commercial grant list of 165, and it is believed that during the winter and spring months, the pace will be substantially stepped up.

Thus far, the books reveal that a total of 283 stations (of all types) have been authorized. Of the 165 who received new commercial allotments, 21 have been awarded special temporary authorization to go on the air. The 108 pre-freeze stations are located in 65 cities in 33 states and the District of Columbia or Washington. Post-freeze grants made during '52 will bring TV service to 112 additional cities.

Only five states have not as yet received TV authorizations: Montana,

New Hampshire, North Dakota, Vermont, and Wyoming. However, applications are pending for stations in each of these states. Incidentally, Alaska and the Virgin Islands had neither TV authorizations nor applications pending at the close of '52 and there'll probably be no interest in TV service for these areas for a long time.

A list of those who now proudly possess permits to build TV stations, appeared in part, last month. On page 76 of this issue appears a continuation of these listings.

WASHINGTON broadcasters, and radio and TV personalities were prominent on the roster of the Gen. Eisenhower inaugural-ball subcommittee. Among those active were: Thad H. Brown, Jr., of the National Association of Radio-TV Broadcasters, who was on the invitations committee; Ed Morris, *Zenith* distributor, co-chairman of floor committee; Ken Berkley of WMAL, Earl Gammons of *CBS* and Frank Russell of *NBC,* who were on the patrons committee. And on the committee on reception to distinguished guests were Phil Graham of WTOP, and Samuel Kauffmann of WMAL, as well as Brown, Morris, and Gammons.

THAT OUTSTANDING SECURITY plan, *Conelrad* (control of electromagnetic radiation), designed to alert and control the operation of all broadcast stations (AM, FM, TV) has become official and nearly 4000 broadcasters have received detailed procedures of operation.

Under the plan, AM stations will be allowed to remain on the air, transmitting on either 640 or 1240 kc. a continuous program featuring special instructions, information, and news on air-raid alert conditions.

Specifically, there are four types of operation which might be used: One is known as "sequential," in which stations are arranged into groups or clusters of two or more stations, located in one or more municipalities, counties, or states, all using the same or both frequencies, mentioned above. Stations will go on and off the air in a non-cyclic sequence with periods varying from 5 to 40 seconds. The second type is an "on-off," which applies to individual stations or cluster outlets, with the Commission controlling power for maximum effectiveness. Air time of the individual outlets will be about 10 to 30 seconds, and off-air time will be about 3 to 6 minutes; outlets will implement air time of cluster groups. In the third group, a pulsating system is used, with power of transmitters on the air varied over a certain range. And in the fourth class a sync method is used, with two or more stations in a given area on the air at the same time, all assigned the same frequency and power regulated by the Commission. It is reported that most stations will use the "sequential" and "on-off" methods.

(*Continued on page* 174)

GET DEPENDABLE PERFORMANCE IN TV TEST EQUIPMENT!

...Accurate Measurements and Increased Profits, Too!

Model ST-4A

COMBINED use of these G-E units takes guesswork out of test measurements With good linearity and amplitude characteristics G-E equipment eliminates misleading results from distorted patterns. Your technicians will handle more work...handle it more efficiently...add to your profits and your reputation!

Sweep Generator ST-4A. Outstanding in performance and varied in application. Adjustable linear sweep that is all-electronic...no moving mechanical parts. Covers all broadcast TV channels. Good attenuation and extremely low leakage plus continuously variable center frequency.

Marker Generator ST-5A. Marks all the critical frequencies on a pass band as well as having continuous coverage. Designed to give fast manipulation with crystal controlled accuracy for outstanding performance. Features separate crystal on each TV channel with simultaneous picture, audio and trap markers on both channel and intermediate frequencies.

Oscilloscope ST-2A. Reports from thousands indicate this scope does the job they need in TV circuit work. Used in conjunction with the G-E Sweep and Marker you have an unbeatable combination. Special features include wide frequency response plus DC amplifier to adapt the equipment to other applications.

Balanced Output Adaptor ST-8A. Converts single-ended Sweep Generator output to balanced output for 300 ohm television receiver work.

Model ST-5A

Model ST-2A

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

General Electric Company, Section 933
Electronics Park, Syracuse, N. Y.
Please send me complete specifications on G-E TV Test Equipment.

NAME.....
COMPANY.....
ADDRESS.....
CITY.....STATE.....

FAR BETTER RECEPTION

IN EVERY LOCATION

with Sensational New

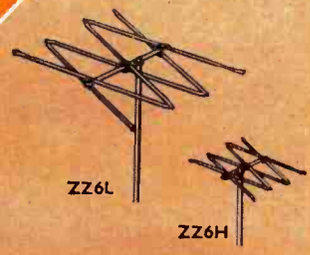
TRIO ZIG-ZAG

Patent Pending

TV ANTENNAS

SUBURBAN MODELS

Models ZZ4A and ZZ6A give you all-channel (2 thru 13) reception in ONE SINGLE BAY ANTENNA. The Model ZZ4A has excellent gain and is designed for suburban areas. Model ZZ6A has even greater gain and provides excellent all-channel reception in near fringe areas.



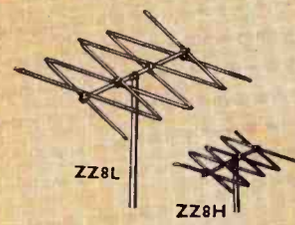
NEAR FRINGE MODELS

For near fringe area reception, the Models ZZ6L and ZZ6H are recommended. Model ZZ6L covers Channels 2 thru 6, Model ZZ6H is for Channels 7 thru 13. Both antennas offer high gain with patterns and front-to-back ratios similar to cut-to-channel yagis.

From ultra-ultra fringe to metropolitan areas, the sensational new TRIO ZIG-ZAG TV Antennas are providing clear, enjoyable TV pictures.

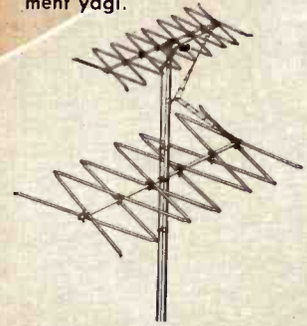
Enthusiastic reports are pouring in from across the nation, testifying to the high efficiency of the new, exclusive TRIO ZIG-ZAG TV Antenna design.

Yes, results — not mere claims — have made the TRIO ZIG-ZAG America's most wanted TV antenna!

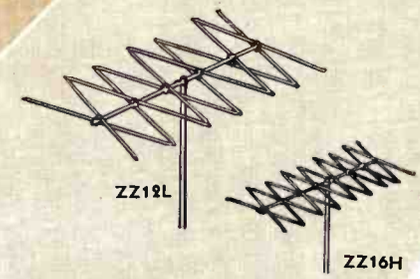


FRINGE MODELS

Models ZZ8L and ZZ8H were designed for normal fringe area reception and provide clear, snow-free pictures. Forward lobe patterns and front-to-back ratios are similar to a good single channel, multi-element yagi.



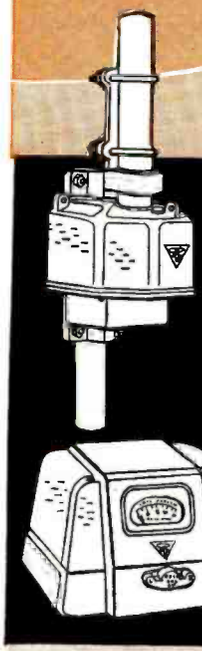
ZZ12L and ZZ16H are stacked for all VHF Channel Reception



ULTRA FRINGE MODELS

The extremely high gains of the ZZ12L and the ZZ16H models provide unequalled reception in ultra-fringe areas. Model ZZ12L covers Channels 2 thru 6 and Model ZZ16H, Channels 7 thru 13. These two models when stacked, are fed with only one 300 ohm line and provide ALL VHF CHANNEL RECEPTION. Line match is excellent and front-to-back ratios are unusually high.

** To provide even greater strength, TRIO Antennas now have stamped steel element clamps.*



TRIO ROTATOR AND DIRECTION INDICATOR

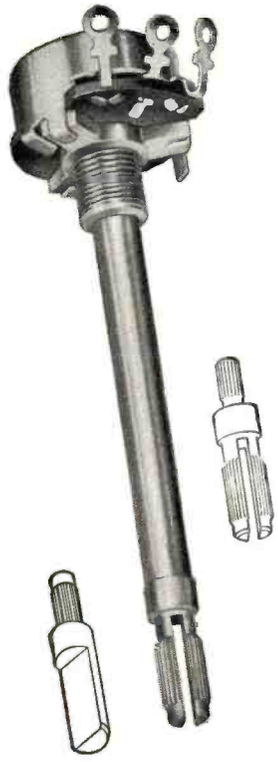
The TRIO Rotator is America's most dependable — has two powerful 24 volt motors — one for each direction of rotation. Absolutely weatherproof, permanently lubricated. All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment, strength and longer life. Every TRIO Rotator fully guaranteed for two years! Beautiful Direction Indicator has "finger tip" control — no need to hold knob for rotation. A touch of the finger starts it — a touch stops it!

TRIO

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

Depend on Mallory
for
Approved Precision Quality

Get More Jobs Done In A Day



There's no profit in sets waiting to be repaired. Profits depend on turning out more jobs . . . and cutting down on time wasting call-backs.

Midgetrols® are designed for fast, easy installation in any set, TV or radio.

Round tubular shafts can be cut accurately and quickly . . . fit split-knurl or flatted-type knobs.

AC switches can be attached instantly without disassembling the control.

Their unique design simplifies inventory problems . . . always available from your Mallory Distributor.

Midgetrols are engineered to duplicate the precise characteristics of original equipment. They will give equal . . . and often better performance and life than the original control.

Save time . . . find extra minutes to turn out more finished jobs . . . be sure of dependable, precision quality for all your TV and radio repairs . . . ask for Mallory Midgetrols the next time you call your distributor.

Another time saver. Get your copy of the Mallory Control Guide. It is a complete cross reference between set manufacturers' part numbers and the equivalent Mallory control.

P R MALLORY & CO Inc

MALLORY

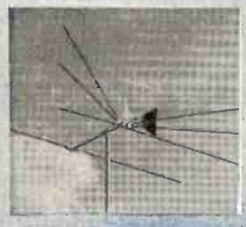
CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
• RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

ULTRA FAN series — Complete VHF-UHF coverage



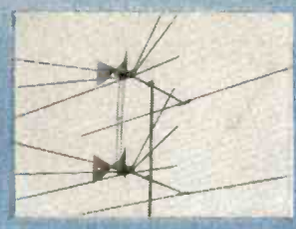
single bay — model no. 413

Today's most sensitive All-VU* antennas! The Ultra Fans actually operate on *three* separate electronic principles — automatically:

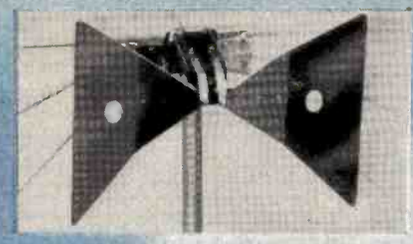
1. Low Band VHF (Channels 2-6) . . . *Conical antenna with parasitic reflector*
2. High Band VHF (Channels 7-13) . . . *Large diameter V antenna*
3. UHF (Channels 14-83) . . . *Triangular dipole with sheet reflector*

One set of All-VU* stacking rods provides highest VHF and UHF gain. Each Ultra Fan has its own 2-stage inter-action filter, so that only one transmission line to the set is required.

*All VHF, all UHF



stacked — model no. 4132



ULTRA DAPTER
model no. 414

Instantly converts all Channel Master Super Fans into high gain, all-channel, VHF-UHF antennas. *Features a built-in inter-action filter.*

Your best bet for UHF!

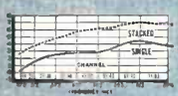
CHANNEL MASTER Ultra-Tennas

America's most complete — most effective — UHF antenna line.

Channel Master's advanced engineering pays off again! While rain caused hundreds of UHF antennas to FAIL recently in Portland, *not one Channel Master antenna dimmed or shorted out a picture!* The facts speak for themselves: Rain or shine, Channel Master antennas outperform all others.

ULTRA BOW
model no. 401

The basic UHF antenna for primary signal areas, and the outstanding member of the bow-type antenna family.



Only Channel Master Antennas are designed to eliminate the "TWIN TERRORS" OF UHF RECEPTION:

- **Vibration, which causes picture flicker.**

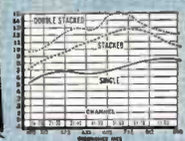
  Eliminated by Channel Master's Ultra-Rigid construction and advanced mechanical design.

- **The accumulation of dirt or moisture around the antenna terminals, which dims and eventually shorts out the TV picture.**

  Eliminated by Channel Master's sensational "free-space" terminals which prevent the accumulation of foreign deposits at the feed points.

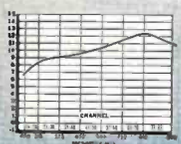
ULTRA BOW
with SCREEN REFLECTOR
model no. 403

Can be stacked in 1, 2, and 4 bays. High, all-channel UHF gain, excellent front-to-back ratio.



ULTRA VEE
model no. 404

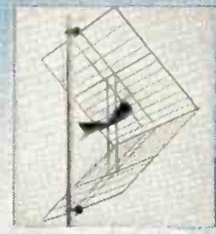
- Good UHF gain
- Low VHF gain
- The most rigid UHF antenna of its type and size.



Gain: 11 DB, single
14 DB, stacked

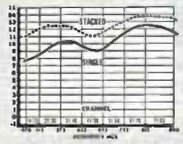
DELTA WELD
Wide Band 10 Element UHF Yagi

Custom-designed for full coverage of your specific area! Brilliant high gain performance across as many as *23 different channels.*



CORNER REFLECTOR
model no. 405

The outstanding all-channel UHF FRINGE antenna. Now — can be stacked for even greater gain.



MEMBER ANTENNA MANUFACTURERS ASSOCIATION

MOST IN PREASSEMBLED ANTENNAS

Sold through the nation's leading distributors

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

Write for complete technical literature

ULTRA-TIE model no. 9034
Electronic Inter-Action Filter

JOINS separate antennas into a single VHF-UHF antenna system, for use with a single transmission line.

SEPARATES VHF and UHF signals at the set or converter where separate inputs are provided.

The only filter with "free-space" terminals.

NOW—read this true story of

UHF ANTENNA FAILURE IN PORTLAND!

GARRETSON RADIO SUPPLY, INC.
INDUSTRIAL DIVISION
2416 SECOND AVENUE
SEATTLE 1, WASHINGTON
SE. 0640 • MU 0422

January 22, 1953

Channel Master Corporation
Napanoch Road
Ellenville, New York

Attn: Harold Harris

Dear Harold:

Now that the UHF station, KPTV in Portland, Oregon has been on the air for a few months, it may interest you to know some of the results of antenna performance.

Antennas of all descriptions, both multi-channel and single channel UHF have been installed in the Portland area. The results in most cases were fair, however in some instances certain types of antennas specifically for the UHF channels failed completely to perform. Several of the so called "all channel" antennas performed in strong signal areas, but failed completely where gain was needed, or ghost problems were encountered. These results were obtained while the weather in Portland was good.

For the past few weeks it has been raining consistently in the Portland area and the antenna failures have been numerous, due to the shorting out of the terminal connection at the antenna. The result -- antenna crew men have been out drilling small holes in the terminal blocks trying to provide as much air insulation as possible. Certain types of antennas, which used an isolation filter at the antenna also had their troubles. In many cases this filter broke down and moisture leaked into the filter, causing it to short out at the terminal.

Many of the Channel Master UHF antennas have been sold and installed by our dealers in Portland, with no complaints whatsoever. In all cases, the antennas have given excellent performance and provided clean pictures, regardless of weather conditions. This, we feel, is the result of research and engineering, and the foresight to foresee the many problems which would confront the UHF antenna.

The use of your free-space terminals has forestalled any problems of signal loss due to moisture conditions and in all cases, our dealers tell us that the Channel Master antennas live up to the published catalog information.

May we offer our congratulations on an excellent unit - and let's keep them rolling!

Very truly yours,

GARRETSON RADIO SUPPLY, INC.

Paige C. Lundberg

By: Paige C. Lundberg

VMH/pl

Look to Channel Master for UHF— IT PAYS OFF!

Within the INDUSTRY

RICHARD A. GRAVER, vice-president and general manager of the *Capehart-Farnsworth Corp.,* has been appointed vice-president and director of marketing of the *Hallicrafters Co.*

In his new capacity, Mr. Graver will be in complete charge of all merchandising, marketing, and advertising activities of the company.

Before joining *Capehart-Farnsworth,* he was vice-president in charge of the electronics division of *Admiral Corporation.* Prior to joining *Admiral,* he was district sales manager in charge of all products for *RCA* in Chicago.

* * *

AEROVOX CORP. has purchased **ACME ELECTRONICS, INC.** of Pasadena. It will be operated as a wholly-owned subsidiary under the continuing management of Hugh P. Moore as president . . . **MOTOROLA INC.** has announced the organization of a wholly-owned subsidiary corporation, **MOTOROLA COMMUNICATIONS AND ELECTRONICS, INC.** It will distribute the products made by the communications and electronics division of the parent company . . . **R. B. BARNHILL & ASSOCIATES** has been recently organized as a manufacturers' representative firm by R. B. Barnhill, former commercial sales manager of the Radio Division of **BENDIX.** The new company has headquarters at 412 Woodbine Ave., Towson 4, Md. . . . **THE RADIO CRAFTSMEN, INC.** has established the **HI-FIDELITY MFG. CORP.** in West Palm Beach to act as a supplier of tuners, amplifiers, and eventually television chassis for the parent company. The plant of the new Florida subsidiary is at 2501 Belvidere Rd. . . . **NAJESCO, INC.** has been formed by **JERROLD ELECTRONICS CORP.** to act as exclusive agents for the sale of the company's test equipment. The firm is located at 1449 S. 26th St., Philadelphia 46 . . . The firm of **HARMAN-KARDON, INC.** has been established at 52 W. Houston St., N. Y. C. as successors to **KARDON MFG. CORP.**

* * *

DAVID BOGEN CO., INC. has moved to new quarters at 29 Ninth Ave., N. Y. C. The new plant provides 70,000 sq. ft. of manufacturing and engineering space . . . **BLONDER-TONGUE LABS., INC.** has completed its new factory and office building at 526-536 North Ave., Westfield, N. J. . . . The Sound Division of **STROMBERG-CARLSON** has opened a sales and sales engineering office at 4607 Cole Ave. in Dallas, Tex. . . . **ELECTRO DEVICES, INC.** has acquired a two-story building at 4-6 Godwin Ave., Paterson, N. J. The new facilities will permit expanded production of electronic motor speed controls . . . **PHILCO** recently purchased a plant in England and is now making available 10 radio receiver models. Production of television sets is expected to start in approximately six months . . . **BELCO INDUSTRIAL EQUIPMENT DIV., INC.,** is now occupying its newly-erected plant at 100 Pennsylvania Ave. in Paterson, N. J. . . . **WARWICK MFG. CORP.** has purchased the Zion, Ill. building of **MARSHALL FIELD & CO.** The building contains 200,000 sq. ft. of space . . . **G-V CONTROLS INC.** of East Orange, N. J. has acquired additional space at 28 Hollywood Plaza which will double the manufacturing facilities of the firm . . . **RESISTANCE PRODUCTS CO.** has opened a new plant at 914 S. 13th St., Harrisburg, Pa. The plant will be used in conjunction with the company's present facilities at 714 Race St.

* * *

GRADY L. ROARK has been appointed manager of equipment tube sales for *General Electric's* Tube Department.

He has been central regional manager for equipment tube sales with headquarters in Chicago since 1950. In his new position he will be located at the Tube Department headquarters in Schenectady and will direct the sales of *G-E* receiving, cathode-ray, industrial, and transmitting tubes to manufacturers of electronic equipment.

Mr. Roark joined *G-E* on the company's test engineering program in 1933.

* * *

DR. V. K. ZWORYKIN, pioneer reseacher in electronics, has been awarded the 1952 Edison Medal by the American Institute of Electrical Engineers.

Dr. Zworykin, who is vice-president and technical consultant of the *RCA Laboratories Division,* was cited for his "outstanding contribution to the concept and design of electronic components and systems."

* * *

ARTHUR L. CHAPMAN has been named to the newly-created post of vice-president in charge of electronics operations for *Sylvania Electric Products Inc.* . . . **MAX BAUME** is now with *Brook Electronics, Inc.* as sales manager. He was formerly head of the sound department of *Hudson Radio* . . . *Mark Simpson Mfg. Co., Inc.* has appointed **RALPH AASEN** as chief engineer and **G. LEON-**

Sweeping the Country!.

BUY DIRECT AND SAVE

'PRE-FAB'

COLLINS TUNERS and RECEIVERS

AUDIO PRODUCTS CO.

Collins Audio Products Co. is in no way affiliated with Collins Radio Co.

Two ALL NEW Complete Kits for Every High-Fidelity Need

FM Tuner Kit **$55**

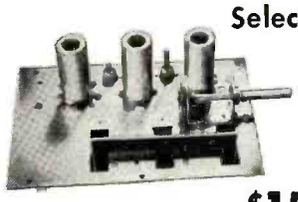
The FM-11 tuner is available in kit form with the IF Amplifier mounted in the chassis, wired and tested by us. You mount the completed RF Tuning Unit and power supply, then after some simple wiring, it's all set to operate. 11 tubes: 6J6 RF amp, 6AG5 converter, 6C4 oscillator, 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF, (2) 6AU6 limiters, 6AL5 discriminator, 6AL7-GT double tuning eye, 5Y3-GT rectifier. Sensitivity 6 to 10 microvolts, less than ½ of 1% distortion, 20 to 20,000 cycle response with 2DB variation. Chassis dimensions: 12½" wide, 8" deep, 7" high. Illustrated manual supplied. Shipping weight 14 lbs.

Each Collins Tuner Kit is complete with punched chassis, tubes, power transformer, power supply components, hardware, dial assembly, tuning eye, knobs, wire, etc., as well as the completed sub-assemblies: FM tuning units, AM tuning units, IF amplifiers, etc., where applicable. Since all these sub-assemblies are wired, tested and aligned at the factory, Collins Pre-Fab Kits are easily assembled even without technical knowledge. The end result is a fine, high quality, high fidelity instrument at often less than half the cost — because you helped make it and bought it direct from the factory. Bring your present reproducing system up to date with a new Collins Tuner.

FM/AM Tuner Kit **$77.50**

The original 15 tube deluxe FM/AM pre-fab kit redesigned on a smaller chassis. The tuner now measures 14" wide by 12" deep by 7½" high. This attractive new front and dial assembly opens up new applications where space is at a premium. Kit includes everything necessary to put it into operation—punched chassis, tubes, wired and aligned components, power supply, hardware, etc. Kit comprises FMF-3 tuning unit, IF-6 amplifier, AM-4 AM tuning unit, magic eye assembly and complete instructions. All tubes included. Shipping weight 19 lbs.

Selected Basic Components For Special Applications



FMF-3 Tuning Unit **$15.25**

The best for FM. The most sensitive and most selective type of "front end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 6½"x4½". In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be attained. Tubes included as well as schematic and instructions. Draws 30 ma. Shipping weight FMF-3: 2½ lbs. Dial available @ $3.85

IF-6 Amplifier **$19.75**

A remarkable value! 6 tubes are used in the IF amplifier: 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF's, (2) 6AU6 limiters and 6AL5 discriminator. High gain, wide-band response (200 KC) for highest fidelity. 20 to 20,000 cycles. Distortion less than ½ of 1%. Draws 40 ma @ 220 volts. Chassis plate dimensions: 11-5/16"x2½" Shipping weight: 3 lbs.

AM-4 Tuning Unit **$24.50**

Tops in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages with high sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes 6BA6 RF amplifier; 6BE6 converter; 6BA6 IF amplifier and 6AT6 detector. Draws 30 ma @ 220 volts. Mounts on a chassis plate measuring 4"x7⅜". Shipping weight 2½ lbs. Dial available at $3.85.

RD-1C Tuner & Dial **$28.50**

The COLLINS RD-1C FM tuner chassis is unique in the field. A whole, compact FM tuner and dial that fits in the palm of your hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. Use in conjunction with your phonograph amplifier. Full frequency response to 20,000 cycles. Sensitivity 20 microvolts, permeability tuned. Tuning unit and IF amplifier on the same chassis plate. Draws 40 ma @ 100 volts. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit. Shipping weight tuner and dial 5 lbs.

MAIL COUPON TODAY

To: Collins Audio Products Co. Inc.
P.O. Box 368, Westfield, N. J.
Tel. WEstfield 2-4390

☐ FM Tuner Kit ☐ FM/AM Tuner Kit ☐ Slide Rule Dial Assembly
☐ FMF-3 Tuning Unit ☐ IF-6 Amplifier ☐ RD-1C Tuner and Dial
☐ AM-4 Tuning Unit

NAME.....

ADDRESS.....

CITY.....STATE.....

Amount for Kit $..... See weights, add shipping cost $.....

Total amount enclosed $..... Check ☐ Money Order ☐

WHEN YOU THINK OF TUNERS, THINK OF COLLINS AUDIO PRODUCTS

ARD WERNER as director of sales . . . **JOHN R. SHEARER** is the new sales engineer for the television transmitter division of *Allen B. Du Mont Labs, Inc.* **LYNAL H. WILSON** has been made general manager of *Argos Products Co., Inc.*, electronic cabinet manufacturer . . . **LOU BURZYOKI** is the new chief transformer engineer of *Crest Labs.* . . . **OSCAR E. CARLSON,** former vice-president of *Servo-Tek Products Co.,* has been elected president of *Electro Devices, Inc.,* of Paterson, N. J. . . . **O. E. BISHOP** has been promoted to the post of manager of sales operations for the distributor division of *P. R. Mallory & Co., Inc.* . . . **KJELL GAARDER,** who has been associated with *Webster Chicago, RCA,* and *G-E,* has joined *V-M Corp.* of Benton Harbor, Mich. where he will head all development engineering and production engineering activities . . . **JOHN A. VAN AUKEN** is the new general manager of *Mark Simpson Mfg. Co., Inc.* . . . *Sangamo Electric Co.* has elected **H. LAURENCE KUNZ,** vice-president. He was formerly general manager of the company's Capacitor Division . . . **H. EARLE RUNION** has been named production manager of *Consolidated Engr. Corp.* . . . **PAUL V. PEMBRICKS,** previously head of the methods department for *Hammarlund Mfg. Co.,* has been appointed assistant plant manager of the firm . . . **ERIK ISGRIG,** former account executive with *Earle Ludgin & Co.,* has joined *Zenith* as director of advertising . . . **RAYMOND K. McCLINTOCK** is the manager of new product promotion of *Sylvania Electric Products Inc.* The new post is a recently-created position with the firm. . . . **HENRY FOGEL,** formerly manager of the commercial products division of *Radio Receptor,* has been named president of the newly-organized firm of *Granco Products, Inc.* The company designs, manufactures, and distributes converters for u.h.f. television and u.h.f. measuring instruments . . . **A. A. DYSON,** managing director of *Erie Resistor Ltd.* of England has been included in Queen Elizabeth's New Years Honors List to receive the Order of British Empire. He has been active on many British government electronics planning and production boards.

* * *

BYRON C. DEADMAN of *Northern Radio & Television Co.,* Green Bay, Wis., has been elected treasurer of the Radio Parts & Electronic Equipment Shows, Inc., sponsors of the Electronic Parts Show, to fill the unexpired term of Jack A. Berman who resigned recently.

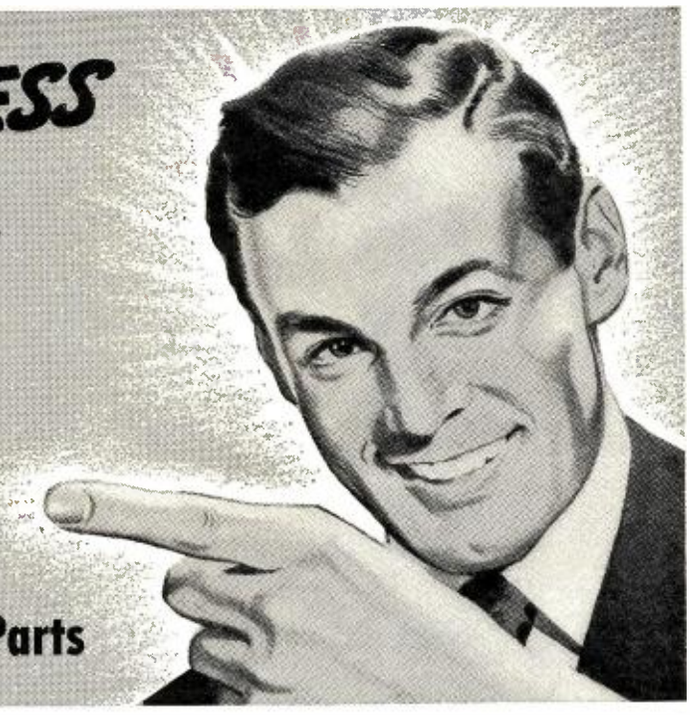
Mr. Deadman has been active in the affairs of the National Electronic Distributors Association, which group he represents on the Show Board.

* * *

JEROME KURTZ, navigator and radio operator on a twin-engine Beechcraft NC-67083, has been reported missing

(*Continued on page* 161)

BUILD A BUSINESS and a REPUTATION!



Replace with Genuine G-E Parts

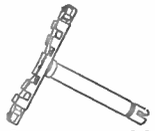
In a business that's growing rapidly, an ever increasing number of expert servicemen carry the *complete* line of General Electric replacement parts. They realize the demand for these products and the opportunity G-E units offer to *increase sales... add to their reputations.*

G-E RECORD COMPENSATOR. "Hit of the New York Audio Fair." Here is a new G-E unit that is sure to build store traffic. Favorite old records sound like new. Modern recordings are interpreted more faithfully. Low cost is a plus feature for volume sales. Lends itself ideally to effective store demonstration.

G-E TONE ARMS. A line designed to bring users the full benefit of our famous variable reluctance cartridges. Stylus replacement requires only a few seconds. Skilled G-E workmanship and quality construction add up to customer satisfaction for many years.

G-E PREAMPLIFIERS. New improved performance. Completely self-contained and ready to operate when connected to a power source. Ease of installation is a factor you'll appreciate. This product goes hand-in-hand with widely accepted General Electric Cartridges.

G-E CARTRIDGES. A complete line of single or dual units to meet every need for quality reproduction. Offers incomparable performance. Deliver smooth, wide range response; low tracking pressure. Available at prices your customers will really appreciate.



G-E WIDE-RANGE STYLI. General Electric manufactured the first wide-range diamond-sapphire* combination! Every stylus is designed to give unexcelled performance *up to 15,000 cycles.* Engineered to minimize record wear...add quality to the products you carry.

G-E SPEAKERS. 27 models in 8 sizes to choose from. G-E high fidelity speakers stand head and shoulders above the industry in providing peak performance at a modest price. Featuring aluminum base voice coils and Alnico 5 magnets, your customers are assured of a quality product for their listening pleasure.

**Some sapphires are synthetic*

● **Contact your G-E Distributor now for the new lucite Record Compensator counter displays, plus many other sales aids that do your selling job for you!**

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

SEND FOR INFORMATION TODAY!

General Electric Company, Section 933
Electronics Park, Syracuse, New York
Please send me information about G-E Parts.

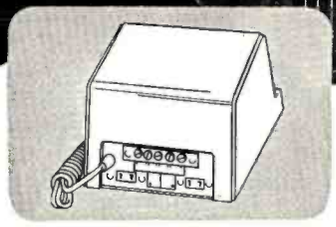
NAME.....

ADDRESS.....

CITY.....STATE.....

GENERAL ELECTRIC

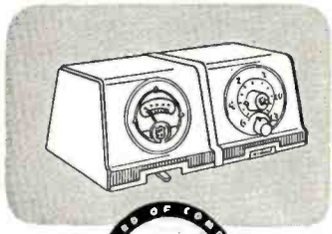
truly outstanding



the RADIART TV BOOSTER

has all the outstanding features

the perfect partner to the C•D•R ROTOR



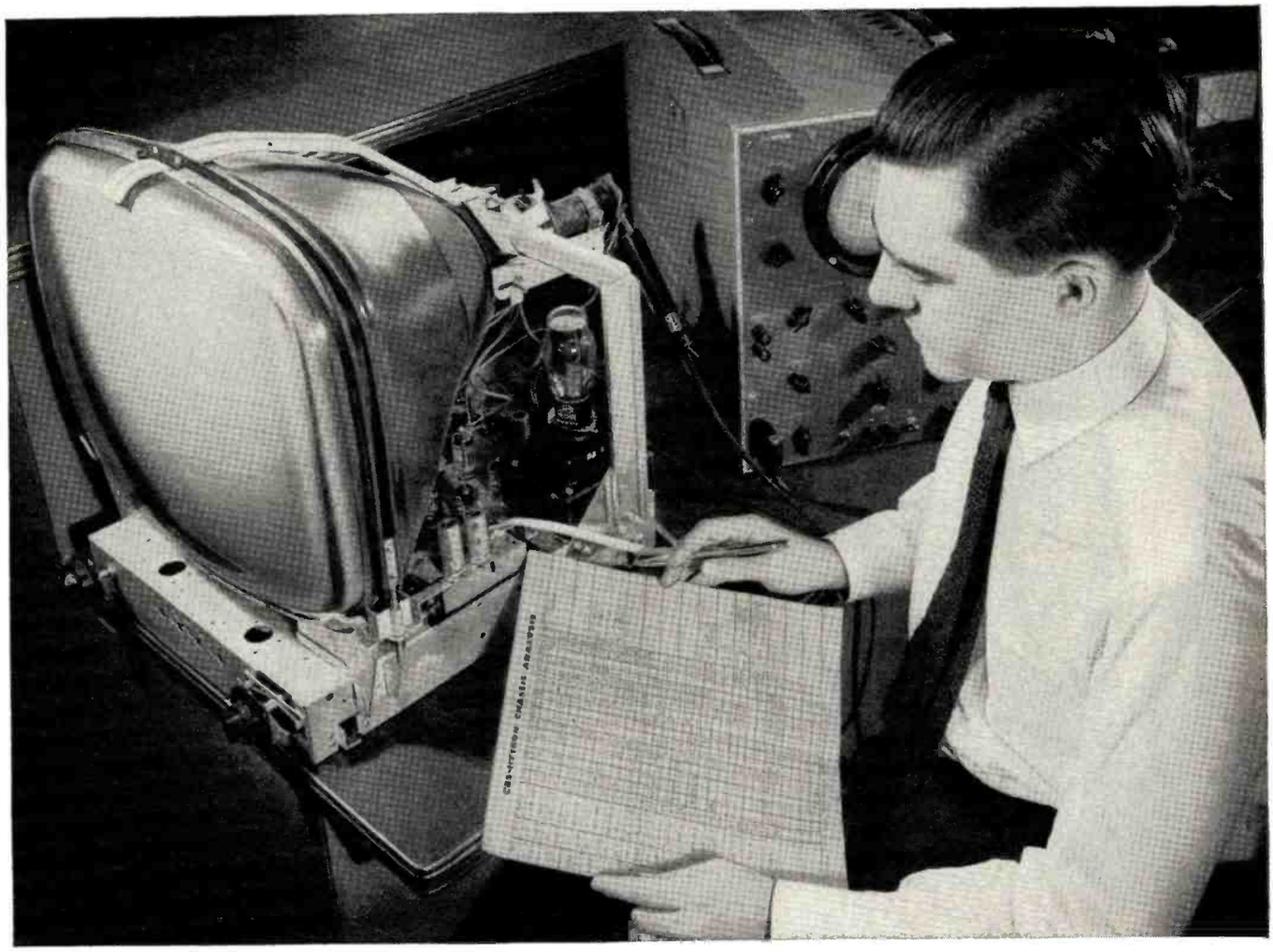
- ★ *Stand-By Position . . . eliminating "Warm-up" time for Booster.*
- ★ *110 Volt Outlet to plug in TV Set—Power Control through the Booster.*
- ★ *Extra 110 Volt Convenience Outlet . . . plug in Rotor or any Appliance.*
- ★ *High Signal-To-Noise Ratio.*
- ★ *Wide Band Amplification.*
- ★ *Complete Neutralization for Stable Operation*
- ★ *Handsome Mahogany Finish.*

Any way you look at it . . . the RADIART BOOSTER is truly outstanding! Its many features make it superior in performance . . . its handsome design sets it off in a class by itself . . . and it is so flexible . . . with its extra outlet!

SUBSIDIARY OF

THE *RADIART* CORPORATION CLEVELAND 13, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES



Bring back that New-Set Sparkle with Performance-Tested Tubes

Meet John Cunningham, a CBS-Hytron Commercial Engineer. John is beginning at the beginning for you. Socket by socket, he is analyzing the tube requirements of a brand-new TV set design.

John knows the superior performance demanded. He concentrates his know-how on insuring top tube operation within standard specification limits. He tests sample tubes . . . checks analysis data. Working hand-in-glove with the set designer . . . and with CBS-Hytron engineers . . . he assures control of the characteristics of all tubes for this new chassis. Finally he achieves . . . from rectifiers to picture tube . . . the perfect performance all of this engineering team (and you) seek.

Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets.

Small wonder that your CBS-Hytron replacement tubes recapture that new-set sparkle. Please *your* customers. Cut *your* call-backs. Profit more. Take advantage of CBS-Hytron engineering. Demand CBS-Hytron . . . your logical replacement tube, because it is performance-tested all the way . . . from original to replacement.

CBS HYTRON RADIO TUBES

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

HYTRON RADIO AND ELECTRONICS CO.

A Division of Columbia Broadcasting System, Inc.

Main Office: Danvers, Massachusetts

NEW . . . BIGGER . . . BETTER

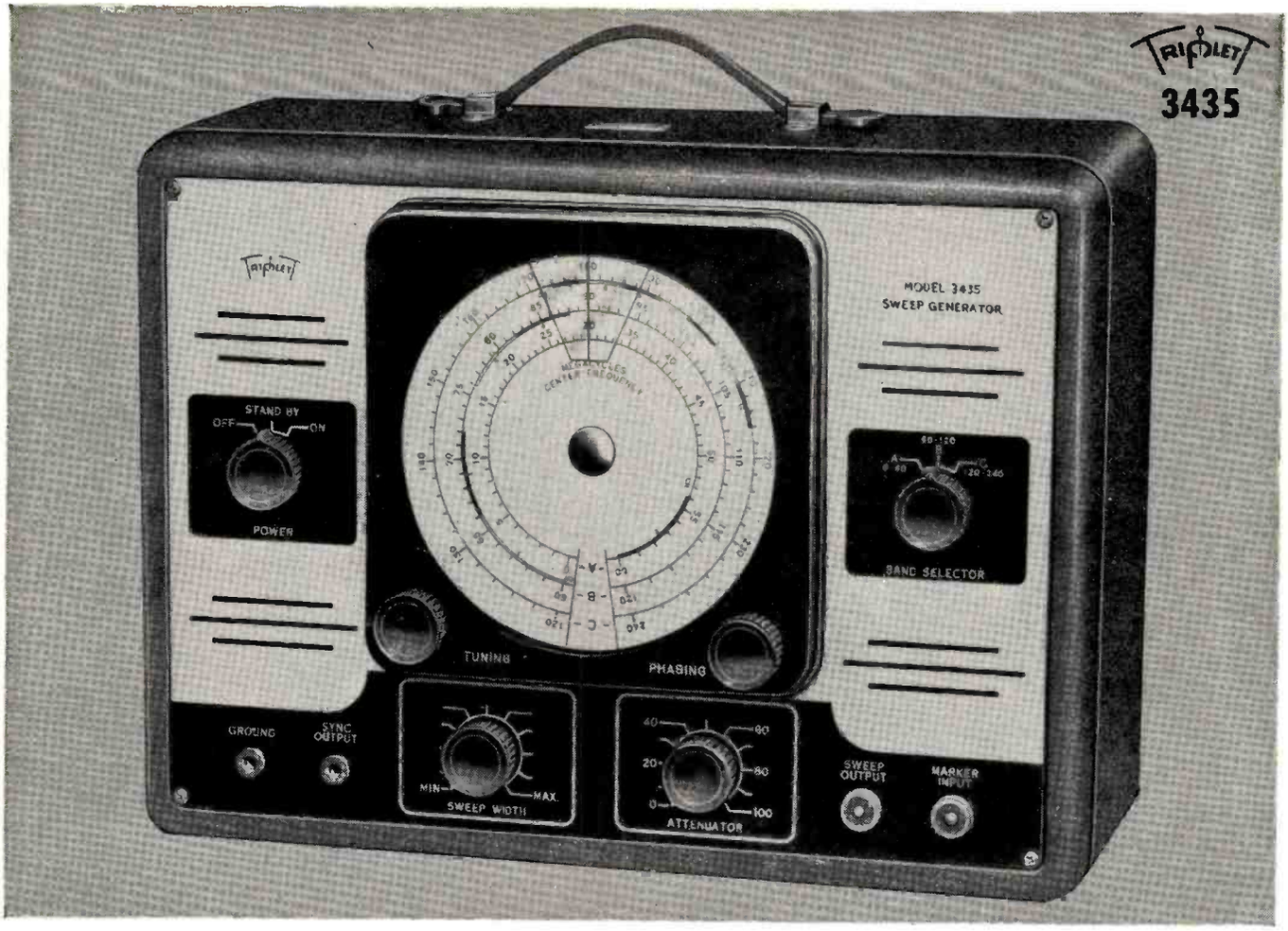
FREE!

6th Edition

CBS-HYTRON Reference Guide for Miniature Electron Tubes

- A CBS-Hytron original . . . it's unique.
- *All* miniatures, regardless of make.
- 250 miniature types . . . 87 new.
- 111 basing diagrams . . . 34 new.
- Similar larger prototypes indicated.
- 8 packed pages of data you need daily.
- And it's FREE!

Get your copy of this old friend brought up to date now. Ask your CBS-Hytron jobber or write direct . . . today!

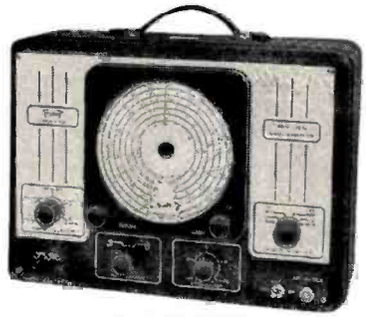


Only $114.50 and you're in Profitable TV Testing

Value-wise you can't make a smarter buy. For if you have a good Signal Generator to use as a marker with 3435, this new Triplett Sweep saves you real money! Performance-wise it's Triplett Engineering at its best. There are no complications in use. Continuous range coverage to 240 MC for all TV carrier and IF frequencies. There are no gaps in frequency, and continuous tuning is provided over all TV and FM bands. Note MAIN frequency dial, marked with channels as well as frequencies; continuously variable sweep width, effective from 500 KC to 12 MC; the PHASE controlled sweep voltage for scope horizontal input; the STAND-BY switch for temporary silencing of generator during other testing. These and many other features make Triplett 3435 an outstanding "buy." See it today at your distributor's.

YOU CAN USE ANY A.M. SIGNAL GENERATOR

. . . but if you are critical you'll appreciate this Wide Range Test Oscillator — Triplett 3432. Five fundamental ranges—165 KC to 40 MC. Two Harmonic ranges 36-120 MC, directly calibrated. Completely Shielded. Seven directly calibrated 330° scales. Illuminated Dial. Try it today.



Triplett 3432

TRIPLETT ELECTRICAL INSTRUMENT COMPANY, BLUFFTON, OHIO

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplett

"Check your air, Sir?"

He's checking the air pressure in a branch cable, one of scores serving a town. The readings along the cable are plotted as a graph to find low-pressure points which indicate a break in the protecting sheath.

Air compressor and tank are at right. Long cylinders on rack dry air before it enters cables.

Master meters keep watch over the various cable networks which leave a telephone office in all directions to serve a community. Air enters the system at 7 pounds pressure, but may drop to 2 pounds in outermost sections—still enough to keep dampness out.

To keep voices traveling strongly through telephone cables, you have to keep water out. This calls for speed in locating and repairing cable sheath leaks—a hard job where cable networks fork and branch to serve every neighborhood and street.

At Bell Telephone Laboratories, a team of mechanical and electrical engineers devised a way to fill a complex cable system with dry air under continuous pressure. Pressure readings at selected points detect cracks or holes, however small. Repairman can reach the spot before service is impaired.

It's another example of how Bell Laboratories works out ways to keep your telephone service reliable—and to keep down the cost to you.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in mechanical engineering

The star of these amazing amplifiers is the Classic 25, fidelity *sans pareil*, 25 watt with complete remote control.

AMERICA'S FINEST HOME MUSIC AMPLIFIERS

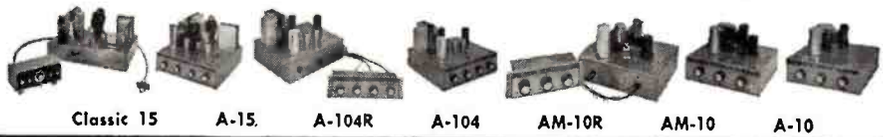
Everywhere they are shown these new amplifiers by Newcomb create a positive sensation. Everyone has a good word for them. Acclaimed at the shows and fairs in New York, Chicago, Memphis and California for their noticeably better sound, unique new features and unbelievable values in every price group. Thousands who have seen them make enthusiastic comments like this:

. . . "the first really new amplifiers in years" . . . "the best record reproduction I've ever heard" . . . "they solve the toughest installation problems" . . . "the **Audi-balance** feature really does away with tube balancing problems" . . . "**Adjusta-panel** makes cabinet mounting a breeze" . . . "I've never seen anything so beautifully designed for the home" . . . "women will love them" . . . "I find the A.E.S. response position very pleasing" . . . "I want the Classic 25 for myself" . . . "the finest coverage yet, there's something here for everyone" . . .

Those are the good words everywhere. If you have not yet seen them for yourself, there's a treat in store for you.

Substantial installation savings

Exclusive Newcomb features make all eight of these new amplifiers easier to install and make possible substantial savings in cabinetry and labor. Models with complete remote control offer a unique design which eliminates the usual necessity of a remote control being near the amplifier, tuner and changer. This permits installation savings frequently greater than the cost of the amplifier itself. These items can now be installed in any out of the way location, leaving only the remote unit and the speaker in the living room, with no messy confusion of wires. All models have "Adjusta-panel" feature to extend control shafts instantly up to ¾" for easy cabinet mounting. Investigate all the amazing advantages of these amplifiers. You will be thrilled with their outstanding improvements.



Classic 15 A-15 A-104R A-104 AM-10R AM-10 A-10

Send for catalog of 8 completely new amplifiers priced from $39.50 to $269.50 audiophile net.

Newcomb

15 years of quality leadership

NEWCOMB AUDIO PRODUCTS CO. DEPT. F, 6824 LEXINGTON AVENUE, HOLLYWOOD 38, CALIFORNIA

TRAIN *FASTER* — TRAIN *BETTER* — TRAIN *EASIER*
IN 10 MONTHS — OR LESS — FOR
RADIO-TELEVISION

Our 21st Year Training Men for Greater Incomes and Security in Radio-Television

Frank L. Sprayberry
President
Sprayberry Academy of Radio

I SEND YOU 18 BIG KITS

of Radio Television parts and equipment. Much of your training will be actual construction and experimentation . . . the kind of truly PRACTICAL instruction that prepares you for your Radio-Television career.

NEW! NO OBLIGATION PLAN

You Have No Monthly Payment Contract to Sign
Pay For Your Training as You Earn and Learn

You can get into Radio-Television, today's fastest growing big money opportunity field, in *months* instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! *No monthly payment contract to sign—thus NO RISK to you!* This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. Start your own profitable Radio-Television shop . . . or accept a good paying job. I have trained hundreds of successful Radio-Television technicians during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!

Valuable Equipment Included With Training

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are *yours to keep* . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is YOURS TO KEEP.

SPRAYBERRY ACADEMY OF RADIO
111 NORTH CANAL ST. Dept. 25-U, Chicago 6, Ill.

MAIL COUPON TODAY! NO OBLIGATION

Approved for Veterans under the G. I. Bill

I invite you to get all the facts—

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MODEL BOAT FOR THE 27 MC. CITIZENS BAND

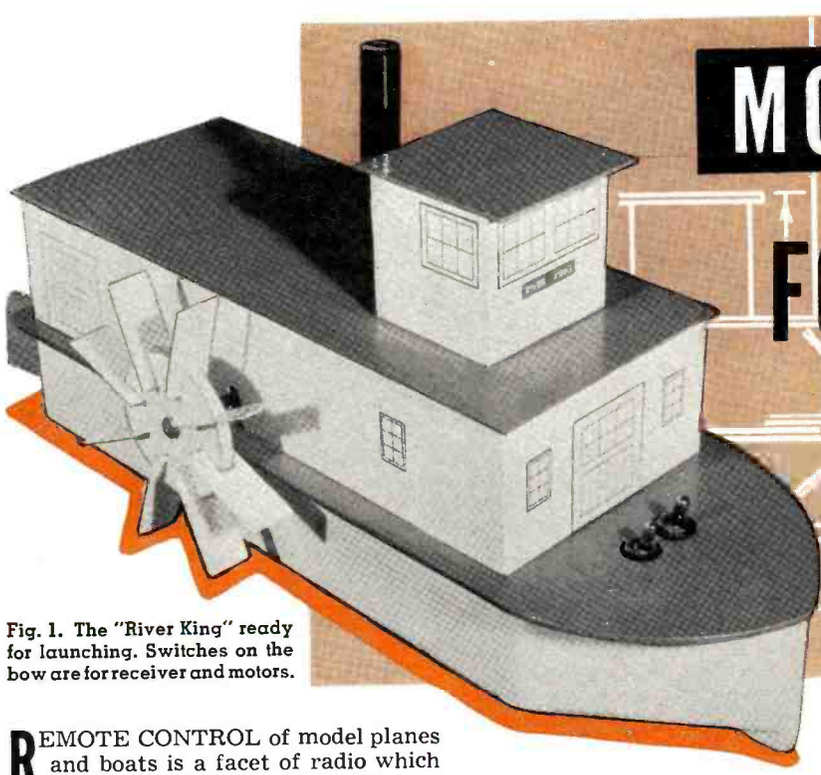


Fig. 1. The "River King" ready for launching. Switches on the bow are for receiver and motors.

By **HARTLAND B. SMITH, W8VVD**

Here it is! A "Citizens Band" radio control system, easy to build, simple to operate, and no license exam required!

REMOTE CONTROL of model planes and boats is a facet of radio which has long intrigued many hams and experimenters. However, two factors have kept most fellows from taking up this branch of the hobby. In the first place, as each succeeding article on the subject has appeared in contemporary publications, the models, the radio gear, or both have become more and more complicated. Secondly, the possession of a radio operator's license has been a prerequisite to the operation of radio control equipment. Since a large number of licensed hams aren't expert model makers and since many model makers lack operator's licenses, only a few people have so far had the opportunity of experimenting with radio control systems.

The *"River King"* was designed expressly to meet these two problems. It requires no particular skill to construct and uses a simple one-tube receiver. Any U.S. citizen over 18 can, without taking a technical exam, obtain the necessary Citizens Radio station license for the transmitter.

Although the FCC's rules governing the Citizens Radio Service have allowed radio control on the 460-470 mc. band since June 1, 1949, the equipment specifications for these frequencies have been so stringent that only commercial transmitters have been practical up to now. A recent amendment to the rules, however, has opened the door to inexpensive home-built gear operating on 27.255 mc. Transmitters using this new frequency are designated as "Class C" Citizens Radio Stations and, when registered with the FCC, may be used without an operator's license. The owner takes out a license for the equipment by a fairly simple procedure outlined toward the end of this article.

Unless a fellow is a dyed-in-the-wool model maker, he finds it hard enough to build an airplane that looks like a plane, let alone flies. On the other hand, almost any piece of wood will float. Thus, a model boat appears to be a logical beginner's choice for a radio control project. Since a flat bottomed hull with no complicated curves to cut makes for easy modeling, a side-wheel river steamer using this type of hull is a suitable prototype from which an approximate copy may be constructed.

The one-tube superregenerative receiver used in the boat is designed around a *Raytheon* type RK-61 subminiature gas triode. With the exception of the plate relay, all receiver parts are standard and can be readily obtained from any well-stocked jobber.

Fig. 2. The 27-mc. "Citizens Band" transmitter, built in a 3"x4"x5" utility box. The batteries are also housed in this box.

The plate relay I used came from a surplus BC-645 and was originally sealed in a cylindrical can with a 5-prong plug. After being removed from its housing the relay was mounted on top of the receiver chassis. If you can't locate one of these relays, I would suggest that you obtain an 8000 ohm *Sigma* type 4F. The latter is still available quite reasonably on the surplus market.

The RK-61 has tinned leads in place of base pins. It can be held in place with a small clamp and the leads may then be soldered directly into the circuit. Use a clean, hot, well-tinned iron, preferably one with a small tip. Do the job neatly but as quickly as possible so that too much heat will not be conducted into this small tube.

The receiver filament switch, S_1 and motor switch, S_2 are mounted on the deck, forward of the cabin, and can be operated without removing the superstructure. Two switches are used so that the receiver and motors may be run independently. It is difficult to make precise receiver adjustments while the paddle wheels are revolving.

The smoke stack, an 18" length of ¾" aluminum tubing, acts as a receiving antenna. While much shorter than a resonant 11-meter antenna, it picks up enough signal to produce reliable model response several hundred feet from the small transmitter to be described. Greater antenna length will increase the working range of the

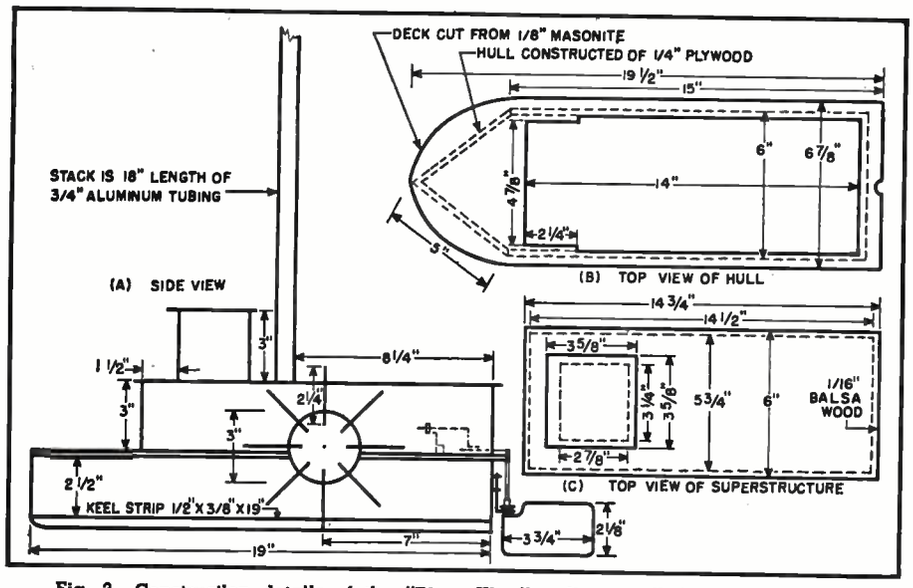


Fig. 3. Construction details of the "River King" radio-controlled river boat. The superstructure is thin balsa wood, the hull ¼" plywood and the deck Masonite. The tall aluminum "smokestack" acts as the antenna for the receiver in the hull.

model, but there seems little point in operating the device very far from the observer. After all, most of the enjoyment in running the boat comes from being able to watch it maneuver. Beyond two hundred feet, it looks pretty small.

The electrical circuits and mechanical linkages used in many radio control systems are quite complex. Transmitters sometimes utilize intricate modulators and keyers which send out specially coded signals that must be translated by the receiver into the proper model maneuver. Actually, it is possible to obtain several different and interesting model responses by merely turning a transmitter carrier on and off.

Examination of Fig. 6 will reveal that the plate relay of the receiver acts as a s.p.d.t. switch. Since the receiver's plate current drops when a signal is picked up, if the transmitter is on, the relay is open and contact *Y* receives 1½ volts *via* the relay armature. When the transmitter is switched off, the receiver plate current increases and the relay closes. Contact *X* then receives 1½ volts. Relay contact *X* is connected to finger 1 and contact *Y* to finger 3 of the rotary selector switch. One lead of the selector switch motor is grounded. The other lead runs to finger 2 on the selector switch. When the transmitter goes on, the switch motor circuit is completed *via* the relay armature, relay contact *Y*, finger 3, a segment on the selector disc, and finger 2. The switch motor receives power and the selector disc turns. It can only go a little way, though, because the connection between fingers 2 and 3 is soon broken due to the shape of the segment on the selector disc.

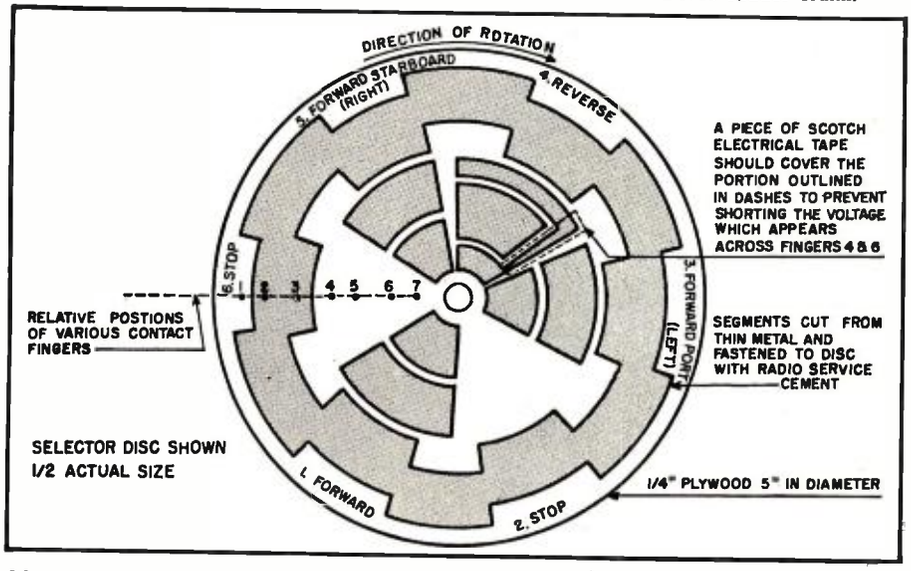
When plate voltage is removed from the transmitter the relay closes and the switch motor is again energized, this time *via* contact *X*, finger 1, a different selector segment, and finger 2. The selector disc turns until fingers 1 and 2 are no longer connected with one another through the disc segment. This time when the disc stops, fingers 4, 5, 6, and 7 make contact with segments which connect the paddle motor to battery, B_4. Depending on what polarity voltage is applied to this motor by the arrangement of the segments, the paddles will drive the boat either forward or backward. If no segments are in this particular position, the paddle motor, of course, stops. At the same time the selector disc turns, the steering arm also turns, thereby changing the rudder position (see Fig. 5).

With the segment layout shown in Fig. 4, there are six possible maneuvers: 1. Forward straight. 2. Stop. 3. Forward port (left). 4. Reverse straight. 5. Forward starboard (right.) 6. Stop. This arrangement is sufficient to provide a great deal of entertainment while maintaining a relatively simple system. The sequence of operations is such that when going from one desired maneuver to another, the undesired positions through which the selector must pass have little effect on the action of the craft. For example, in going from forward straight to forward starboard, it is necessary to go through positions 2, 3, and 4. At 2 the paddles stop. At 3 the paddles start to go forward, but before they can pick up speed, they are reversed by position 4. Position 5, the one desired, is reached long before the boat starts to back. A time delay circuit could be used to keep the paddles at rest until the selector is in position for the desired maneuver. However, this would be a rather unnecessary complication as each following position more or less nullifies the previous action.

Inspection of Fig. 4 will show that a small portion of the selector switch must be covered with insulating material to avoid shorting the switch contacts as that portion is reached. *Scotch* tape was used in this model, but if any difficulty occurs with the tape cracking, or the switch fingers tracking adhesive out from under the tape, a few thin coats of polystyrene coil dope or radio service cement can be used instead, if they are allowed to dry sufficiently.

The BC-645 relay is not quite so sensitive as one of the usual radio control types. Neverthless, if it is adjusted carefully, it will perform very well. In order to correctly set the relay, it is necessary to insert a low range milliammeter in series with the "B-plus" lead of the receiver. First, contact *X*, the one which controls the spacing between the armature and the pole piece, should be adjusted so that when the relay is energized, the armature just clears the pole piece. If the armature-pole piece spacing is too great, the sensitivity of the relay will be low, while if the armature touches the pole piece, it is apt to stick when the relay is de-energized.

Fig. 4. Pattern for the rotary stepping switch in the receiver. The base is ¼" plywood, 5" in diameter. The switch segments (shaded areas) are thin sheet metal. A ¼" hole is drilled in the center for the shaft, which also drives rudder crank.



Next, the pull-in and drop-out range should be checked. With "A" and "B" voltages applied to the receiver, advance the regeneration control until the relay can be heard to snap closed, then back off on the control until the relay clicks open. The current difference between pull in and drop out should be no greater than .2 ma. If it is, the spacing between the relay points should be reduced. The relay should close at approximately 1.0 ma. and open at around .8 ma. If more current is required to close the relay, the spring tension should be reduced. If it closes at less than 1.0 ma., the spring tension should be increased. With a more sensitive relay, the pull-in and drop-out range may easily be set to a variation of only .1 ma., thus resulting in somewhat greater control sensitivity.

The process of relay adjustment is not difficult, but you should keep the following points in mind: 1. As soon as the armature-pole piece spacing is set, do not change the position of contact *X*. Make all changes in contact gap spacing by varying the position of contact *Y*. 2. Never advance the regeneration control beyond the point where plate current exceeds 1.5 ma., otherwise the life of the RK-61 will be materially reduced.

As soon as the relay is properly adjusted, the receiver can be tuned up. Advance the regeneration control, R_2, until plate current is between 1.1 and 1.2 ma. The relay will act as a miniature loudspeaker and should give forth with the characteristic squeal of a superregenerator. Have someone operate the transmitter at a distance of at least 100 feet. Tighten antenna coupling condenser, C_1 fairly well and then adjust C_2 until the receiver is tuned to the transmitter's frequency as evidenced by a dip in plate current, accompanied by the opening of the relay and a lack of superregenerative squeal. C_1 should then be readjusted, to find the smallest capacity that gives positive relay operation when the transmitter is switched on.

The no-signal receiver current should be set slightly under 1.2 ma. From time to time as the RK-61 ages, C_1 and the regeneration control will require touching up. When the tube is reaching its limit of usefulness, an idling current of as much as 1.6 ma. may be required to obtain positive pull in action with no signal. Rated life of an RK-61 is between 3 and 10 hours. However, if the idling current is held in the vicinity of 1.2 ma. for as long as possible, the tube will probably last somewhat longer.

The dimensions of the boat are not very critical. The *"River King"* was my first attempt at marine architecture and it can definitely be improved upon in both appearance and seaworthiness. For example, another ¾" added to the depth of the hull would allow the use of heavier, longer-lived batteries.

The hull is made of ¼" plywood (see Fig. 3). The various pieces can be cut out with either a power or hand scroll saw and then fastened together with waterproof glue such as *Cascophen*. The glue must be applied very liberally and after it sets, all joints should be smeared with an extra coat, thereby insuring watertight joints. It is a good idea to give the inside of the hull a coat of spar varnish so that if it accidentally gets wet, it won't absorb water. The deck may be cut from a piece of ⅛" *Masonite* and then glued to the hull. The exterior should receive two applications of enamel undercoat and one of high grade enamel.

The boat is powered by a midget plastic-cased motor designed to operate from ordinary flashlight cells.

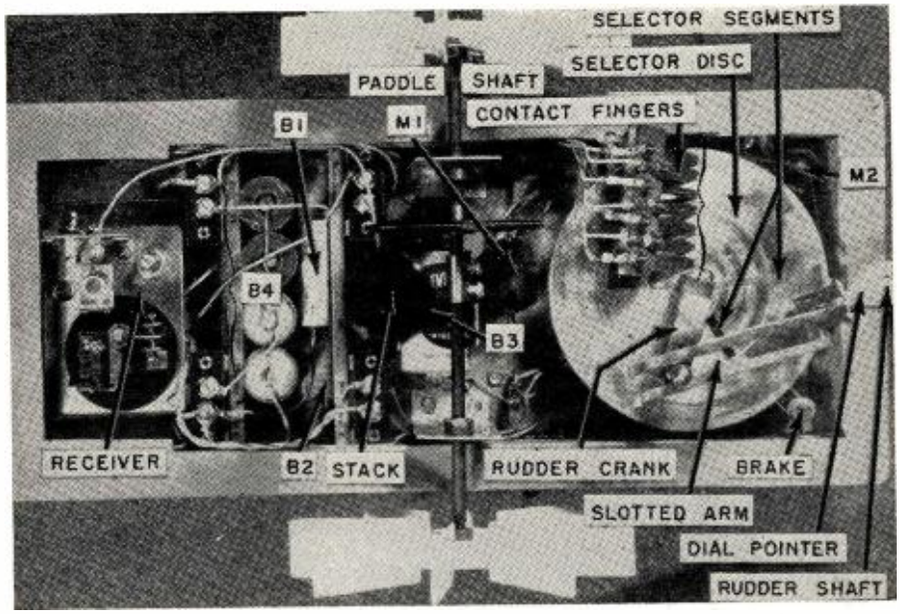
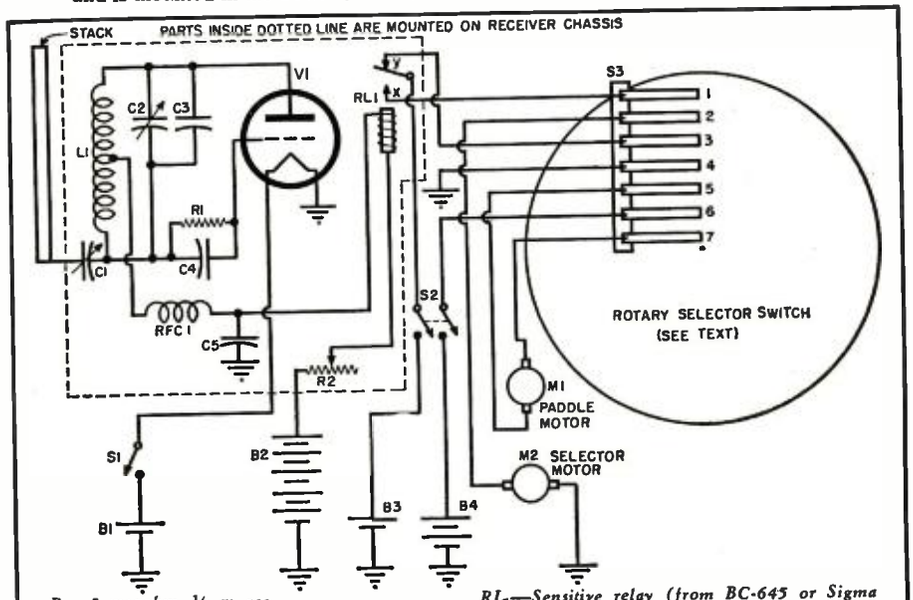


Fig. 5. Top view of the hull, with the superstructure removed. Placement of parts can vary according to materials on hand, but weight should be evenly distributed and heavy items such as batteries kept low in the hull. The paddle shaft is made from two ¼" carriage bolts. At extreme right is the old dial pointer used as coupling between the rudder and the slotted "tiller," which is about 4⅛" long and is driven by a homemade crank on the selector switch shaft. Both the rudder and selector switch shafts and bearings are made from old volume controls.

Fig. 6. Wiring diagram of the receiver, motors, and selector switch contact fingers. The receiver is built on a small "U" chassis which may be homemade and is mounted in the bow. S_1 and S_2 are mounted up on deck. See Figs. 7 and 8.



R_1—3 megohm, ½ w. res.
R_2—100,000 ohm pot.
C_1, C_2—1-10 μμfd. mica trimmer
C_3—20 μμfd. tubular ceramic cond.
C_4—100 μμfd. tubular ceramic cond.
C_5—.01 μfd. disc ceramic cond.
S_1—S.p.s.t. toggle switch
S_2—D.p.s.t. toggle switch
S_3—Rotary selector switch (see text)
L_1—15 t. #16 en. wire, center-tapped, 9/16" i.d., spaced width of wire
RL_1—Sensitive relay (from BC-645 or Sigma 4F)
M_1, M_2—Electric motor (Wilson's "Tiny Atom")
B_1—1.5 volt penlight cell
B_2—Two 30-volt miniature "B" batteries in series (Eveready No. 413)
B_3—1.5 volt size "D" flashlight cell
B_4—3 volt battery made by soldering four size "C" flashlight cells in series-parallel
RFC_1—R.f. choke (Ohmite Z-50)
V_1—RK-61 tube (Raytheon)

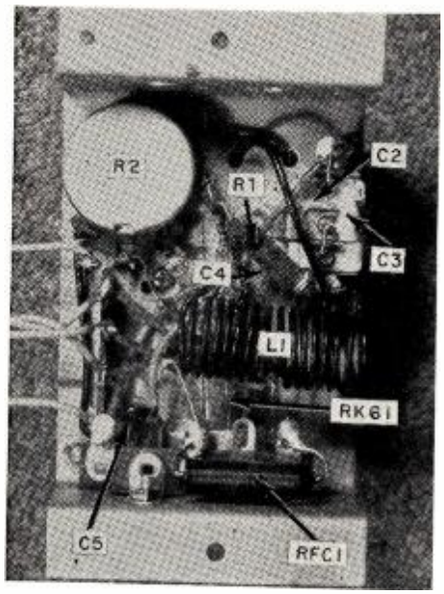


Fig. 7. Bottom view of the receiver. The RK-61 tube, which has no socket, is mounted along the centerline of chassis.

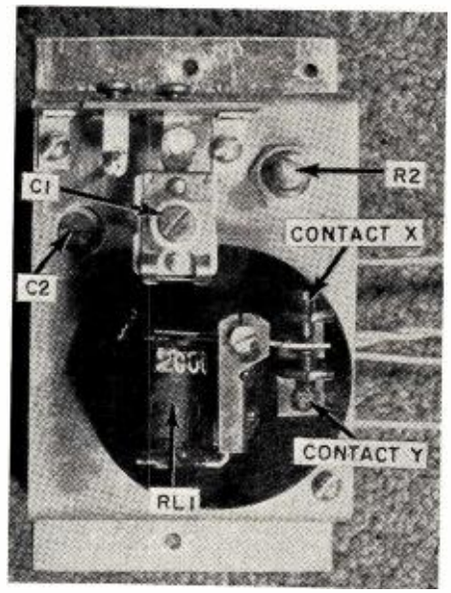


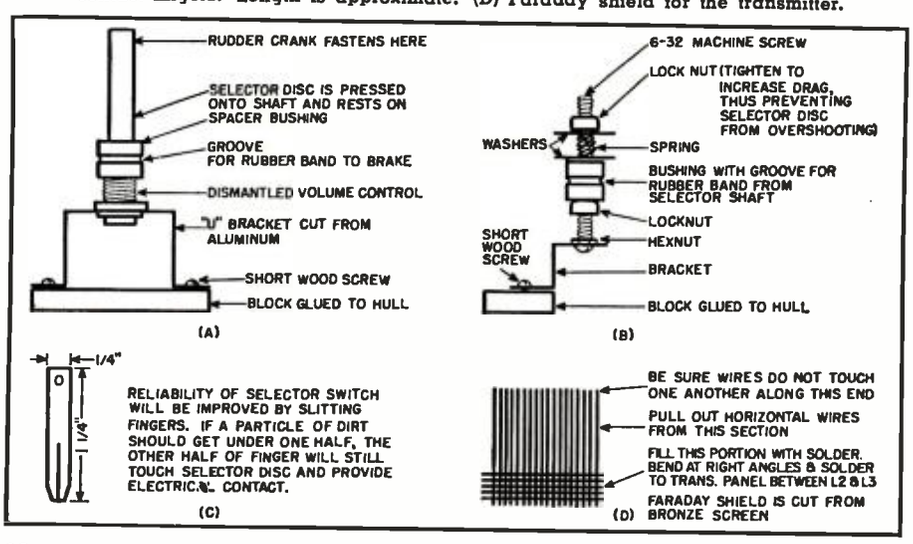
Fig. 8. Top view of the receiver. The relay shown is from a surplus BC-645 but other types may be substituted (see text).

These motors are on sale at toy and model supply stores and are priced from $1.50 to $2.00 apiece. Despite a rating of only 1/2000 horsepower, one of these little motors is capable of propelling a model boat at greater than scale speed.

A similar motor drives the selector switch that controls both the direction of paddle rotation and the rudder position. This motor, M_2, is mounted vertically in the stern (see Fig. 5). The rotating disc portion of the selector is made from a piece of ¼" plywood, 5" in diameter. It must be carefully cut to shape and a groove filed in the edge to receive the rubber band that acts as a drive belt. The shaft and bearing of the selector can be adapted from an old volume control. The control should be dismantled until all that remains is the shaft and its associated panel bushing. This is then fastened to a U-shaped bracket cut from sheet aluminum and the bracket is screwed to a small piece of wood previously glued to the hull. Put a hole in the center of the selector disc with a ¼" drill and press the disc onto the old volume control shaft. If the disc fits too loosely, one or two applications of service cement to the edges of the hole will reduce its size sufficiently to stop the disc from slipping on the shaft. A spacer bushing keeps the disc at the proper height with respect to the switch motor's shaft.

Since a volume control bearing operates smoothly, it is quite likely that the selector disc may coast from one segment to another, thus going past a desired position. This overshoot problem can be minimized by increasing the pressure of the contact fingers against the disc or by constructing the brake shown in Fig. 9B. Tighten the top nut on the brake only enough to keep the disc from coasting too far. Otherwise, the selector motor will be overloaded and may, at times, lack sufficient power to rotate the disc.

Fig. 9. (A) Selector switch shaft and bearing assembly, taken from an old volume control. (B) Adjustable brake for the rotary selector switch. (C) One of the contact fingers. Length is approximate. (D) Faraday shield for the transmitter.



The segments of the selector disc can be fashioned from thin sheet metal. I used heavy copper foil picked up at a surplus store. After the segments have been cut to proper shape, fasten them to the disc with radio service cement. The contact fingers for my switch were cut from the same copper as the segments. Use any metal which is thin and fairly springy.

Rubber bands act as drive belts for both the paddles and the selector disc. No pulleys are required on the motor shafts since the rubber bands are kept in alignment by grooves in the edges of the selector disc and the paddle shaft pulley. The latter item, by the way, was originally a part of the dial mechanism from an old radio. A pulley cut out of ¼"plywood should work just as well.

The paddle wheels are made from 3" discs of ¼" plywood. Eight radial slots ¾" long are cut in the discs at regular intervals as shown in Fig. 3A, and 1" by 2¼" pieces of aluminum are forced into the slots. *Cascophen* or radio service cement should be daubed on the ends of the paddles so that they will adhere to the slots. The paddle shaft is made from two ¼" carriage bolts, the heads of which have been cut off, the two bolts then being fastened together with a ¼" shaft coupler. The paddle wheels have ¼" holes drilled in the center and are held in place on the threaded ends of the shaft bolts between nuts and washers. The shaft bearings are simply ¼" holes drilled in two aluminum brackets that support the paddle assembly. The shaft is held in position between the bearings by means of brass collars fastened to the shaft with set screws.

The rudder bearing, salvaged from another discarded volume control, is mounted on a small, L-shaped bracket at the rear of the hull. A piece of lightweight galvanized iron is cut into the shape of a rudder and is soldered to what was originally the potentiometer end of the shaft. An old dial pointer is fastened to the other end of the shaft. The slotted arm, or "tiller," actuated by the rudder crank of the selector switch is, in turn, soldered to the dial pointer (see Fig. 5). If no suitable dial pointer is readily available you can, of course, cut out a small sheet-metal tab, with a ¼" hole for the rudder shaft, and go on from there. The slot in the "tiller" is about 4⅛" long. The crank arm is about 1¾" between the center of the selector shaft and the center of the screw-and-nut or whatever you use as a drive pin or "handle." The dimensions of these three items are not critical. The old volume-control shaft will, of course, have to be long enough so that the crank and swinging tiller will clear the top of the wood or plastic strip that holds the selector fingers.

A superstructure must be built to hide the works of the model. The cabin and pilot house are cut from

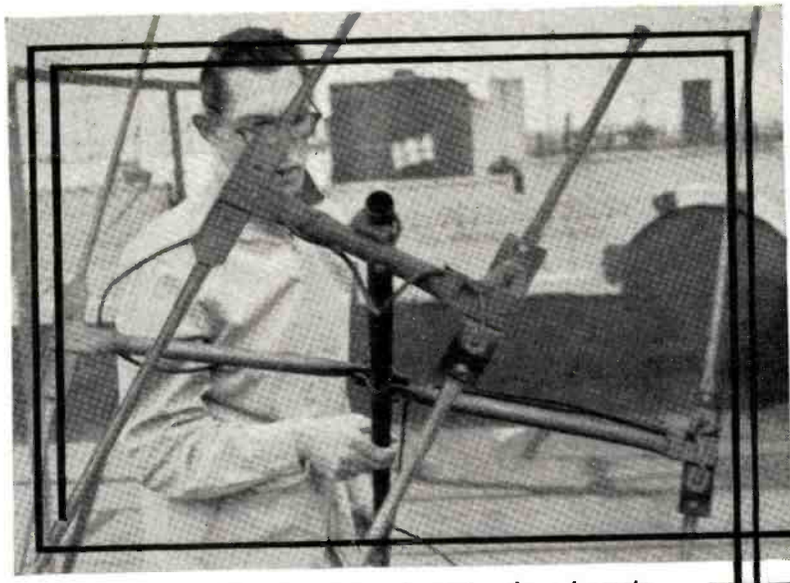
(*Continued on page* 162)

MAINTENANCE OF TV ANTENNAS

By

M. BETTAN & A. S. PRICE

Radio Merchandise Sales Inc.



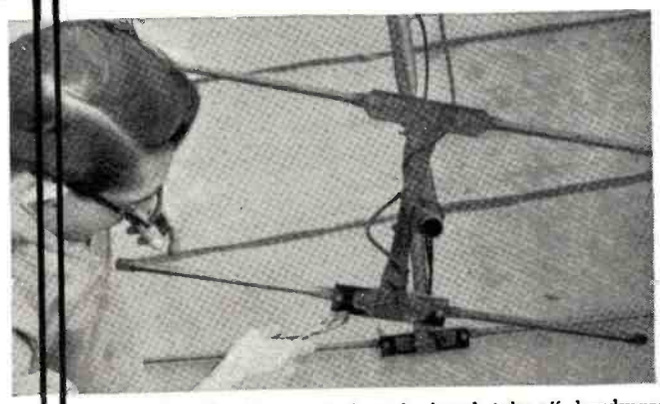
1 TV antenna rusted by average weather, taken down for maintenance. Lead-in connectors are corroded; elements oxidized.

TV antennas rust enough in 1 year to cut signal down. A 20-minute cleanup can return such antennas to good operating condition.

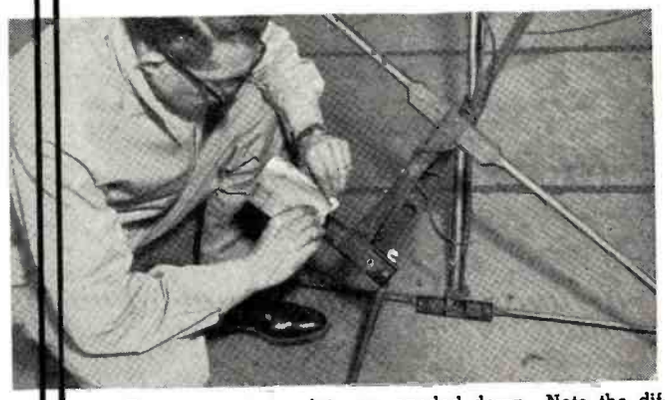
WHEN servicing a TV antenna a standard procedure should be followed. This eliminates wasted time and makes certain that all necessary maintenance points are covered. First, dismount the antenna and inspect it for missing or broken elements, cracked insulators, loose connections, and badly corroded signal take-off hardware. At this point a time and materials cost estimate should be made to determine whether the antenna is worth repairing. If it is necessary to replace too many parts, or if the cleaning and repairing job will take more than approximately one-half to three-quarters of an hour, it will probably not be worth the customer's money or your time to do the job. However, each case must be judged on its own merits. Repairing and cleaning a costly complex stacked array will, in most cases, be cheaper than replacing the antenna. Servicing a simple antenna without broken parts and missing elements (such as is shown in Fig. 1) should take no longer than twenty minutes and is definitely a worthwhile job.

The next step is to check the signal take-off hardware. Disconnect the antenna lead-in wire from the connectors. If the connectors are badly corroded, replace them. It may be necessary to drill them out and therefore it is recommended that you have a portable drill and long extension power cord available for such work.

(*Continued on page* 120)

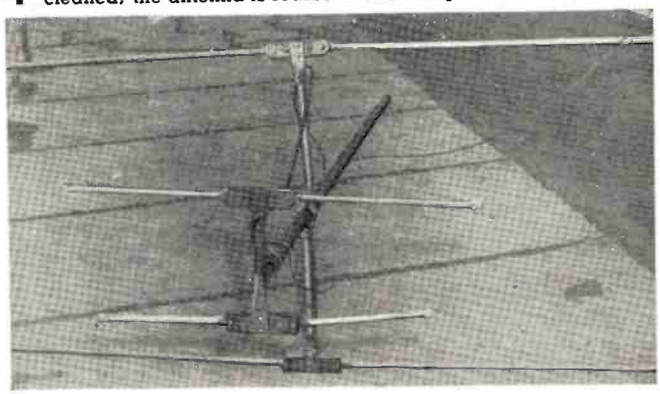


2 Lead-in is disconnected and signal take-off hardware removed. Corroded hardware attenuates input signal.

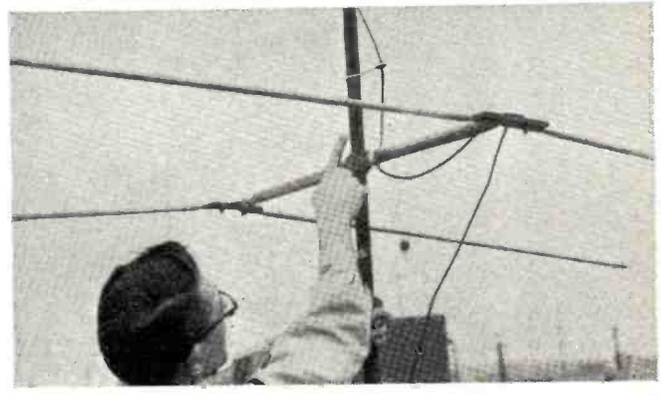


3 Element contact points are sanded down. Note the difference between clean contacts and corroded element.

4 Elements, signal take-off points, and hardware have been cleaned; the antenna is reassembled, ready for mounting.



5 Cleaned antenna is mounted and mast stand-offs are added for the lead-in wire to replace tape used formerly.



TRANSISTORIZE YOUR

Another interesting application for transistors. Details for constructing several amplifiers are also included.

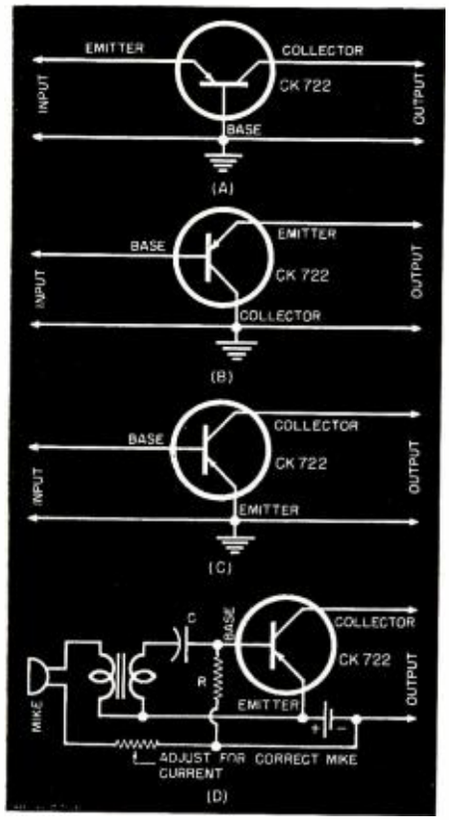


Fig. 1. Typical transistor circuits. (A) grounded base. (B) grounded collector. (C) grounded emitter. (D) carbon mike input.

WE HAVE used electron tubes for so many years that we seldom give any thought to the power required for operation until we find that portable, battery operation is desirable for some new project. However, the engineer or experimenter who builds a junction-transistor amplifier suddenly realizes how much simpler it is to design and assemble for there is no complicated power supply and there are fewer components for each stage of amplification. Furthermore, the operating power is unbelievably low so that small batteries of standard flashlight cell sizes last so long that there is no advantage in using a.c. power sources. This, in time, makes possible very small and compact equipment for which there are many uses. Even though parts of an equipment, such as a portable amateur transceiver, require tubes, the use of transistors where applicable in the circuit, will help to reduce size and weight. As an example, the audio preamplifier might use transistors while the modulator and r.f. stages of the transmitter would use tubes. Likewise, the same transistor amplifier could be used for the audio amplifier for receiving, by using suitable switching.

Other uses for small battery-operated transistor amplifiers are: hearing aids, portable receivers, portable intercoms and variations thereof, portable recorders, record players, sound measuring equipment, etc. In these applications junction transistors provide, in addition to long life and ruggedness, a freedom from microphonics never achieved with tubes even though tremendous improvements have been made in the CK500 subminiature tube series produced during recent years for hearing aid use and other critical applications.[1]

In a recent issue of this magazine[2] there appears a discussion of transistors and some description of their uses. This present article will discuss the use of junction transistors in audio amplifiers in an effort to indicate to each reader the methods to be used in designing amplifiers for his particular needs.

Junction transistors such as the *Raytheon* type CK722, may be used in any of three basic circuits. The *grounded-base* circuit is shown in Fig. 1A. This circuit utilizes the transistor emitter as the signal input element and the collector as the output element. Input impedance is low, output impedance is high, and gain is fairly good. This circuit also exhibits less variation with temperature than the grounded-emitter circuit to be discussed below. For the type CK722 junction transistor, typical input impedance is 1000 ohms, typical output impedance is 100,000 ohms or better and average power gains of 20-22 db can be obtained.

The *grounded-collector* circuit shown in Fig. 1B provides less gain (about 12 db for CK722) and has less power output capabilities than either grounded-base or grounded-emitter circuits. The lower power output obtainable with this method of connection is due to the limitations on emitter circuit power imposed by the manufacturer's ratings. Grounded-collector circuits are used when high input impedance is required for this may be one or two hundred thousand ohms depending upon the value of load impedance used. For example, a 10,000 ohm load will provide 150,000 or 200,000 ohms' input impedance with type CK722 but this may drop to 50,000 ohms or less if the load is dropped to 1000 ohms.

In contrast to the grounded-base or grounded-collector circuits for which two batteries or a tapped battery are needed, the *grounded-emitter* circuit requires but one battery and is thus particularly desirable for compact, lightweight, portable amplifiers. It provides typical input and output impedances with CK722 of about 1000 and 40,000 ohms respectively and gives the highest gain, averaging 30 db for this type. The grounded-emitter circuit is more susceptible to temperature variations although under about 125° Fahrenheit, the temperature effects are usually not serious. Gain decreases as the temperature increases and the higher the temperature the faster the gain decreases for additional increases in temperature.

Let us assume that we wish to design a small portable amplifier using type CK722 *p-n-p* junction transistors to be used by police to listen in on suspects. Because but one battery is required, a grounded-emitter circuit will be used. The first problem is to design the input stage for which carbon, dynamic, and crystal mikes are available. Carbon mikes require operating current from the battery so are not desirable for low battery drain. Fig. 1D shows a possible connection.

Dynamic microphones may be obtained with various impedances, 500 ohms not being unusual. The mismatch would not be critical with microphone impedances as low as 100 ohms. Furthermore, the average dynamic microphone puts out more *power* for a given sound pressure than crystal microphones except some of the old large types having high capacity. Because our transistor amplifier is really a power amplifier, this is important, for by using the microphone giving the most power, we can obtain desired amplifier performance with a minimum number of transistors. Fig. 3A shows the input amplifier stage using a dynamic microphone directly coupled to the transistor without an input transformer. Fig. 3B shows a variation of this circuit which is equally satisfactory. If a dynamic or magnetic microphone with an impedance appreciably different from 1000 ohms is used, a matching transformer may be employed as indicated in Fig. 3C to give better over-all gain than if the mike is poorly matched to the CK722. Resistor *R* is adjusted for minimum noise and best gain and should result in a collector (output) current of no more than 0.5 milliampere. *R* will probably be at least 100,000 ohms for CK722 but will depend upon the battery voltage to be discussed later. Condenser *C* must be large enough to pass the lowest frequencies which must be amplified. This condenser *must* be used to allow the base voltage and therefore the collector current to be correctly adjusted by *R*.

Except for the large, high capacity types mentioned previously, the aver-

AUDIO AMPLIFIERS

By **CHARLES W. MARTEL**
Raytheon Manufacturing Company

age crystal mike will give at least 10 db less power than a dynamic microphone and, in addition all crystal microphones have high impedances which will not match the relatively low input impedance of the grounded emitter CK722 unless coupled through a step-down transformer. The circuit will be identical to that of Fig. 3C except that the transformer primary impedance should be as high as possible (several hundred thousand ohms) and the secondary impedance should be about 1000 ohms. An intercom transformer of the type used to couple the voice coil of a loudspeaker microphone to the input tube grid may be used "in reverse" to obtain a reasonably good impedance match.

With the input circuit determined, the next step is to add transistor stages to obtain the desired gain. The user of this amplifier will listen-in with a small receiver similar to those used for hearing aids or by amateurs so a total gain of 60 to 80 db should be sufficient and will therefore require at least three and probably four stages if transformer coupling is used to obtain maximum gain. Resistance coupling may be employed but at least one additional amplifier stage will be needed for the gain-per-stage with resistance coupling will average about 6 db less than that obtained with transformer coupling. Except for the output circuit to be discussed later, Fig. 2A shows a transformer-coupled amplifier and Fig. 2B a resistance-coupled amplifier using the input circuit of Fig. 3A. The primary and secondary impedances of the interstage transformers should match reasonably well the output and input impedances respectively for CK722 in the grounded-emitter circuit as indicated in a preceding paragraph.

In both Figs. 2A and 2B resistor R in each stage is adjusted for the collector current giving best gain, lowest noise, and lowest distortion but no more than 0.5 ma. should be needed per stage. A suitable value for R is usually in the range of 200,000 to 250,000 ohms. Also for both circuits, C must be large enough to give desired frequency response and because it is in series with the input impedance (about 1000 ohms) of the CK722, it must be several microfarads for good low frequency gain. Small size electrolytic condensers are on the market and it is suggested that a 10 or 20 μfd. unit be used. The lowest available voltage ratings are ample, for the maximum voltage in the circuit is two or three volts depending upon the battery used. In the resistance-coupled circuit, R_L must be a compromise between matching the output impedance of the transistor and causing too low

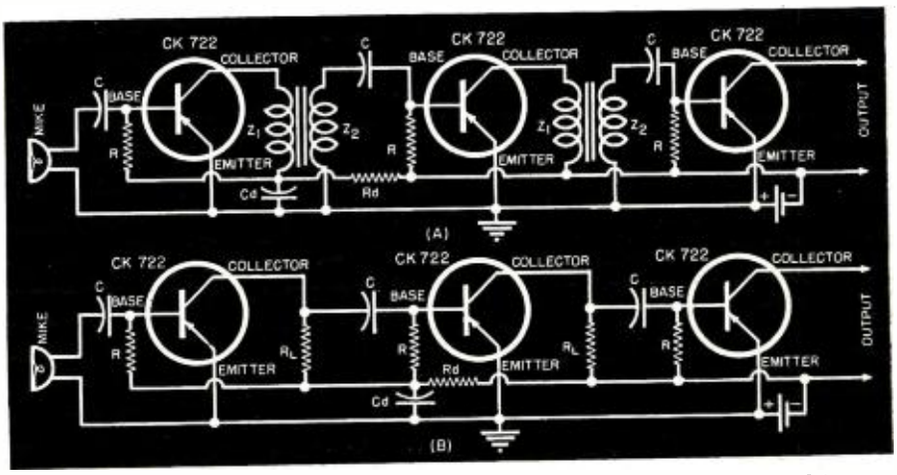


Fig. 2. (A) Transformer-coupled and (B) resistance-coupled amplifiers using transistors.

a voltage at the collector because of the voltage drop in R_L resulting from collector current. 10,000 ohms is about right for CK722.

Note that in each of these circuits (Figs. 2A and 2B) a decoupling filter comprised of R_d and C_d is shown. This is necessary for unless the battery is of extremely low impedance there will be positive feedback resulting from the fact that the battery impedance is common to all stages. It may even be found necessary to add decoupling filters in other stages depending upon the total number in the amplifier, the total gain, etc. Experience has shown that most batteries will cause feedback in a high-gain transistor amplifier for even though the battery impedance is low, it is appreciable compared to the relatively low impedances of the transistors. C_d must be a fairly high capacity if R_d is to be kept small enough to not drop the operating voltages too greatly. For example R_d of 500 ohms and C_d of 40 μfd. or more might be satisfactory but final values can be determined by trial and will depend upon the frequency range of the amplifier as well as the gain, number of stages, etc. In general, the time constant (C_d R_d) should be greater than $1/f$ for the lowest frequency passed by the amplifier. (In computing this time constant C_d must be expressed in *farads*, R_d in *ohms*, and f in cycles per second.)

Now we come to the output where we wish to operate a small earphone requiring 2 or 3 milliwatts for suitable output. Because we are dealing with a power amplifier operated from a low voltage supply, the output signal will have a voltage swing of only a few volts, never more than the theoretical limit of twice the supply voltage. Crystal phones are of high impedance and depend on larger voltage swings so are not desirable because they require a matching transformer. Magnetic phones are readily available with impedances of a few thousand ohms and may be used without transformer

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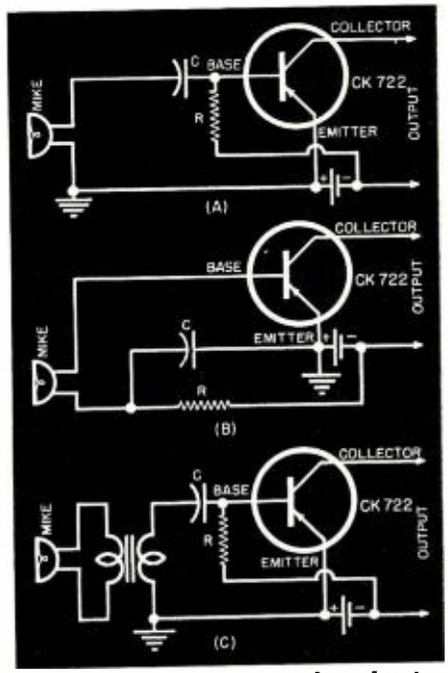
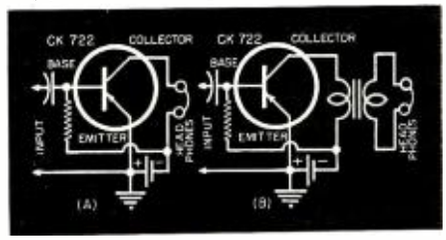


Fig. 3. (A) Dynamic microphone input circuit. (B) Variation of circuit in (A). (C) Transformer-coupled dynamic mike input.

Fig. 4. (A) Direct-coupled output and (B) transformer-coupled output. See text.



RECEIVER CHANGES TO IMPROVE FRINGE RECEPTION

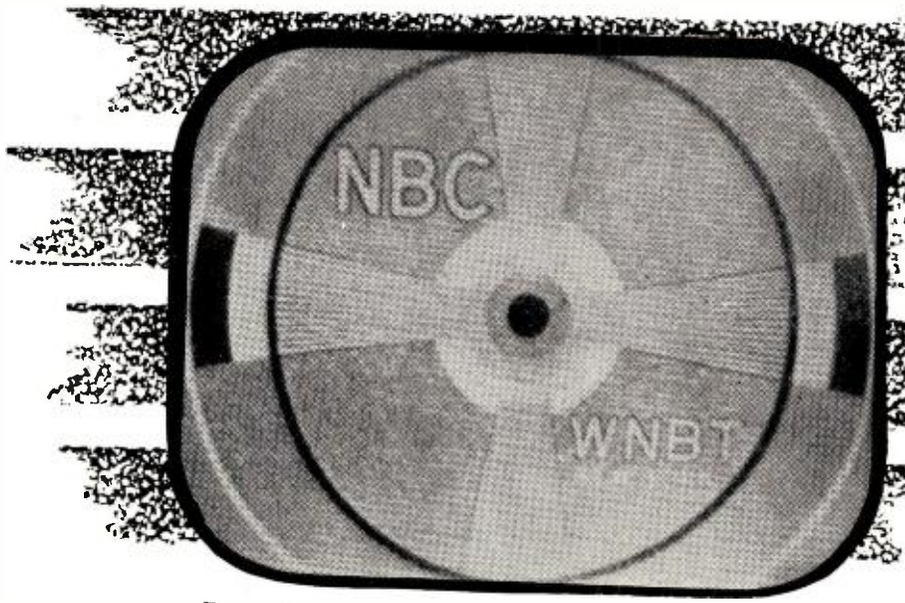


Fig. 1. Test pattern when incoming signal is weak. Note that the snow present reduces definition, as is evident in vertical wedges.

Part 1. A practical discussion on how to increase TV set sensitivity by making tube, a.g.c., and alignment changes.

By
PAUL STEVENS

THE satisfactory reception of TV signals in fringe areas is a problem for TV service technicians and set owners. With the opening up of u.h.f. channels, the problem may be intensified.

The input circuits of a u.h.f. converter—or u.h.f. receiver, for that matter—introduce a considerable loss in signal. Some of the loss occurs in the input coupling circuit; most of it occurs in the conversion process, and is due to poor conversion gain. Not only must this loss be tolerated—there is also the matter of the greater transmission loss of u.h.f. signals compared to v.h.f. signals. The u.h.f. signal loses approximately 10 db more than the v.h.f. signal in transmission. These factors tend to make the signal-to-noise ratio of u.h.f. channels at the cathode-ray tube of the receiver much poorer than the ratio for v.h.f. channels.

The increased power output of many TV transmitters has resulted in considerable improvement in v.h.f. reception, to the extent that the fringe has been pushed back somewhat. There are still many set owners in weak-signal areas, however, who are not happy about their receivers' performance. The undesired symptoms may be divided into two chief categories: (1) Masking of the picture signal by receiver noise, or snow; and (2) Imperfect synchronization.

High-gain antennas and boosters have improved the performance of many receivers in weak-signal areas. Changes in the receiver design offer another, often less expensive method of increasing set sensitivity. Such changes may be attempted when the set owner, for reasons of economy, cannot go all-out on an antenna installation; or when, in spite of the use of a high-gain, correctly-installed antenna and low-loss line, reception remains unsatisfactory.

Before the service technician begins making the changes to be described, he should be absolutely sure that (1) the antenna system is as well-installed as the circumstances permit, and no troubles are present in it and (2) the receiver is in correct alignment and working perfectly. If the service technician is making the installation himself, he should of course know which antenna and transmission line will bring in best reception, under the conditions present, and within the limitations imposed by the customer's pocketbook. It is assumed that he is thoroughly familiar with installation procedures, and has done his best to bring in a good picture.

When the antenna system or its installation cannot be improved further, the checks described below should be made.

The line voltage should be measured. If it is considerably below 117 volts, the receiver's sensitivity will be reduced appreciably.

Constant-voltage transformers are available that will boost a line voltage which is as low as 80 volts to 117 volts. The price of these transformers is relatively high. Most 300-watt units cost $35; a 150-watt one is approximately $30. The unit purchased will have to have the same wattage rating, at least, as the TV receiver to which it is to be attached. The power consumption of TV receivers ranges from about 250 watts to 375 watts. The cost of the transformer will therefore be, on the average, around $35.

The constant-voltage transformer not only boosts the line voltage to 117 volts—it also keeps it constant at that level, and thus provides voltage regulation. It is, therefore, especially useful in cases where considerable line voltage fluctuations are causing set reception to be impaired from time to time.

The constant-voltage transformer should not be confused with inexpensive voltage-regulating units. These units may keep the a.c. voltage supplied to the set relatively constant in the presence of line surges, but are incapable of boosting the low line voltages.

The next test should be an inspection of all the tubes, to make sure they are all of the correct type. The tube numbers should be checked against the set schematic. In some cases, it may be discovered that some tube with similar characteristics but a lower gain has been substituted for the one specified in the schematic, due possibly to a short supply of the original tube at the factory. The tube (or tubes) should, in such a case, be replaced by another of the correct type.

The d.c. voltage output of the low-voltage rectifier should next be measured, and compared with the voltage specified in the set manufacturer's notes. If the voltage is lower than it should be, even if only by a few volts, one or more tubes (as the case demands) or selenium rectifiers (if these are present) should be substituted, to bring this part of the receiver to optimum operation.

The video amplifier tube or tubes should next be changed, and results

noted. The gradations in shading of the test pattern's inner circles should be very carefully observed, to see whether there are any changes for the better in their contrast. (It is assumed that a test pattern with such inner circles can be tuned in.)

Substitutes should also be tried for the r.f., i.f., and video detector tubes. These substitutions should be made during the alignment check (described later), because the small increase in gain one tube may provide over another is not apt to be noticeable in a test pattern or picture. When the peak-to-peak amplitude of a test signal is observed on a scope, however, any increase in its amplitude will be very apparent. The small increases resulting from various tube substitutions may, when added up, afford quite a noticeable improvement in picture reception.

When front-end tubes are being substituted three or four tubes should be tried to insure that a tube whose interelectrode capacitances are closest to those of the original tube, is obtained. The one that produces maximum signal output with correct bandpass (as observed on a scope) should be retained.

A slight receiver misalignment may be contributing to the receiver's lack of sensitivity, and this should be checked. The correct i.f. alignment of receivers operating in very weak signal areas is particularly important. The technician should be certain of the accuracy of his signal generator when aligning receivers in fringe areas (which is not to imply that he may be uncertain of its accuracy in other areas).

If all or most of the received channels are very weak, the video i.f. stages should be realigned with *no a.g.c. voltage* applied to the grids of the a.g.c.-controlled video i.f. stages. The test signal applied to the mixer should be so small in amplitude that a signal of no more than about ½ volt peak-to-peak amplitude is observed at the video detector output on an oscilloscope.

Such an alignment procedure will far better approximate the conditions under which the receiver is to operate, than the alignment procedure cited in the manufacturer's notes, since the latter is usually intended to apply to sets located in medium- and strong-signal areas. Tuned circuits will not provide optimum gain at the desired frequencies when very weak signals are coming in, and the a.g.c. voltage these signals develop is low, if they have been aligned at conditions of medium or strong test signal input, with a relatively large a.g.c. voltage present.

The gain of the i.f. tuned circuits may be boosted if their bandpass is reduced. The definition of the picture will, theoretically, be impaired by such a procedure. Since the excessive snow present in a picture produced by a very weak signal will not allow 4 mc. definition to be observed anyhow (see Fig. 1), nothing is really sacrificed. The bandpass may be reduced to a minimum of 2.5 mc., and the improved receiver gain obtained on realignment, with the consequent reduction of snow, should prove quite gratifying, even though high-frequency detail is absent (see Fig. 2A).

The bandwidth of the i.f. stages should not, of course, be tampered with if one or more medium- or high-level stations are being received in the area, unless the set owner is willing to impair reception on good channels, to improve it for the weak ones.

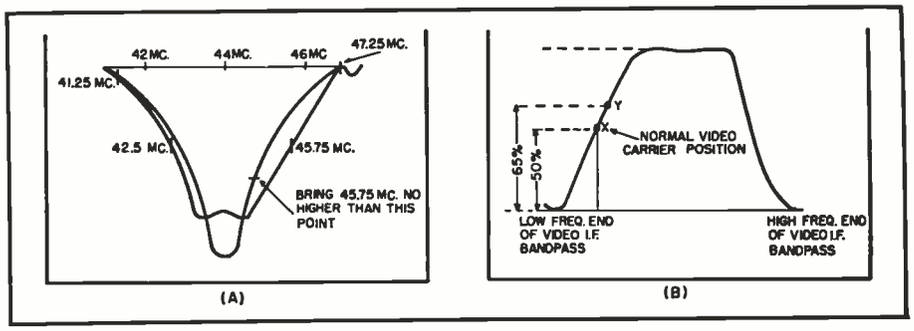


Fig. 2. (A) To peak the response, the bandpass of the tuned circuit must be sacrificed. The broader bandpass curve represents the original response of an assumed video i.f. circuit with a carrier of 45.75 mc. The narrower bandpass curve indicates the higher amplitude response after peaking. The curve is not drawn to scale. (B) How the video carrier may be raised to the 65 per-cent point on the i.f. curve in order to boost the gain of the i.f. tuned circuits in the television set.

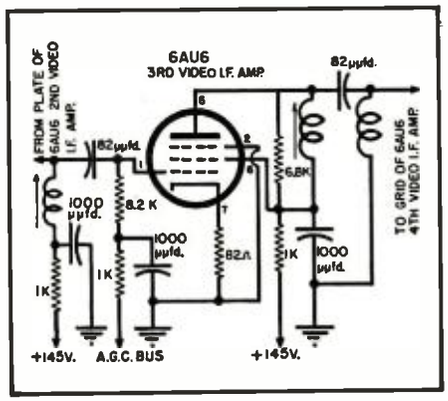


Fig. 3. To narrow the bandpass and increase gain of a video i.f. section the 8200 ohm grid resistor and the 6800 ohm plate resistor can be changed to 16,000 and 12,000 ohms respectively and set realigned. The circuit is a Firestone Model 13-6-44.

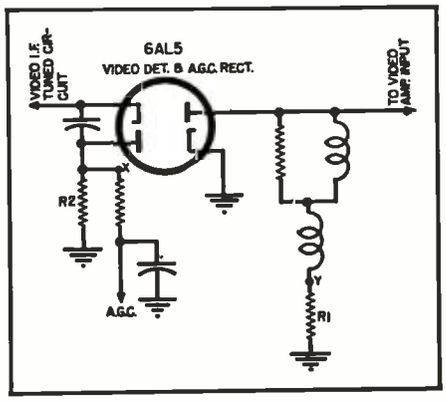


Fig. 4. In a circuit like this, the a.g.c. line may be disconnected at point "X" and connected to point "Y". Since R_1 is smaller than R_2, a.g.c. voltage is reduced. The modification will not be valid if R_1 is returned to a negative voltage source.

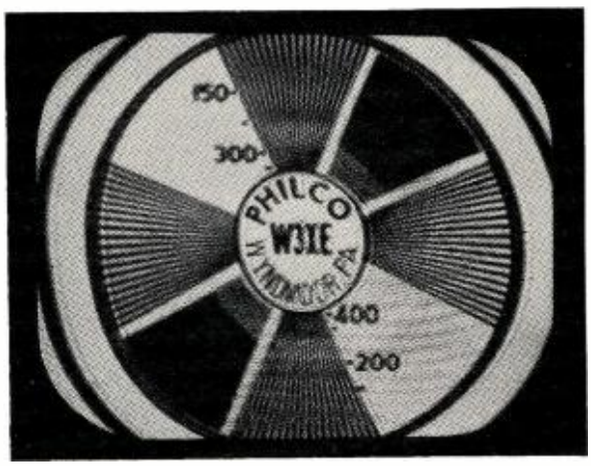


Fig. 5. Effects of regeneration on a test pattern. Note intensification of different parts of vertical wedges (left) and intensification of blacks in bulls-eye region and in lettering and the whites trailing blacks as shown at right.

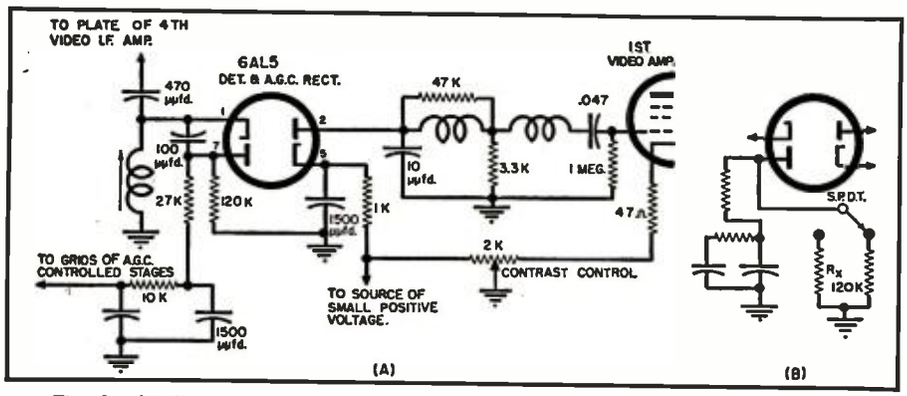


Fig. 6. (A) To reduce a.g.c. voltage in this circuit, the 120,000 ohm a.g.c. load resistor may be changed to one of lower value. A resistor of about two-thirds the value may be tried first, then half value, etc. The a.g.c. system shown has a delay feature and should, theoretically, produce no a.g.c. voltage in the presence of weak signals. Noise pulses may, however, cause appreciable a.g.c. voltage to develop. Circuit is from the Philco 50-T1443. (B) When the presence of medium or strong stations requires a substantial a.g.c. bias, this switching arrangement may be inserted. R_x is a smaller resistor than the 120,000 ohm load resistor which is switched in when the incoming signal is weak. The larger resistor is switched in when the received channel is strong. Switch should be as near a.g.c. rectifier as possible.

Resistors in shunt with grid and plate tuned circuits in the video i.f. stages may have to be increased in some cases, to permit the attainment of adequate gain with reduced bandpass (see Fig. 3). These loading or damping resistors may be replaced, one at a time, by resistors twice their value, and results observed on the response curve as realignment proceeds. (It has been assumed that the technician has access to a sweep generator and an oscilloscope. If he doesn't, he can perform the alignment, or make bandpass checks, by the point-to-point method, using a signal generator and voltmeter.)

The video carrier may be raised from its customary 50% point on the i.f. curve, to about the 65% point (see Fig. 2B). Since the low video frequencies are close to the carrier, large objects in the picture will be better received, and the over-all picture quality will seem better, as the result of such a procedure. Any slight smearing that tends to occur will be masked by the high-amplitude noise signals present on the CRT screen. The background lighting of the picture will also be brighter, since this lighting represents a low frequency.

Placing the video i.f. carrier higher than 65% is not recommended, since it is apt to result in excessive phase shift at low frequencies, causing smearing to become noticeable (see Fig. 7). Even the snow in the picture may be smeared in such a case. (Clean white snow in the picture is bad enough, but smeared snow is too much.) If smearing is noticeable with the carrier at the 65% point, it should be placed slightly lower on the response curve, and results noted.

Care should be taken to avoid i.f. regeneration in the realignment process. The increased gain of the i.f. tuned circuits increases the possibility of regeneration. The condition will manifest itself by a peak in the response curve that may be noted only when the test signal input is reduced. Sections of the vertical wedges in the test pattern will be intensified, if such peaking is present at the middle- and high-frequency end of the bandpass (see Fig. 5). The alignment should be gone over until all such peaks are eliminated or minimized, and the response is relatively flat. A slight peaking at the high-frequency end of the curve (the one farthest from the video i.f. carrier) is not undesirable in many cases, since it tends to improve picture definition.

The a.g.c. voltage may be reduced or eliminated in fringe areas, to boost receiver sensitivity. This voltage, which should be very low in the presence of weak signals, may actually be quite large if the noise associated with the incoming signal is large (unless a delayed a.g.c. system is present). The gain of the receiver will be unnecessarily reduced in consequence, and impaired synchronization, insufficient picture contrast, snow, and poor sound may result.

If some medium-level signals are being received, the a.g.c. voltage may be reduced, instead of being entirely eliminated, by disconnecting the a.g.c. feed line from the a.g.c. rectifier (if one is employed) and reconnecting it (see Fig. 4) to the hot side of the video detector output circuit (provided that the detector connections are such that a negative d.c. voltage is produced at its output). This change cannot be made if the resistor is returned to a negative voltage source instead of ground since the a.g.c. voltage may be increased rather than decreased.

Such a circuit change should not be made when one or more strong signals are received, since the receiver will overload (*i.e.*, picture bending, negative picture, complete loss of horizontal sync, etc. may take place) on these signals (see Fig. 8). A switching arrangement can be made up to reduce the a.g.c. on weak signals only, in which case satisfactory reception may be obtained on both strong and weak stations.

The resistor in the plate load of an a.g.c. rectifier, across which the a.g.c. is taken off, may also be reduced in value (see Figs. 6A and 9), to lower the a.g.c. voltage and increase the receiver sensitivity. If overloading on a strong station is to be avoided, a switch may be installed (see Fig. 6B). Before installing any switches of this type, make sure the customer is not the kind of person who will consider it a tax on his energy or intelligence to operate an additional control.

Reduction of the a.g.c. voltage will reduce the ability of the receiver to compensate for fading, changes in contrast when stations are switched, etc. This is, however, a relatively small price to pay for better set sensitivity.

If the sound volume of the TV set is insufficient, all the tubes in the sound

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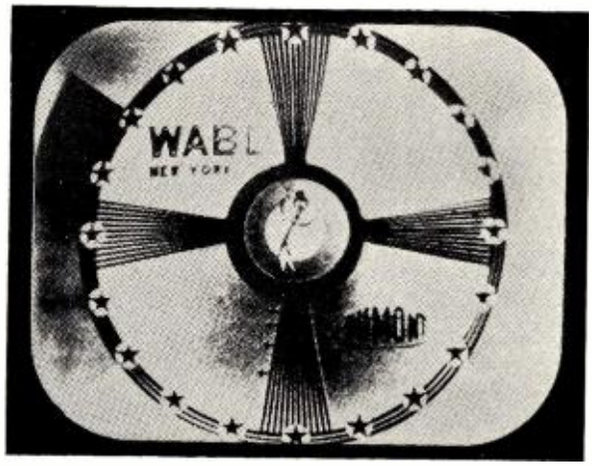


Fig. 7. The effect of smearing on a TV test pattern.

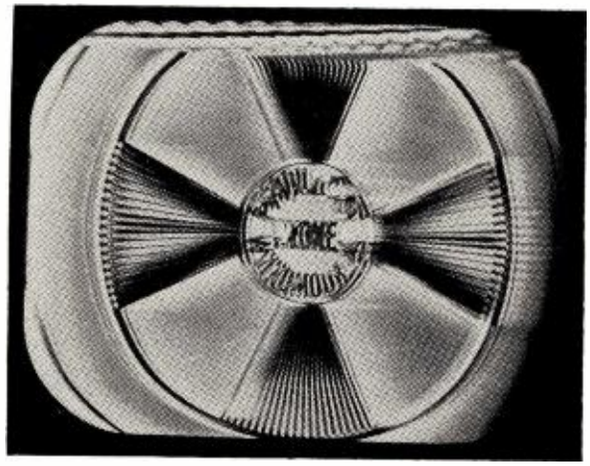


Fig. 8. Effect of overloading. Note reversals of the blacks and whites, tearing at top of picture, etc. Complete loss of sync may take place when overloading is especially severe.

THE STEPHENS OTL AMPLIFIER

By
FRANK H. GILBERT
Stephens Manufacturing Corp.

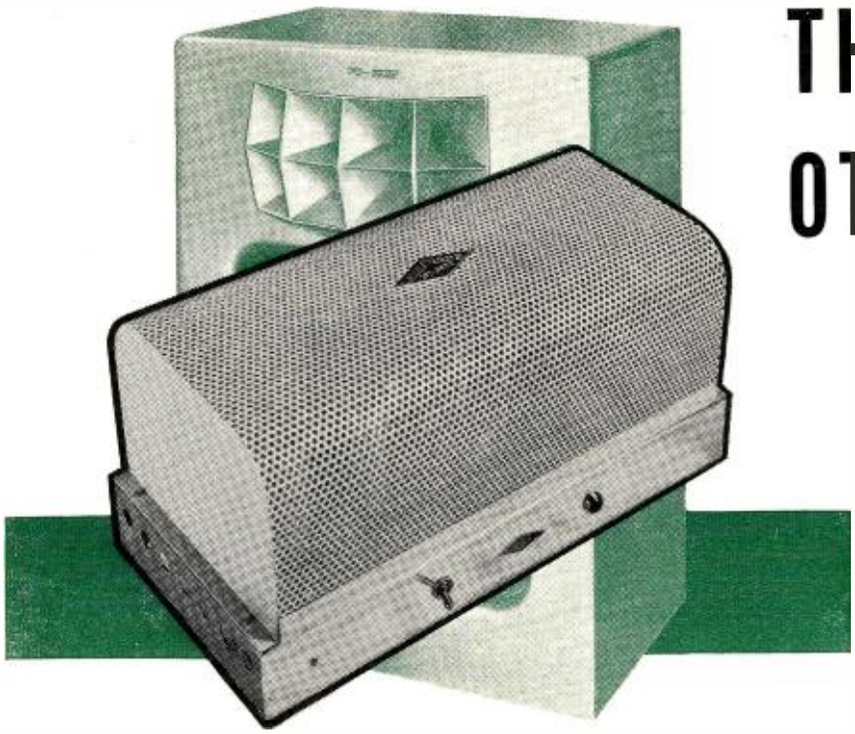


Fig. 1. Over-all view of the Stephens 500D power amplifier. Elimination of output transformer results in smaller unit. Model 5417 speaker system is shown in background.

Performance details on a compact, lightweight power amplifier whose design omits the output transformer.

The late FRANK H. GILBERT, noted audio engineer of Stephens Manufacturing Corp., met with tragic death recently in an auto accident. The accompanying manuscript was his final contribution to the audio fraternity and was completed in the last hours of his outstanding audio career.

IN RECENT years, considerable effort has been expended in improving the performance of power amplifiers for use in "high fidelity" sound systems. The techniques of handling resistance-coupled voltage amplifiers to supply relatively distortion-free signals to the output power stage have been well developed, leaving most of the residual distortion in this output stage and its associated matching transformer.

In the past few years, considerable emphasis has been placed on improving the output transformer to permit greater over-all feedback with its attendant reduction of distortion components. Unfortunately, these developments have resulted in increasing the cost as well as the performance of these devices. But even with the improvements already available, the transformer remains the factor limiting the performance of a power amplifier employing this means of coupling to the loudspeaker.

The problem of transferring large amounts of power at very low frequencies was encountered during the war in the aircraft industry in connection with large vibration exciters. This early circuitry was developed through the efforts of R.E. Rawlins and described in an article by Paul Holmes.[1] For some reason, this circuitry was ignored by the audio industry for several years. Recently a method of employing push-pull drive to such an output system was worked out by Sinclair and Petersen of *General Radio* and described in recent literature.[2] The system employed in the amplifier here described was worked out by the author at the *Stephens Manufacturing Corporation* independently and first shown at the New York Audio Fair in October 1951.

There are several methods of eliminating the output transformer. First, impedance coupling can be employed. This method suffers from the loading effects of the inductance at some low frequency, while the distributed capacity causes phase shifts which limit the high-frequency performance; also several tubes must be employed in parallel to obtain sufficiently low impedance to make direct matching to the loudspeaker load practical. Second, cathode follower output can be employed, but this system is quite inefficient in converting the d.c. power into audio-frequency energy and also requires rather high driving voltages to obtain high power outputs. Both of these latter systems require quite high currents from the power supply system and thus make the use of standard power supply components difficult.

A recent commercial approach to this problem has resulted in an amplifier which operates with quite reasonable conversion efficiency, very low distortion, and negligible phase shift. Further, the elimination of the output transformer results in less weight and smaller size than amplifiers of comparable power. A photograph of this unit is shown in Fig. 1.

The most unconventional part of the circuit of this amplifier is in the power and driver stages whose simplified schematic diagram is shown in Fig. 2. It can be seen that these stages are direct-coupled to supply amplification to d.c., thus eliminating any phase shift caused by coupling components. To stabilize the bias on the output tubes, reduce distortion, hum, and noise, 25 db of direct-coupled inverse feedback is applied through the resistor *A* to the cathode of the input triode.

To obtain good high-frequency response it was decided to drive the lower pair of power tubes from a cathode follower so that the input capacity from the power tubes would not cause serious shunting effect on the driving source at the frequencies involved. Linear operation of this driver is assured through a high supply voltage.

Additional feedback to the driving cathode follower is provided by supplying its plate from the output circuit. This arrangement reduces the apparent source impedance at the output tubes to approximately 100 ohms. The reflected input capacity of the lower pair of tubes, because of

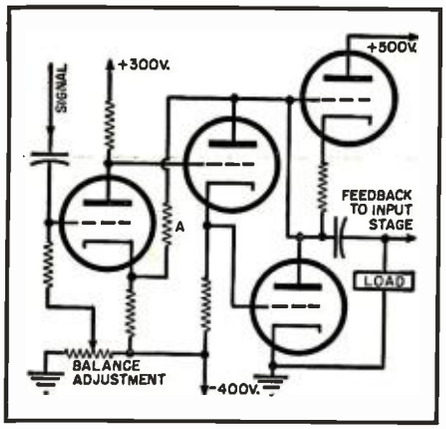


Fig. 2. Simplified schematic of the power and driver stages of Stephens Model 500D.

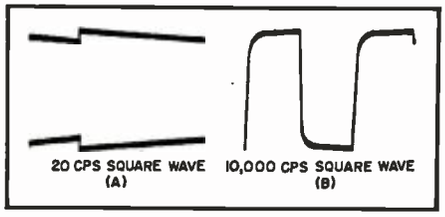


Fig. 3. Transient response of amplifier. (A) at 20 cps and (B) at 10,000 cps. See text.

FREQ. (cps)	OUTPUT (watts)	2ND HARM.	3RD HARM.
20	20	.29%	.32%
5500	20	.13%	.52%

Table 1. Harmonic measurements of 500D amplifier at overload point for 20 and 5500 cps.

Miller effect, is about 200 $\mu\mu$fd. The low driving impedance makes this shunting capacitance have negligible effect in the audio and ultrasonic range.

The upper pair of output tubes receives its driving voltage from the voltage drop across the cathode resistor in which the current is a combined result of the current drawn by the lower tubes and by the load. It should be noted that this driving voltage is 180° out-of-phase with the input signal to the lower grids; thus, the upper and lower tubes are essentially acting in push-pull as far as the audio frequency voltages are concerned.

The d.c. supply is, however, fed to the tubes in series so that the supply requirement is for a high voltage, low current supply. Because of the direct coupled driving system, it is also necessary to have a negative supply below the potential of the cathode return for the lower pair of output tubes. This arrangement can be more conveniently seen in the complete schematic diagram of Fig. 5. Here all potentials in the complete amplifier are shown.

Coupling to the load is accomplished through the use of an electrolytic condenser which serves to remove the d.c. drop across the lower tubes from the load circuit. In practice, this condenser is chosen so that a low impedance is provided for all frequencies in the passband. The impedance thus introduced is still further lowered by a second negative feedback loop to the first of the voltage amplifier stages.

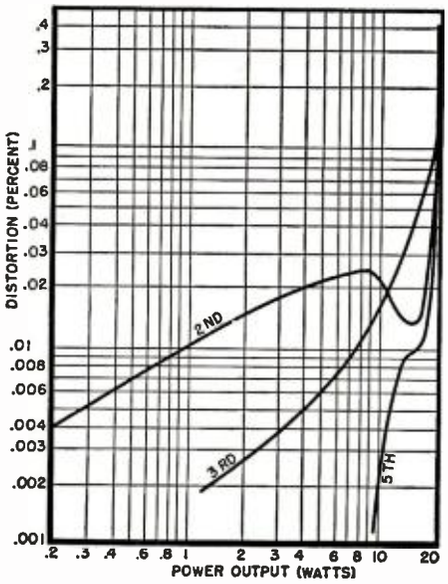
Coupling into the last three stages from the cascade voltage amplifier is through a condenser with sufficiently high capacity to introduce negligible phase shift at the low end of the audio spectrum. Approximately 11 volts are required to drive the amplifier to full output. This is easily furnished from the conventional two-stage voltage amplifier.

Gain of the final three stages with feedback is approximately 9. Additional feedback around the complete circuit is provided to reduce distortion and noise developed in the input stages. Two values are provided, depending upon the gain required, either 20 or 11 db. With the jumper connected in the output plug, full feedback is applied and a signal of 1.5 volts is required for full output. With the jumper removed, the lower value of feedback is used and the amplifier may be driven to full output from one-half volt.

Correct operating potentials are established on the output tubes by properly setting the bias control, R_9. This adjusts the d.c. potential on the grid of the direct coupled triode and takes into account the leakage, if any, in the input coupling condenser. The proper setting of this control is that which applies one-half the plate voltage available to the lower pair of tubes. It will be noted that the upper tubes have individual cathode resistors, so that proper current balance is obtained regardless of tube characteristics. This arrangement makes the selection of tubes less critical. It has been found that four tubes of the same make, condition, and age can be juggled to provide essentially equal currents in the two branches as indicated by equal voltage drops measured across the parasitic suppression resistors in the two upper plates.

The power supply considerations, both from the standpoint of filament and plate, are somewhat more complex than in a conventional amplifier. Because of the fact that the output tubes are 2A3's and thus require a different voltage than other tubes in the amplifier and because they employ directly heated cathodes, and so require a center tap, two 2.5-volt center-tapped windings are needed. The floating cathodes of the driver cathode follower and its associated voltage amplifier each require separate heater windings because of their differing cathode potentials, which exceed the tube ratings for heater-cathode potentials. This heater situation is further complicated by the fact that a.c. isolation is required between the various cathodes so that each winding has to be shielded while maintaining a low capacity to ground. The total heater requirement is five windings, two of which are center tapped—twelve leads, in all.

Fig. 4. Distortion curves for the 2nd, 3rd, and 5th harmonics of the 500D amplifier.



It is obvious from the above that vacuum tube rectifiers for the positive and negative high voltage supplies would make the use of a single power transformer somewhat cumbersome, so selenium voltage doubler type supplies, operating from a single two-lead high voltage secondary, are employed. Both the negative and positive supplies are identical voltage doubler systems operating from a 230-volt winding with two standard 130-volt elements in series; those in the positive supply are 150-milliampere elements, while those in the negative supply are 65-milliampere units. Conventional choke condenser filters are used.

With the direct-coupling arrangement employed and the feedback loops providing an apparent output impedance of .8 ohm for the low gain position, virtually all of the power developed by the output tubes is available to the loudspeaker circuit, as the insertion loss of the transformer is not present. The damping of the speaker system then becomes that introduced by the resistance of the voice coil circuit of the speaker system. Such damping effectively smooths resonant effects introduced by enclosures and thus reduces "hangover" present in most systems.

Transient response to the amplifier is shown in the oscillograms of Fig. 3; (A) is taken with a 20 cps square wave and shows approximately 12° of phase shift at this frequency, while (B) shows the performance with a 10,000 cps square wave with slight rounding of the leading corners, indicating the drop in response above 100,000 cps. Response of the amplifier in this higher frequency region is purposely attenuated to prevent r.f. signals from being passed, which might detrimentally affect the performance of the system. The gain of the amplifier is down 30 db at 1 megacycle.

Distortion curves are shown in Fig. 4 for the 2nd, 3rd, and 5th harmonics, as these were the only significant ones found in the amplifier output. The overload point of the amplifier occurs at 20 watts where the harmonic con-

tent is at its highest value. Just below overload, the harmonic content is in the neighborhood of 0.1%, while at normal listening level, in the vicinity of 2 to 3 watts, the distortion is negligible. Harmonic measurement with the sensitivity indicated by these curves was made possible through the use of a newly developed audio oscillator of extremely low distortion[3] and a carefully adjusted wave analyzer. It is felt that such harmonic measurements are a much truer measure of amplifier performance than can be obtained by any other type of analysis.

While complete harmonic curves are shown for the 1000 cps frequency, measurements were also made at 20 cps and at 5500 cps at the amplifier overload point, and the results are shown in Table 1. While the distortion at these frequencies is slightly higher, it is still well below that usually found in amplifiers employing coupling transformers.

The principles involved in the design of this particular amplifier can be employed with other tube types and modified arrangement to suit particular applications. This design provides an adequate power level for most "high-fidelity" applications in the home and for sound reinforcement. A recent installation at the Los Angeles County Fair employed five of these amplifiers, driving five theater-type, two-way reproducers to more than adequately cover an open-air grandstand with a seating capacity of twenty-thousand people. Reports of many critical listeners indicated that this system provided clean sound reinforcement of musical program material.

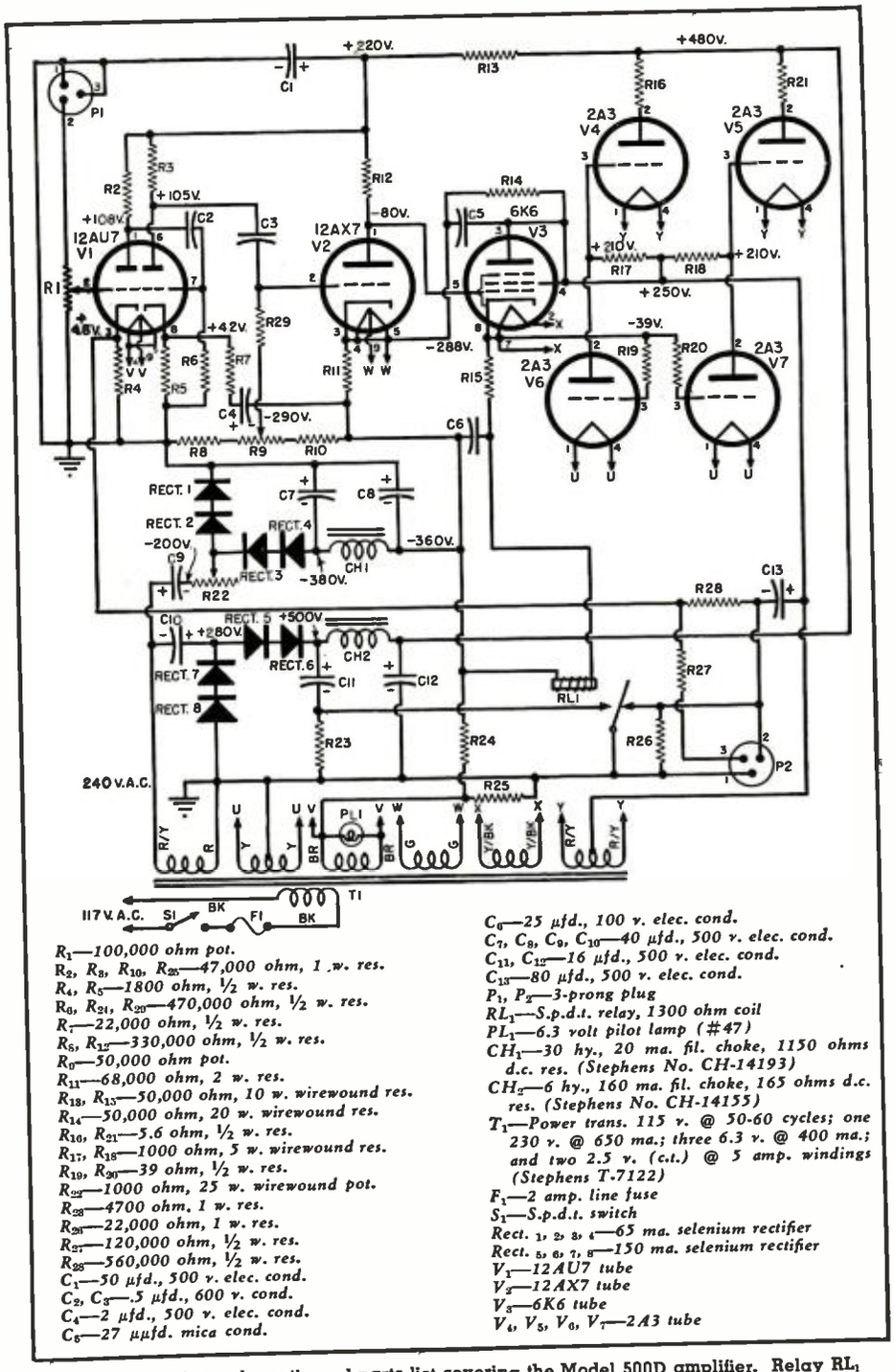
A complete line of single speakers and two-way components is now being manufactured to take full advantage of the capabilities of this amplifier. No point has been overlooked in the design and construction of these speakers to provide the most outstanding performance available when used in combination with the amplifier and high-quality source material.

The 500-ohm output impedance of the amplifier should be directly fed to a 500-ohm voice coil speaker or 500-ohm crossover network for a two- or three-way combination 500-ohm speaker system.

A companion unit for use with this amplifier is the company's #5106 15" coaxial speaker with separate 500-ohm voice coils, 500-ohm network, and six and one-half lb. *Alnico* V permanent magnet.

However, all of the company's *"Tru-Sonic"* speakers and speaker systems are available in 500-ohm voice coils from the #5112 12" co-spiral to the full three-way systems. This gives the high-fidelity enthusiast a selection in any price range with an assurance of a perfectly-matched hi-fi audio system.

EDITOR'S NOTE: Audio enthusiasts who have a sizable sum invested in speakers may be loathe to discard their present units just because they do not happen to have 500-ohm voice coils. The Stephens Model 500D audio amplifier can be used in sound distribution systems utilizing conventional speakers by employing a 500 ohm-to-voice-coil output transformer. This technique, however, cancels several of the unique advantages of this circuit (elimination of the output transformer with its resultant saving in space and weight). The ideal arrangement is, still, to use this amplifier with a matching, companion loudspeaker.



R_1—100,000 ohm pot.
R_2, R_3, R_{10}, R_{25}—47,000 ohm, 1 w. res.
R_4, R_5—1800 ohm, ½ w. res.
R_6, R_{24}, R_{20}—470,000 ohm, ½ w. res.
R_7—22,000 ohm, ½ w. res.
R_8, R_{12}—330,000 ohm, ½ w. res.
R_9—50,000 ohm pot.
R_{11}—68,000 ohm, 2 w. res.
R_{13}, R_{15}—50,000 ohm, 10 w. wirewound res.
R_{14}—50,000 ohm, 20 w. wirewound res.
R_{16}, R_{21}—5.6 ohm, ½ w. res.
R_{17}, R_{18}—1000 ohm, 5 w. wirewound res.
R_{19}, R_{20}—39 ohm, ½ w. res.
R_{22}—1000 ohm, 25 w. wirewound pot.
R_{23}—4700 ohm, 1 w. res.
R_{26}—22,000 ohm, 1 w. res.
R_{27}—120,000 ohm, ½ w. res.
R_{28}—560,000 ohm, ½ w. res.
C_1—50 μfd., 500 v. elec. cond.
C_2, C_3—.5 μfd., 600 v. cond.
C_4—2 μfd., 500 v. elec. cond.
C_5—27 μμfd. mica cond.
C_6—25 μfd., 100 v. elec. cond.
C_7, C_8, C_9, C_{10}—40 μfd., 500 v. elec. cond.
C_{11}, C_{12}—16 μfd., 500 v. elec. cond.
C_{13}—80 μfd., 500 v. elec. cond.
P_1, P_2—3-prong plug
RL_1—S.p.d.t. relay, 1300 ohm coil
PL_1—6.3 volt pilot lamp (#47)
CH_1—30 hy., 20 ma. fil. choke, 1150 ohms d.c. res. (Stephens No. CH-14193)
CH_2—6 hy., 160 ma. fil. choke, 165 ohms d.c. res. (Stephens No. CH-14155)
T_1—Power trans. 115 v. @ 50-60 cycles; one 230 v. @ 650 ma.; three 6.3 v. @ 400 ma.; and two 2.5 v. (c.t.) @ 5 amp. windings (Stephens T-7122)
F_1—2 amp. line fuse
S_1—S.p.d.t. switch
Rect. 1, 2, 3, 4—65 ma. selenium rectifier
Rect. 5, 6, 7, 8—150 ma. selenium rectifier
V_1—12AU7 tube
V_2—12AX7 tube
V_3—6K6 tube
V_4, V_5, V_6, V_7—2A3 tube

Fig. 5. Complete schematic and parts list covering the Model 500D amplifier. Relay RL_1 limits charging current on condenser C_{11} until the 6K6 tube starts drawing current. The relay also eliminates "pop" in the output when the amplifier is first turned on by shorting the output until all tubes are in normal operation. The time delay is about 5 seconds. Resistors R_{27} and R_{28} are in the feedback circuit. At the present time all of the commercial models of this amplifier are being shipped with pins 2 and 3 strapped together. This increases the feedback 9 db and decreases the gain by the same amount. In this position the driving voltage required for full 20 watts output is 1½ volts. By cutting the jumper, the gain of the amplifier is increased 9 db and requires an input voltage of ½ volt. The output impedance of the amplifier is 500 ohms which should be coupled direct to any 500-ohm v.c. speaker or speaker system.

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[1] *Holmes, P. J.; "Vibration Exciter for Structural Tests," Electronics, December 1946.*
[2] *Sinclair & Petersen; "A New Push-Pull Amplifier Circuit," General Radio Experimenter, October 1951.*
[3] *Better Audio Co., 4638 10th Avenue, Los Angeles, California.*

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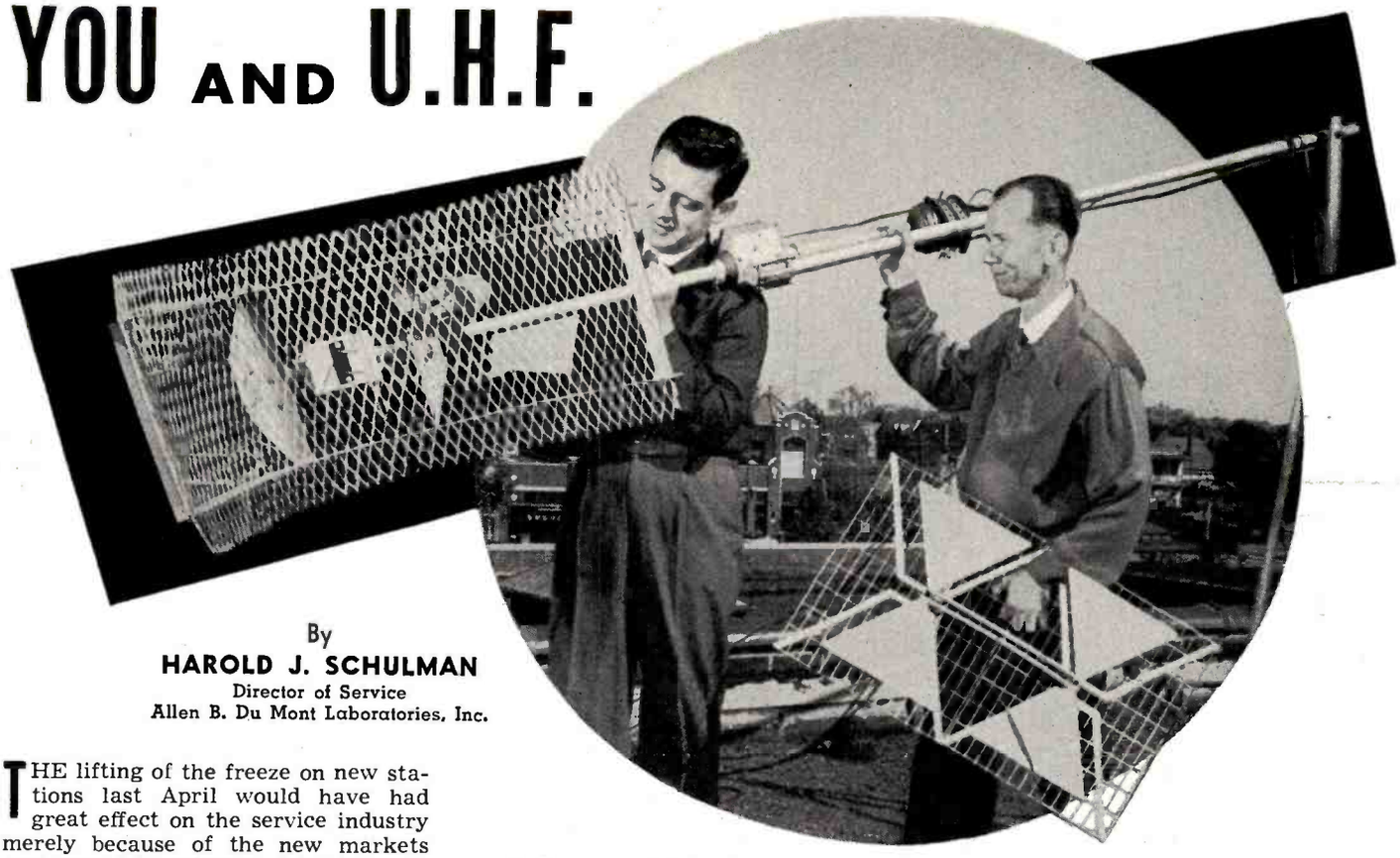
YOU AND U.H.F.



By
HAROLD J. SCHULMAN
Director of Service
Allen B. Du Mont Laboratories, Inc.

Setting up a u.h.f. dipole with reflector and stacked bow-tie with reflector for tests.

Your u.h.f. antenna installations will be successful by following these pointers from Portland and other cities.

THE lifting of the freeze on new stations last April would have had great effect on the service industry merely because of the new markets that would be stimulated by the new stations.

But when you add to this the coming to commercial life of a new band of frequencies, called u.h.f. for convenience, it's easy to see why service technicians in every part of the land started asking many basic, practical questions.

Will u.h.f. really work? Can I handle it without too much additional study? What is there different about the handling of u.h.f. installations? And many more.

Since u.h.f. transmission is now a fact in both the East and West, practical answers can now be given to these important questions. Portland (27), Atlantic City (46), York (43), Mobile (48), South Bend (34), Wilkes-Barre (28), and Youngstown (27, 73), and others all report the same excellent results with u.h.f. transmission.

Millions of dollars were spent in research and experimentation during the freeze period. The *Du Mont* experimental station, KE2XDR, and the *RCA* experimental station in Bridgeport, KC2XAK, did yeoman service in providing proving grounds for all manufacturers who wanted to test their own methods of adapting their receivers to u.h.f. Therefore it's no wonder that u.h.f. is working as well as it is.

Now that u.h.f. is a commercial reality let's examine it from four vantage points: (1) the coverage and quality of its signal, (2) the devices used to receive it, (3) the techniques used to install it, and (4) its significance to service technicians.

TYPE	VOLTAGE OUTPUT FRONT	BACK
Single Bow-Tie	6.5	5.5
Single Bow-Tie (with reflector)	8	2
Stacked Bow-Tie	11	10
Stacked Bow-Tie (with reflector)	21	3
Stacked V	20	11.5
Double V	15	9.5
Trombone	12.5	8
Parabolic	12.5	4.5

Table 1. Comparison of relative voltage outputs (measured at second detector) for various u.h.f. antennas.

Table 2. Attenuation losses (in db per 100 feet) for wet and dry lead-in lines.

TYPE	100 MC. WET	100 MC. DRY	700 MC. WET	700 MC. DRY
300-ohm flat	7.3	1.2	26.5	3.6
300-ohm tubular	2.5	1.2	8.2	3.6
RG-11/U	1.9	1.9	6.2	6.2
RG-59/U	3.7	3.7	11.7	11.7

The u.h.f. coverage has been most thoroughly checked in Portland. We had a crew in Portland even prior to the start of telecasting on September 8, 1952. At that time most television activity centered around closed-circuit demonstrations. The most notable demonstration was conducted under a huge tent during the political conventions. Thousands of Portland people saw television pictures for the first time even though it was only a closed circuit.

Since that time we have conducted many service clinics and observed many installations and receivers in action. Based on our own experience plus that of others, certain conclusions regarding the coverage of u.h.f. can be drawn.

A station can go on the air with a 1 kw. transmitter. This should radiate anywhere from 16 to 20 kw. *erp.* A signal of this magnitude can be expected to provide class A coverage over a radius of 14 miles and class B coverage within approximately 23 miles.

In very flat areas this distance will be increased somewhat, and in hilly areas it will be somewhat decreased, but averaging out the variables of terrain and transmitting antenna height, these figures can be used as a rough guide.

For the future, there is no doubt that this range will be extended. The FCC authorizes u.h.f. stations to go as

high as 1000 kw. *erp.* The range of reception will also be extended as the noise figures in the u.h.f. front end improve. In summary, because of the greater inherent noise in u.h.f. tuners or converter circuits at present, the smaller capture area of the u.h.f. antenna, and the greater transmission line losses, a stronger radiated field is required at u.h.f. than at v.h.f.

It is interesting to note that pictures observed in Portland and in York were free from noise interference, as was predicted with u.h.f. Multi-path signals presented no problem either because of the increased directivity of u.h.f. antennas.

Shadow areas were found in Portland where the signal didn't get through at all. In all cases this could be traced to a foothill, building, or other obstruction in the line-of-sight path from the transmitter. Fortunately, the signal shadow area appears to be about half as long as the light shadow area. Thus, residents living in areas which do not have a clear view of the transmitter, but who live reasonably close to the end of the light shadow, should be able to receive a usable signal, if in close enough. (See Fig. 3).

If the transmitter antenna is atop a tall building in your community, you might spend some profitable moments up in the tower just looking your city over. You might find some of the locations hidden by buildings, hills, or valleys and thus have a clue as to the dead spots you might anticipate.

As an example of the coverage that might be expected, it was estimated that the present Portland station, KPTV, with its present power output, could expect to reach about 90% of the people in the city proper and up to 88% of the 650,000 inhabitants of the greater metropolitan area.

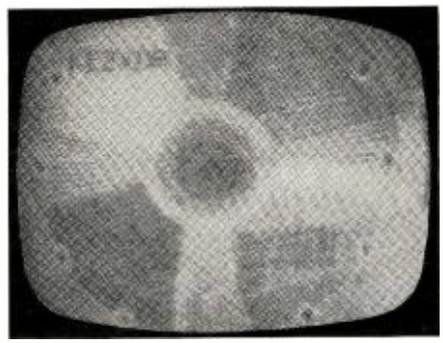
Before we leave coverage, how about fringe signals? Well, reception acceptable to dealers and purchasers was found in some parts of Salem, Oregon, about 40 miles south of Portland—and there were even reports of reception 65 miles away.

U.H.F. Conversion

Since there appears to be no integrated u.h.f.-v.h.f. tuner on the market as yet, almost all devices act as converters. While different manufacturers will make different claims, at the moment one can safely say there is no one "best" device. Some people want to get all channels, while others will be satisfied with just one or two stations in their locality. Some will stress the easy tuning and economy of strip conversion, while others will brag about the built-in tuner that was obtained at additional cost.

When it is all added up we find that each conversion method, like everything else in life, has its advantages and disadvantages. The important thing to remember is that good reception was available to Portland residents with receivers now on the market.

All the present u.h.f. conversion devices were found capable of producing satisfactory pictures. Under different conditions one method may have been a little better than others, but this was usually reversed when a new set of conditions was found. What the receiver did with the signal after conversion down to the i.f. depended, of course, on the inherent performance characteristics of that particular receiver. After all, the u.h.f. portion of the receiver is still concentrated only in the front end. You still have i.f. bandpass, sync circuits, video circuits, etc., to contend with before you finally get your picture onto the cathode-ray tube screen. Further discussion of current conversion methods can be found in the June and July 1952 issues of RADIO & TELEVISION NEWS.



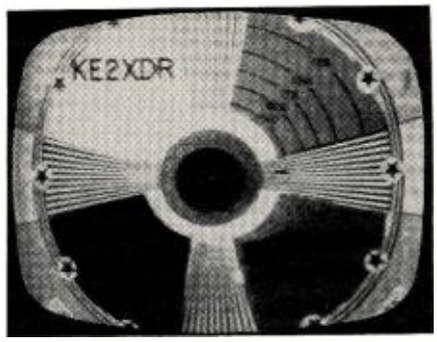


Fig. 2. (Left) Picture obtained using 100 feet of dry 300-ohm ribbon or 300-ohm tubular lead-in lying on roof. (Right) Using RG 11/U coaxial lying on the roof.

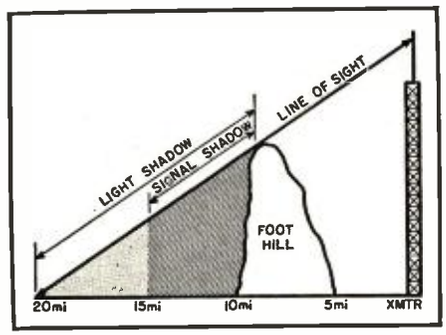


Fig. 3. Signal shadow resulting from u.h.f. transmission is approximately half of corresponding light shadow.

Installation Techniques

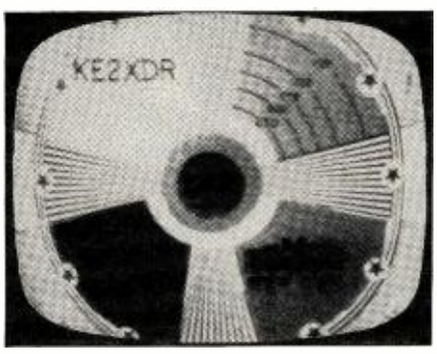
Probably the biggest item under the direct control of the service technician is the quality of the installation. Since this is also the most important factor in determining whether or not a customer will enjoy good reception it is worth our while to go over each of the items that go into a good installation. Here we are particularly fortunate because we can draw on both our experiences in Portland and York and our own *Du Mont* experimental lab atop our service department roof in Paterson, New Jersey.

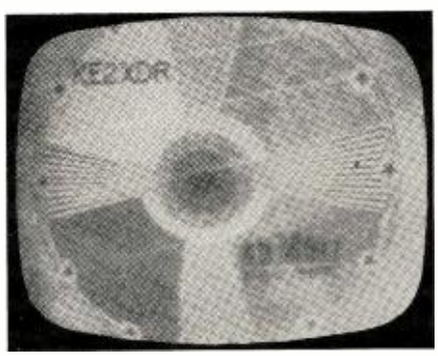
Prior to the on-the-air date in Portland, we gathered as many sample u.h.f.-v.h.f. antennas as were available. We checked their relative performance using the signal put out by the *Du Mont* experimental station KE2XDR. Directivity patterns were carefully plotted. Relative gain and front-to-back ratios can be determined by reference to Table 1. Additional u.h.f. antenna information will be found in the series on "U.H.F. Antennas" which began in the Dec. 1952 issue of RADIO AND TELEVISION NEWS.

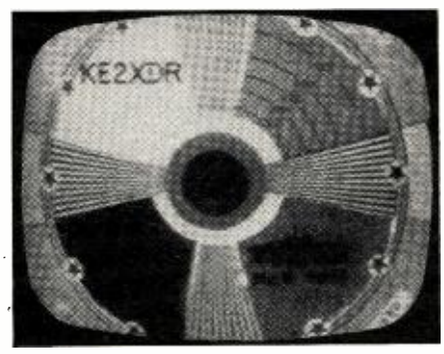
In general, we found the double-V antenna to be a good all-around antenna in Portland where signal conditions

(*Continued on page* 128)

Fig. 4. Effects of moisture on transmission lines. (Left) picture obtained with 100 feet of dry 300-ohm ribbon or tubular line. (Center) Picture with 100 feet of wet 300-ohm ribbon lead-in. (Right) With 100 feet of wet 300-ohm tubular line.







A MULTIPLE INSTALLATION FOR TV RECEIVERS

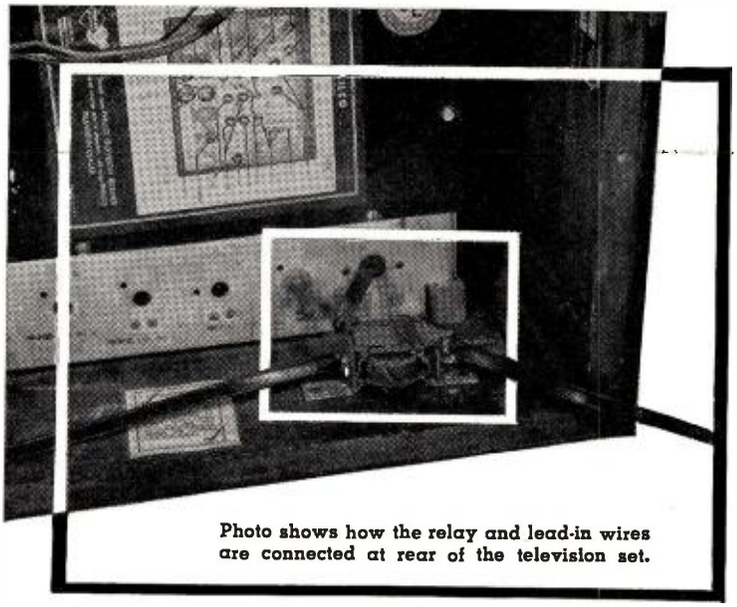


Photo shows how the relay and lead-in wires are connected at rear of the television set.

By
NORMAN C. FULMER
Research Division
Allen B. Du Mont Laboratories, Inc.

Avoid multiple antenna installations by using this novel scheme to connect several auxiliary home TV receivers.

THE popularity of television has reached the stage where it is convenient to have more than one TV set in the home. It is convenient, for example, to have a main TV set in the living room and auxiliary TV receivers in the kitchen (for the wife to watch TV programs, especially cooking instructions, while doing kitchen work), in the bedroom (to watch late evening news programs and movies, and early-morning news programs while dressing), and (heaven forbid!) in the dining room to watch important programs while eating. Auxiliary TV receivers can also be used to advantage in the den or basement recreation room. When a new TV set with a larger screen is purchased, the old small-screen set can be used as an auxiliary set.

Since only one auxiliary TV set is normally used at a time in the home, the effort and expense of erecting several antennas and lead-in cables, or of installing an antenna coupler (with its attendant loss of signal strength and with several lead-in cables fanning out all over the house to the different TV sets), can be avoided by using a single lead-in cable connected to each TV receiver as shown in Fig. 1A. An inexpensive relay, at each auxiliary receiver, automatically switches the entire signal power of the antenna to whichever TV set is turned on. In lieu of relays, the "on-off" switch in each auxiliary TV set may be replaced with a switch having an extra double-pole, double-throw section.

As shown in Fig. 1A, the antenna lead-in is first connected to the relay switch at the TV set nearest the antenna, such as the one located in an upstairs bedroom. From there, the lead-in wire runs to the next nearest TV set, etc. This keeps the length of lead-in wire at a minimum. For use with twin-lead lead-in wire, the relays should be of the double-pole, double-throw type. The last TV set connected to the lead-in wire, shown as the main living room set in Fig. 1A, does not need a relay; the ends of the lead-in wires are directly connected to the receiver. At the other TV sets, the incoming lead-in wires are connected to the arm-contacts of the relay, the outgoing lead-in wires are connected to the normally-closed contacts, and the TV set input terminals are connected to the normally-open contacts of the relay. Any number of TV sets can be connected in this manner. To add a new TV set anywhere along the line, merely cut the lead-in wires and connect the severed ends to the relay at the new TV set.

The energizing coil of each relay may be of the 6-volt a.c. type, in which case the coil leads are connected to the 6-volt filament winding *X-X'* of the power transformer in the TV set at which it is installed, as shown in Fig. 1B. Alternately, the relay may have a 117 volt a.c. coil, in which case the coil is connected to the a.c. power leads *Y-Y'* at a point after the "on-off" switch.

When the TV sets are off, the relays connect the TV signal through the entire length of the series-connected sections of the lead-in wire and to the last TV set, which may be operated in the normal manner. When one of the other TV sets is turned on, its relay is energized and automatically connects the entire strength of the TV signal to that set only. Thus, for a few dollars spent for relays, a home can be equipped with several TV receivers which automatically switch onto a single antenna and lead-in system.

The rather simple procedure outlined herein can be performed in a reasonably short time yet provides a much-needed boon to those families with several television receivers.

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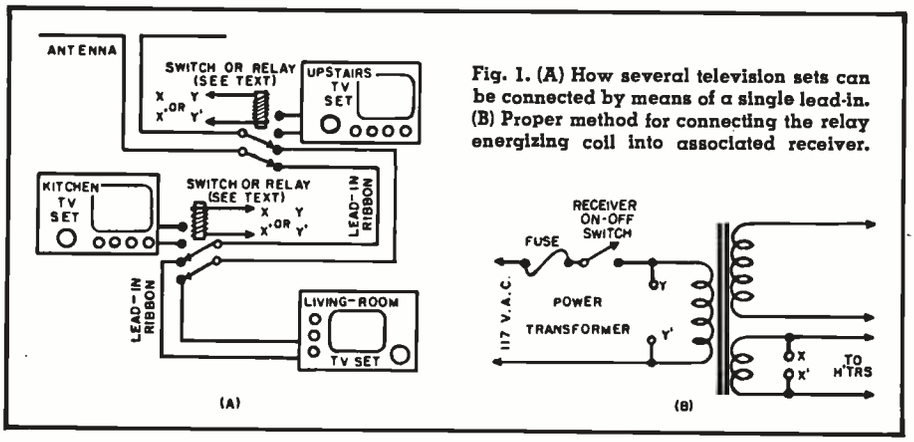


Fig. 1. (A) How several television sets can be connected by means of a single lead-in. (B) Proper method for connecting the relay energizing coil into associated receiver.

PHILADELPHIA'S NEW MOBILE UNIT

Over-all view of external equipment on truck, including p.a. system for disaster service. External feeder service is employed if power is available, otherwise generator unit is used.

By
EDGAR P. GRIM
Chief, Electrical Bureau
City of Philadelphia

A mobile communications center that "has everything" needed for disaster service.

THE City of Philadelphia, recognizing the importance of uninterrupted communications during emergencies, has acquired a unique mobile communications unit which could well serve as a model for other communities.

Like most large cities, Philadelphia has modern, up-to-date fire and police department communications systems. But, like other large cities, these systems are subject to interruption in case of a major disaster. To insure continuity of communications, the Philadelphia Electrical Bureau and the Philadelphia Civil Defense Council have planned a complete, self-contained mobile communications center for the city.

After months of study, planning, and construction, the city is now provided with the most complete mobile communications center ever devised. It is equipped to handle the entire fire and police communications system from any point within the City of Philadelphia, as well as Civil Defense messages.

The mobile unit is self-supporting in its operation. It has its own 15,000 watt power plant. It is equipped with heating and air-conditioning units, incorporates four powerful movable searchlights on its roof, and carries its own public address system. The unit has fire and police two-way mobile units; fire and police two-way station units; and three bands on the amateur frequencies, thus permitting communications with other cities and towns throughout the United States.

It is also equipped to permit two-way communications with airplanes and has *Bell* two-way equipment and facilities for handling 16 telephones from the telephone company's stations to the unit.

Since the unit was put into operation on May 17, 1952 it has responded to thirty-seven three-alarm fires and has participated in seven Civil Defense demonstrations.

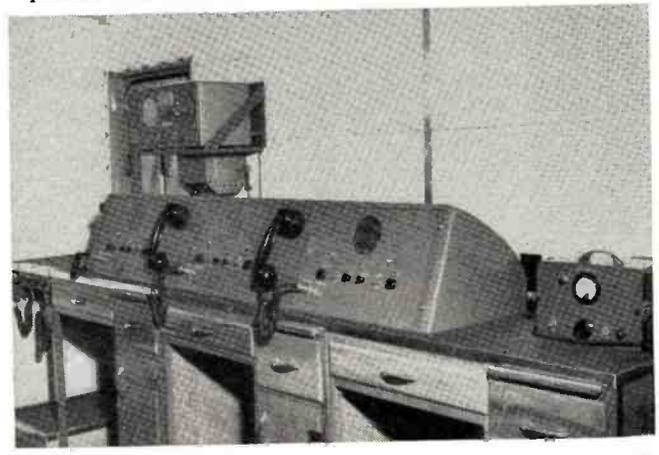
The unit is operated by members of the Fire Alarm Communications Division under the direction of the author. It is used by the chief of the fire department as his headquarters at the scene of all major fires with the unit's p.a. system being employed to direct personnel and companies to the most advantageous points for fighting the conflagration.

Should you be in Philadelphia and if you should happen to see the "500" on the fire ground, do not hesitate to come in and look us over. If we can be of any help in assembling or disseminating technical information, we will be glad to do so.

Other communities may wish to follow our basic plan for setting up such a communications center or may wish to adapt certain features to their own requirements. —30—

On the left-hand side of the truck, looking from the driver's seat, is the bank of two-way ham equipment which permits coverage of the 2, 10, and 75 meter bands. Anthony Repici, superintendent of radio, is shown making operational tests on this gear. The Bell System two-way radiotelephone equipment, with which the truck is equipped, is also visible in this photo.

Right-hand side of truck houses two consoles for fire and police mobile system. On top of desk is police base transmitter and receiver, fire transmitter and receiver, and CAA transmitting console. Above is receiver for air-to-ground communications. At extreme right is p.a. amplifier. Note the soundproofed wall construction that has been incorporated in truck.



BUILD THIS ELECTRONIC FLASH

By **CHARLES I. HELLMAN**

Fig. 1. Over-all view of flashgun structure. See text for full details.

Details on a simple unit using the new low-voltage flash bulbs and related components. Gives 100 watt-sec. flash.

CARLOADS of flashbulbs are sold every year to enthusiastic users. Professionals and amateurs alike have learned that the flashbulb makes possible picture-taking in almost any circumstance. The electronic speedflash offers two telling advantages so that more and more photographers are turning to it. First, it uses the same bulb for thousands of flashes. Ten-thousand flashes have been exceeded by many lamps. Further, the light pulse is only of one or two thousandths of a second duration. Consequently, even cameras with slow shutter speeds are given effective exposure of less than 1/1000 sec.

Advantages of This Unit

This unit is built around recent advances in components that have made possible new standards of efficiency, portability, and economy. Battery or a.c. operation is conveniently available by means of plug-in units.

Sprague has fabricated new low-loss electrolytic condensers that have phenomenal capacitance ratings in small volume. The *Sprague* Type FF-1 condenser packs 525 μfd. into a cylinder 2⅛ inches in diameter by 4 7/16 inches long. It weighs only 11 ounces and has a working voltage of 450 volts d.c.

Kemlite has perfected a speedlamp of high efficiency at only 450 volts and with the excellent capacity of 100 watt-seconds. Furthermore, the trigger transformer is built right into the tube so that wiring is quite simple, particularly for the high voltage trigger circuit. This new type DX lamp is available through *Sprague* electronic parts distributors as catalogue No. FA-100.

EDITOR'S NOTE: *The voltages present in this unit are about the same as those found in many radio sets. Use the same precautions in handling this gear.*

Before checking the unit, discharge the condensers through a 500 ohm wirewound resistor. Do NOT short them with a screwdriver as the tip will be vaporized by the high storage energy of the condensers.

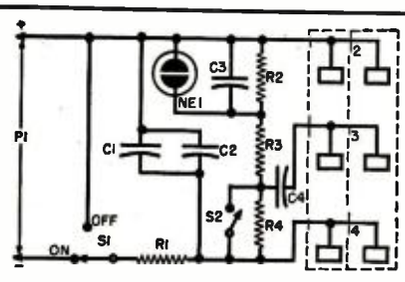


Fig. 2. Diagram of the electronic flash. The basing diagram is for the Kemlite DX unit (Sprague catalogue No. FA-100).

R_1—500 ohm, 5 w. wirewound res.
R_2—1.5 megohm, 1 w. res. ±5%
R_3, R_4—3.3 megohm, 1 w. res. ±5%
C_1, C_2—525 μfd., 450 v. elec. cond. (Sprague FF-1)
C_3—.05 μfd., 400 v. cond.
C_4—.25 μfd., 600 v. cond.
S_1—S.p.d.t. switch
S_2—S.p.s.t. switch (operated by camera shutter)
P_1—Male connector for power supply leads
NE_1—Neon bulb (NE-1)

Parts List for Power Supplies (Fig. 5)

B_1, B_2—225 v. battery pack (Eveready #492)
SO_1, SO_2—Female connector
S_1—S.p.s.t. switch
PL_1—117 volt pilot lamp
Rect.$_1$, Rect.$_2$—20 ma. selenium rectifier (Radio Receptor #16Y1)
T_1—Any transformer with sec. voltage of 300 to a maximum of 320 v. (Stancor #P6425)

National Carbon Company has made up a "B" type battery pack, #492, supplying 225 volts in a space 5 x 3½ x 3 inches. Two of these units are used to give a high voltage supply of 450 directly, without the use of multipliers. The battery supply will deliver about 1500 flashes, at a cost of less than one cent per flash.

These components make possible the design of a speedflash of 100 watt-seconds that outperforms many high voltage units of greater watt-second rating. The higher efficiency results from the use of the high-value storage condensers which increase the flash duration. This insures more effective use of film speed and contrast. Older speedlamps used shorter pulse times which changed the film contrast, requiring considerable overdevelopment to get any useful contrast.

Furthermore, by the use of plug-in units, the speedflash is instantly convertible to battery or a.c. operation.

Finally, the speedflash provides for the use of one or two speedlamps. Poor photographic quality often accompanies the use of a single lamp. The use of two lamps makes possible flash pictures of studio quality.

How Speedlamp Works

Speedlamp uses the pulse technique employed by radar. A large condenser is charged in several seconds to about 450 volts. The condenser is then discharged into a glass tube filled with xenon under pressure. A high voltage from the secondary of a tiny ignition transformer is applied to the tube initiating the discharge of the condenser.

Since the condenser is discharged through the flashtube in about a thousandth of a second, the power is enormous for the short interval, producing the brilliant flash of light that is characteristic of speedflash. The color temperature of the light approximates daylight and is bright enough to make possible camera exposures with small lens apertures. Color films of the daylight type need no filter except for the most critical uses, such as magazine food illustrations, etc.

Building the Basic Unit

The basic unit is built into a plywood box as shown in Figs. 3 and 4. The circuit is shown in Fig. 2.

C_1 and C_2 are the storage condensers. R_2, R_3, R_4 form a voltage divider network for C_3 and C_4. C_3 is used with the small neon lamp to indicate when the storage condensers are adequately charged. The neon lamp begins to blink when the condensers are sufficiently charged. C_4 supplies about 250

volts to pulse the ionization transformer.

R_1 limits the charging rate to C_1 and C_2, de-ionizes the flash after the condensers are discharged, and also removes the charge on the condensers when S_1 is in the "off" position.

The flashlamps are connected to the power pack with three-prong connectors. The lamps use standard four-prong sockets which are built into any suitable reflector as shown in Fig. 1.

Most synchronizing cords use a standard two-prong line type male plug which fits the female socket in the unit.

All parts are mounted on the panel, except for C_1 and C_2 which are mounted in the box.

The simplicity of the circuit gives the builder considerable latitude in housing the components. The dimensions given are intended as a guide. The unit shown in the photographs was made by a teen-age enthusiast using the simplest tools and is giving a good account of itself.

Powering the Unit

The battery pack is mounted as shown in Fig. 6. It is important to adhere to the polarity markings shown in the diagram, Fig. 5 (right). No other construction work is required.

The diagram for the a.c. pack is shown in Fig. 5 (left). It is advisable to test the output of the pack for voltage and polarity before inserting it into the basic unit. The output voltage should never exceed 450 volts, even at peak line voltage conditions. The a.c. pack is shown in Fig. 7.

The *Stancor* P6425 transformer was not available at the time this unit was constructed. The large surplus transformer shown was used temporarily. It is larger than necessary but worked satisfactorily. The exposed connections were taped over before use.

Flashgun

The flashgun is made by mounting a standard four-prong socket into a support. The actual method will depend on the preference of the builder. The unit shown in Fig. 1 shows the base mounted into part of an old flashgun. The diameter of the metal tubing was sufficient to make a snug fit of the socket. The screw base of the gun was retained to mount the gun on the usual flash bracket.

A universal clamp fitted to a second flashgun makes a versatile two-lamp unit.

Three-wire cable is used to connect the gun to the three-prong *Jones* plug.

Using the Speedlamp

Synchronization of this unit is designed for "X" type or zero delay shutters. This method is used as it is the most reliable type. It is accurate at any shutter speed and never needs adjustment.

Battery Operation

Insert the battery plug-in unit. Connect the synchronizing cord to the speedflash and camera. Throwing switch S_1 to "on" connects the battery to the condenser. The neon lamp should blink after several seconds. The first time the unit is used after the condensers have idled for several months, this may take about a minute. It soon drops to 5 seconds or so. The blinking neon indicates that the condensers are sufficiently charged for picture taking. Set the lens aperture according to the guide numbers in Table 1. The camera shutter is now released, firing the speedlamp and exposing the film. The neon will go out for several seconds and then glow again giving the "go-ahead signal" for another exposure. The switch should be turned to the "off" position when the picture session is over.

A.C. Operation

This type of operation is particularly useful in the home or studio where power outlets are readily available. Simply plug the a.c. pack into the

(*Continued on page* 90)

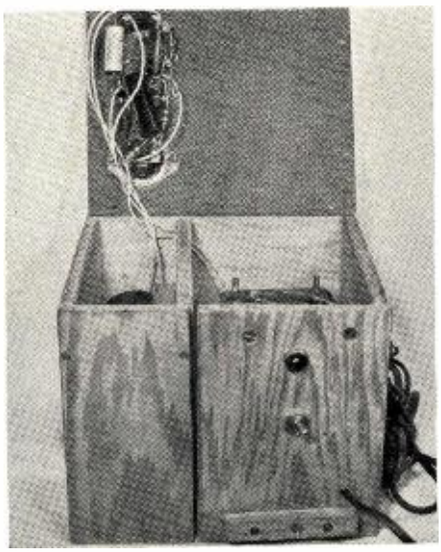


Fig. 3. View of electronic flash cabinet. The storage condensers are in left compartment. The a.c. plug-in unit is shown in place in the right-hand compartment.

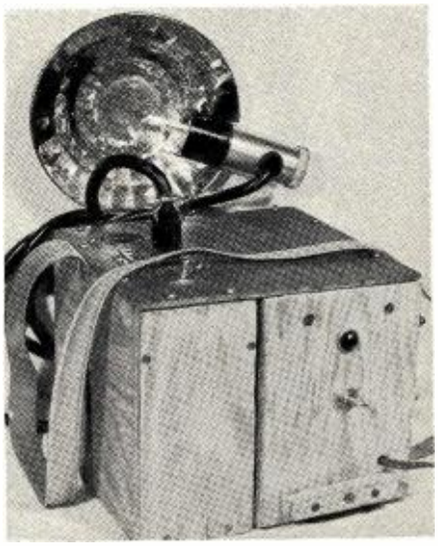


Fig. 4. Over-all view of complete unit. The cabinet measures 7"x6⅛"x6¾". The 450-volt battery pack weighs 8½ pounds and will provide approximately 1500 flashes.

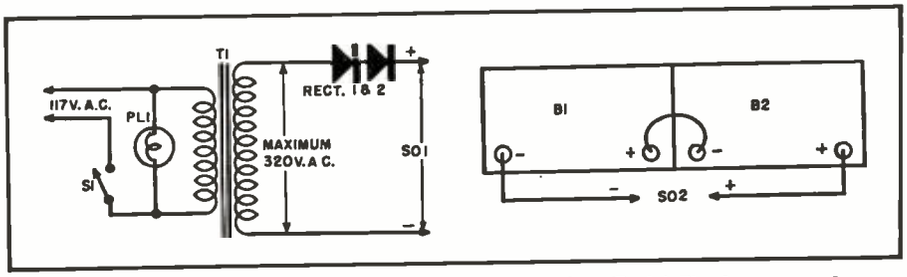


Fig. 5. (Left) Circuit diagram of the a.c. power supply. (Right) The battery pack.

Film (ASA Rating)	Super XX* 100	Plus X* 50	Daylight Kodachrome 10
Unit with one lamp	160	120	35
Unit with two lamps	120	80	25

* Developed normally in D76.

Table 1. Guide numbers for different films.

Fig. 6. How the battery pack is mounted.

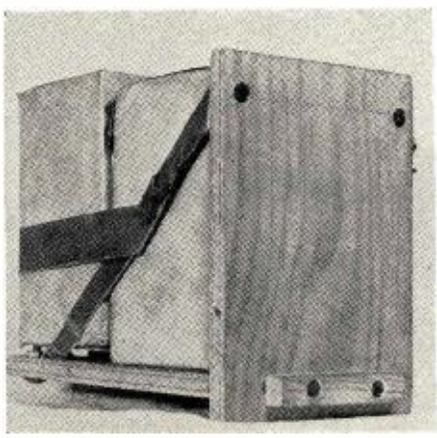
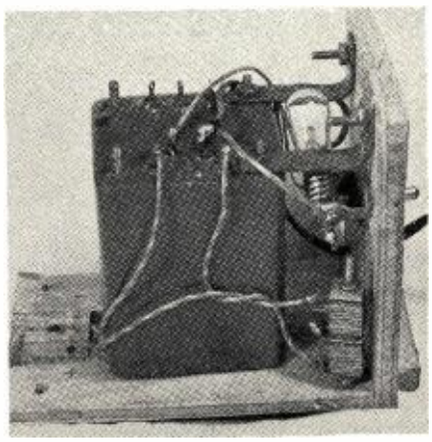


Fig. 7. The a.c. power pack in place.



U.H.F. ANTENNAS

Fig. 1. Four types of transmission lines used in v.h.f. and u.h.f. installations. (A) RG-59U cable, (B) the RG-11U cable, (C) a 300-ohm flat line, (D) 300-ohm tubular.

By

MILTON S. KIVER

Pres., Television Communications Institute

Part 4. Concluding article covers suitable transmission lines for u.h.f. and practical installation suggestions.

TRANSMISSION lines in common use at v.h.f. frequencies include a 450-ohm open-wire line (Fig. 2), 300-ohm flat and tubular lines, and two coaxial cables, the RG-59U and the RG-11U. See Fig. 1. At 100 mc., the signal-loss-per-100-feet of the open wire line is .35 db, in the 300-ohm lines it is about 1.2 db, in the RG-11U cable it is 1.9 db, and in RG-59U, it is 3.7 db. The open wire line has, by far, the lowest attenuation and, as such, is eminently suited for fringe area installations. Unfortunately, this line is the most difficult one to work with physically and for that reason is not used more widely. Its 450-ohm impedance is somewhat of a hindrance, too, since most antennas and receivers are designed for 300 ohms. However, this is not as serious as you might at first believe. There are practically no television receivers whose input impedance remains constant at 300 ohms for all channels. (The same is true of the so-called 300-ohm twin-lead or 300-ohm antennas.) Thus, simply connecting the 450-ohm line to the receiver will frequently (although not always) give you as good results as you would obtain by carefully matching the line to an impedance transformer and then making the connection to the receiver.

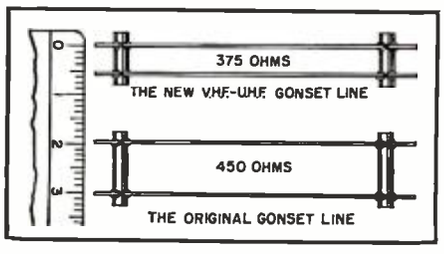


Fig. 2. Two types of transmission line made by Gonset. See text for additional details.

Recently, a 375-ohm open-wire line was announced. This brings the line impedance closer in value to the standard 300-ohm receiver input and it is doubtful whether a matching network will ever be required with it.

The 300-ohm flat line is the one most extensively employed at v.h.f. frequencies because it is economical, it matches receiver input impedances directly, and its attenuation is comparatively low. In areas where the surrounding noise is high, use of the unshielded open-wire or 300-ohm lines becomes impractical and one of the the coaxial cables must be employed.

With increase in frequency to the u.h.f. band, line db attenuation rises, too. Thus, at 500 mc., the open-wire line loss mounts to .78 db, the 300-ohm line loss becomes 3.2 db, RG-11U attenuation increases to 5.0 db and RG-59U loss reaches the rather high figure of 9.4 db. Comparative figures at 500 mc. (near the start of the u.h.f. band) and at 1000 mc. (near the end) are given in Table 1 and it can well be appreciated how carefully the amount of line needed must be reckoned in order that no more than necessary be employed.

An interesting sidelight on line attenuation is the rapid rise in this value in unshielded lines when they become wet. The 300-ohm flat line appears to be most vulnerable in this respect, jumping from a value of 3.2 db (at 500 mc.) when the line is dry to 20.0 db when it becomes wet. What this rise would do even to a strong signal is quite obvious. The 300-ohm tubular is considerably better and hence would be more desirable for installation purposes. No data is available on the attenuation increase in wet 450-ohm open-wire lines although it is not considered to be appreciable. Shielded cables, such as the RG-11U and RG-59U, are not affected at all by inclement weather.

On the newer 375-ohm open-wire line, the manufacturer states that the attenuation rises to 3.1 db from a dry value of 1.9 db. This is at 500 mc. At 1000 mc., both wet and dry line attenuation increase by about 50 per-cent.

The reason for the lower attenuation of the 300-ohm tubular line when it becomes wet is explained by the manufacturer as follows. See Fig. 4. In the flat twin-lead line the field of energy exists, in large measure, outside of the polyethylene ribbon and hence will be affected by dielectric changes such as coating the ribbon with water. Other agents which also

Table 1. Transmission line losses (in db per 100 ft.), as measured by Sylvania Electric.

TYPE	100 MC.		500 MC.		1000 MC.	
	WET	DRY	WET	DRY	WET	DRY
450-ohm open wire*	...	.35	...	.78	...	1.1
300-ohm tubular	2.5	1.2	6.8	3.0	10.0	4.6
300-ohm flat	7.3	1.2	20.0	3.2	30.0	5.0
RG-59U	3.7	3.7	9.4	9.4	14.2	14.2
RG-11U	1.9	1.9	5.0	5.0	7.6	7.6

*Estimated values—unknown for wet conditions.

have an effect on line attenuation include snow, salt spray, and dirt.

In the tubular twin-lead, the polyethylene plastic is shaped so that the field of energy set up between the two conductors is largely confined within the surface of the plastic. This thus prevents changes in atmosphere conditions from affecting the line to the same extent as the flat twin-lead.

EDITOR'S NOTE: *A new type of tubular line for u.h.f., developed by RCA, is being manufactured by the Anaconda Wire and Cable Co. The line has approximately 270 ohms impedance and attenuation of 3.6 db per 100 feet at 500 mc. and 5.1 db per 100 feet at 900 mc. both wet and dry.*

An important factor in keeping over-all attenuation down is the careful routing of the line from antenna to receiver. This is especially true in the case of unshielded lines. Keep the line away from gutters, pipes, or other metal objects as much as possible. Avoid sharp bends in the line. If a bend must be made, have it occur gradually. Finally, secure the line tightly by means of stand-off insulators so that it does not sway in the wind or otherwise alter its position.

Impedance Matching

While it is frequently unnecessary to carefully match 450-ohm impedances to 300-ohm impedances, the same is not true when a 75-ohm impedance is to be connected to a 300-ohm impedance. Here a careful match should be made because of the great disparity between the two values and also because 300-ohm impedances are usually balanced while 75-ohm impedances are not.

A favorite matching device is the elevator transformer. This unit first appeared in v.h.f. receivers and possessed the form shown in Fig. 3. Its purpose was to match the receiver input circuit (which has an impedance of 300 ohms) to either a 300-ohm twin-lead or a 75-ohm coaxial cable.

The elevator transformer consists of two sets of coils as shown in Fig. 5. One set of coils (L_1 and L_2) is closely wound on one form and the second set of coils (L_3 and L_4) is placed on another form. Electrically, each set of coils can be considered as a transmission line having a characteristic impedance of 150 ohms and a length of approximately one-quarter wave at the lowest operating frequency.

Now, if it is desired to match a 75-ohm line to one end and a 300-ohm input circuit impedance to the other end, we would connect the two sets of coils as shown in Fig. 7A. At the 75-ohm end the two coils are connected in *parallel*. Thus, two 150-ohm impedances in parallel produces a resultant impedance of 75 ohms.

At the other end of the coils, they are connected in *series*, producing the necessary 300 ohms.

If there are 300 ohms at both ends, the coil arrangement would be as shown in Fig. 7B. Now both ends are connected in series. Finally, a 300-ohm line can be matched to a set having a 75-ohm impedance as shown in Fig. 7C. Now, it is the input ends of the lines that are connected in series and the output ends that are in parallel. The impedance at one end can be balanced while it is unbalanced at the other end and the match is still effective. Or both ends can be balanced or unbalanced, as desired.

While the elevator transformer (in v.h.f. applications) uses coils that function as transmission lines, it is perfectly possible to achieve the same results using suitable transmission lines. (Transmission line lengths at v.h.f. frequencies would be too cumbersome to be handled readily. At u.h.f. frequencies, however, line length is only on the order of 5 inches or so.) Fig. 6 illustrates how two quarter-wave sections of 150-ohm twin-lead line can be connected to match a 75-ohm impedance at one end to 300 ohms at the other. Following the above discussion, all the other combinations can be obtained as well.

U.H.F. Antenna Installation

The job of locating the best position for the u.h.f. antenna follows closely the present v.h.f. practice of probing. That is, one man will remain at the receiver while a second man will take the antenna, with lead-in, to the roof. The lead-in is then run loosely from the antenna to the receiver following the most likely route of the final installation.

After the lead-in has been connected to both the probing antenna and to the receiver, the set is turned on. The controls should be adjusted so that a picture will be produced if a signal is received. Simultaneous work is now begun by the man on the roof with the unmounted antenna and by the man at the receiver. A two-way communications system enables them to talk with each other.

The man on the roof moves the antenna to various positions and the man at the receiver judges each position in terms of relative signal strength and picture quality. After all likely and accessible areas of the roof have been probed, the most promising locations are re-tested, until the best single location for the antenna is found.

Experience has shown that where the incoming signal is received directly from the transmitter, a certain amount of leeway in position is possible. This may permit the u.h.f. array to be mounted on the same post holding up the v.h.f. antenna. On the other hand, when the signal is a reflected one, it has been found that position tends to be quite critical. In fact, in the short distance of only six inches, the signal intensity can fluctuate con-

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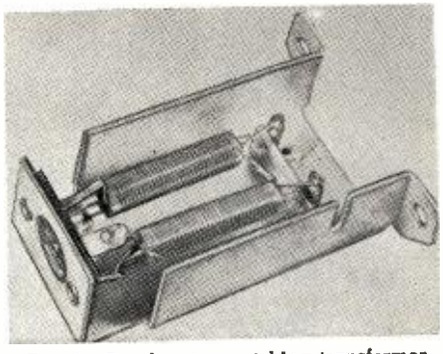


Fig. 3. An elevator matching transformer as used in v.h.f. television receivers.

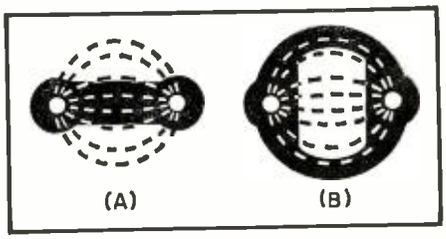


Fig. 4. (A) The field of energy in the flat twin-lead line is largely exposed to weather conditions. (B) In the tubular twin-lead, the field of energy is contained by the tubular construction of the line itself.

Fig. 5. The elevator transformer of Fig. 3 consists of two sets of coils. L_1 and L_2 form one set, L_3 and L_4 the other set.

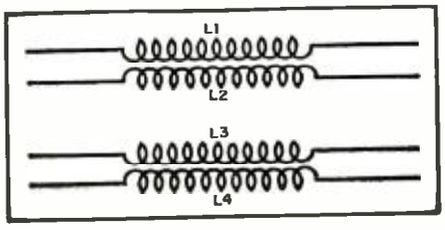


Fig. 6. An elevator transformer using sections of actual transmission lines. This device is widely used on the u.h.f. bands.

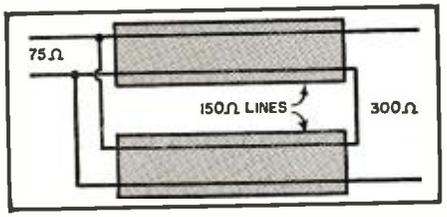
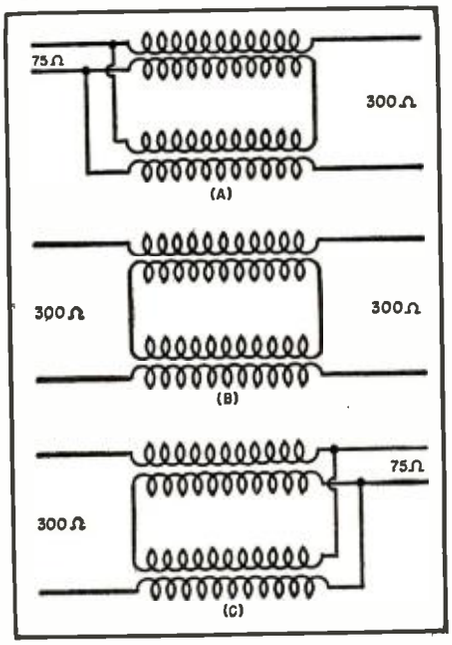
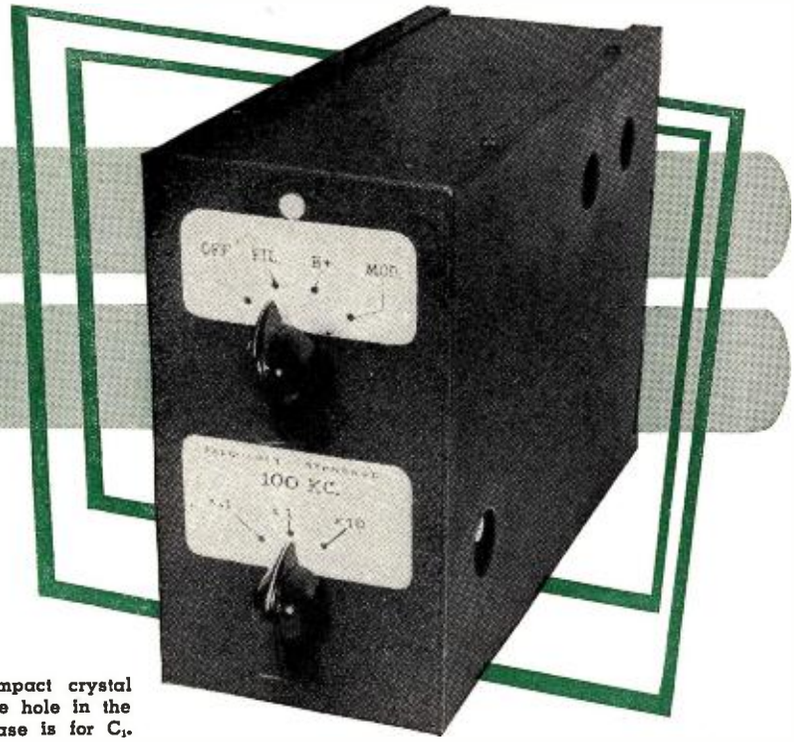


Fig. 7. Various impedance combinations obtainable with the elevator transformer. See text for details on different connections.



A HAM SHACK FREQUENCY STANDARD

By
RICHARD GRAHAM, W1VJV



The neat, compact crystal standard. The hole in the side of the case is for C_1.

Check points every 1000, 100, and 10 kc. will let you make full use of crowded bands and avoid "pink tickets".

FOR THE serious ham and experimenter, an accurate method of frequency measurement is an indispensable aid. A frequency standard, along with voltmeters and ohmmeters, is one of the essential tools of the trade. One wouldn't expect to see a carpenter work without the aid of a rule, level, or square, yet many of us continue to hobble along without the electronic equivalents of these basic tools.

Some method of frequency measurement is a legal requirement for the ham. The letter of this law is usually fulfilled by the station receiver. However, the spirit of the law, which was intended to keep all radio services within their assigned bands, is really not fulfilled. This is verified by the continuous and apparently unending stream of pink tickets issued by the FCC. Thus for the ham who likes to work close to the band edges in an effort to find a hole in the over-crowded spectrum, something capable of a higher order of precision is necessary.

As with most all basic tools, there are a host of other uses for this device. Its use in calibrating and maintaining the calibration of the station v.f.o., the grid-dipper, receivers, and signal generators, etc., will soon make you wonder how you did without it for so long!

The unit described provides a selective output consisting of marker frequencies every 1000 kc., 100 kc., and 10 kc. These marker frequencies, which naturally decrease in strength with increasing frequency, are "strong" up to and beyond 30 mc. Of course the word "strong" is a relative term that can mean almost anything, depending on the receiver used, etc. However on the writer's receiver, which incidentally is of the most inexpensive variety, the harmonics of even the 10 kc. multivibrator were definitely in the S9-plus class even at 30 mc. Furthermore, this is accomplished without resorting to any tuning or peaking of the output.

A second switch is provided on the front panel of the frequency standard to: 1. turn the a.c. to the unit off; 2. turn on the heaters only so that the standard is always ready for instant use; 3. turn on "B-plus," thus placing the unit in operation; 4. modulate the output with a heavy and distinctive 60-cycle note for identification of the frequency standard's output markers. This is particularly helpful in today's crowded amateur bands, since the 60-cycle note is readily identified and differentiated from the mass of other signals on the bands.

The heart of any frequency standard is the crystal. The crystal chosen for use in this unit is a dual-frequency crystal capable of oscillating at either 100 kc. or 1000 kc. depending upon the inductance switched in the circuit. Admittedly this type of crystal is more expensive than most others; however, it has certain other advantages which tend to make the total construction cost no more or possibly even less. Namely, if one purchased a 100 kc. crystal, to produce 1000 kc. markers it would be necessary to use an additional multivibrator, thus adding the cost of another tube and its associated circuit components to the total construction cost. By using a dual-frequency crystal, the oscillator performs both functions directly.

The 1000 kc. harmonics are used for identification of the 100 kc. harmonics only. That is, the 100 kc. mode of oscillation is the position actually used for frequency measuring. The 1000 kc. signals serve to identify the 100 kc. harmonics that coincide with the 1000 kc. harmonics. This is not meant to infer that the 1000 kc. markers are grossly inaccurate. It simply means that the 1000 kc. harmonics are not of the same precision as the 100 kc. signals. Even so, the accuracy of the 1000 kc. harmonics is better than .05% at room temperature. The oscillator in the 100 kc. position is adjusted to zero beat with WWV and any drift experienced will be negligible for most ordinary applications. The drift due to heating in the 100 kc. position is .001%/°C, an insignificant amount except for the most critical applications. However, to make the standard as stable as possible in this respect without going to any extremes, the crystal was mounted below the chassis. Thus when the unit is in the cabinet, the aluminum chassis serves as a sort of heat shield, conducting the heat from the tubes back out to the cabinet to be dissipated.

The oscillator circuit (see circuit diagram) is actually a modified form of the simple tuned-plate type of crystal oscillator circuit, in which the feedback at 100 kc. is aided by the r.f. of the plate circuit flowing through the a.c. divider formed by condensers C_3 and C_4. The screen grid of the 12AU6 serves as the plate of the oscillator. Since it is desired to make the output as rich in harmonics as possible, both the grid-leak resistor and plate resistor of the oscillator tube are larger than what might be considered normal. The oscillator output becomes a series of clipped-off pulses which are very rich in harmonics.

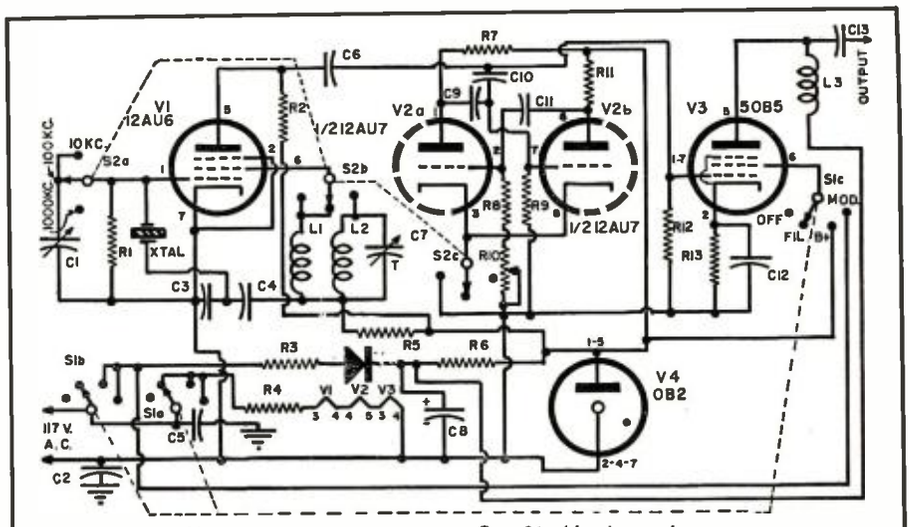
However, because of the high value of the plate resistor the oscillator output is quite low and the usable harmonic output dies off somewhere around 20 mc. Thus it becomes necessary to amplify the oscillator output. A 50B5 is used as the harmonic amplifier. This tube is admirably suited for this application because of its low cost, high transconductance, and its relatively low internal capacitances even though it was intended for audio work. This circuit is quite conventional and straightforward and needs little comment except for the modulation.

As stated previously, modulation of the frequency standard's output is very desirable particularly when counting up from the megacycle marker to some 100 kc. marker. This modulation serves to differentiate the frequency standard signal from any other carriers and heterodynes which serve only to confuse the count. Thus by switching the 50B5 harmonic amplifier from d.c. to a.c. direct from the line, we get a signal which is thoroughly disagreeable to the ear. Although this may sound unusual, such a note serves to make it all the more valuable for identification purposes. Experiments were performed using a nice 800-cycle sine wave for modulation. It was very nice sounding but it also was very easily confused with a heterodyne when attempting to identify the standard signal. The 60-cycle voltage, when applied to the screen, results in a modulation waveform similar to that of an unfiltered half-wave rectifier output and is guaranteed to be easily identified as the signal emanating from the frequency standard.

The 10 kc. markers are locked to the 100 kc. oscillator by using a synchronized multivibrator. The multivibrator using a 12AU7 double triode is quite conventional except for the fact that the synchronizing signal and multivibrator output are taken from the same point, *i.e.*, pin 7 of the 12AU7 multivibrator. This method reduces the switching requirements and also cuts down on the harmonic amplifier grid-circuit-to-ground capacity. This capacitance has a very marked effect on the higher order harmonic strength. Thus in the construction of this unit it is advisable to keep the oscillator plate-circuit wiring and the harmonic amplifier grid-circuit wiring up off the chassis and to make the leads as direct as possible. The potentiometer R_{10} in the grid circuit of the multivibrator is provided to adjust the frequency of the multivibrator to 10 kc. The exact adjustment will be described in detail later. The switch S_{2c} opens up the cathode of the 12AU7 thus disabling the multivibrator when the frequency standard is used on 100 and 1000 kc.

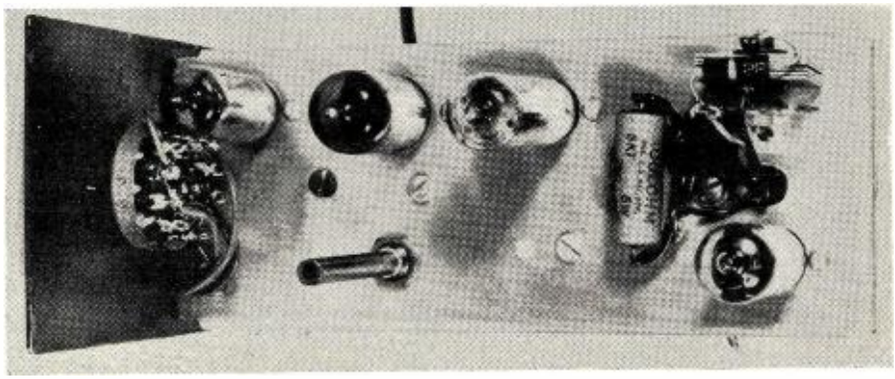
The power supply is basically an a.c.-d.c. type supply using a 65 ma. selenium rectifier and it more than adequately takes care of the d.c. requirements of the frequency standard. This supply has the advantage of being economical, lightweight, and compact. 80 μfd. worth of capacitance takes care of the filter requirements. An 0B2 voltage regulator supplies 108 volts to the oscillator, multivibrator, and screen grid of the 50B5. This voltage regulation helps to further stabilize the unit. It was included more for the multivibrator than for the crystal oscillator itself. This is because the multivibrator free-running frequency is dependent upon the applied plate voltage, among other things. Even

(*Continued on page* 136)



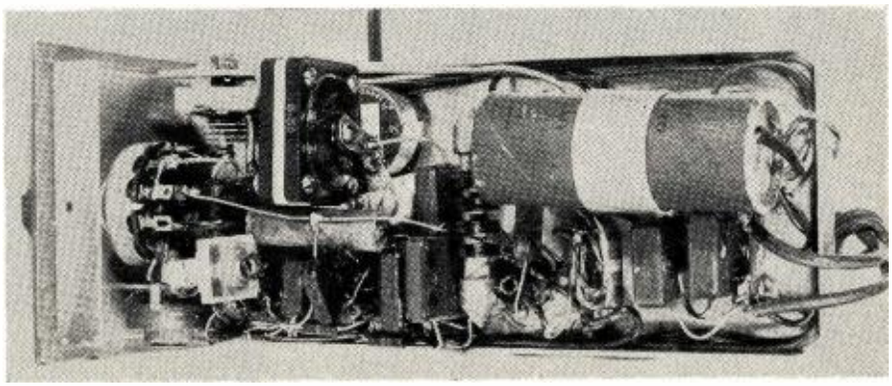
R_1—4 megohm, ½ w. res.
R_2—470,000 ohm, ½ w. res.
R_3—22 ohm, ½ w. res.
R_4—250 ohm, 10 w. wirewound res.
R_5—43,000 ohm, ½ w. res.
R_6—1000 ohm, ½ w. res.
R_7, R_8, R_{11}—20,000 ohm, ½ w. res.
R_9—30,000 ohm, ½ w. res.
R_{10}—20,000 ohm pot.
R_{12}—100,000 ohm, ½ w. res.
R_{13}—220 ohm, ½ w. res.
C_1—25 μμfd. miniature var. air cond.
C_2, C_5—.005 μfd. mica cond.
C_3, C_6, C_9, C_{11}, C_{12}—.001 μfd. mica cond.
C_4—.01 μfd. mica cond.
C_7—3-180 μμfd. mica trimmer cond.
C_8—80 μfd., 150 v. elec. cond.
C_{10}, C_{13}—10 μμfd. mica cond.
L_1—8 mhy. r.f. choke
L_2—Single-pi from a 2.5 mhy. r.f. choke
L_3—2.5 mhy. r f. choke
Xtal—100-1000 kc. crystal (Bliley SMC-100)
S_1—3-pole, 4-pos. rotary tap sw.
S_2—3-pole, 3-pos. rotary tap sw.
1—65 ma. selenium rectifier
V_1—12AU6 tube
V_2—12AU7 tube
V_3—50B5 tube
V_4—0B2 VR tube

Circuit diagram and parts list for the ham-shack frequency standard.



Top view. The tubes are, left to right, 12AU6, 12AU7, 50B5, 0B2. The shaft is R_{10}.

Under-chassis view, showing the dual-frequency crystal and compact parts layout.



A UNIVERSAL SPEAKER TESTER

By
SIDNEY LENSON
Engr. Dept., Atomic Instrument Co.
and
MARVIN TEPPER
Instr., Mass. Trades Shops School

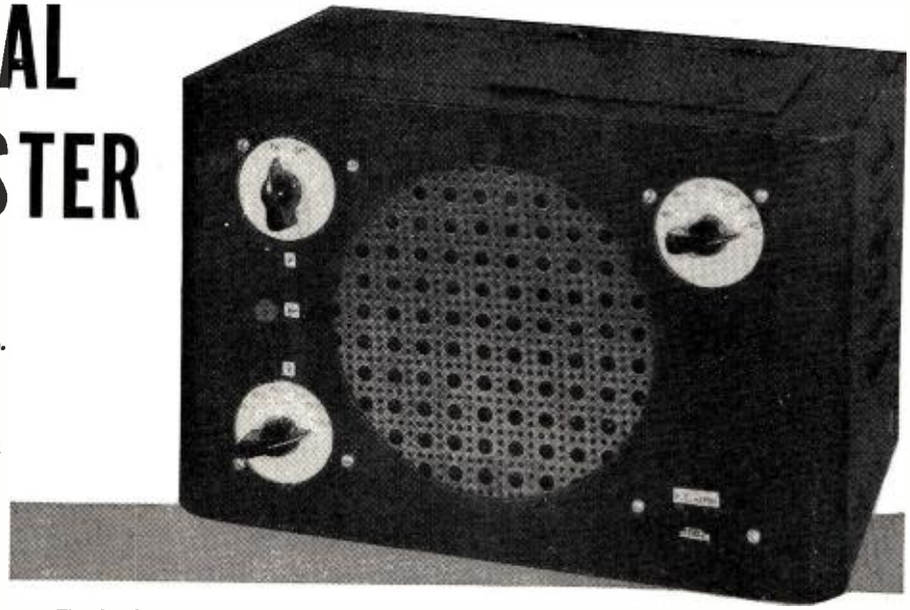


Fig. 1. Over-all view of the home-built test unit. Handlettered dials permit the easy selection of the correct output transformer taps, the function, and v.c. impedances.

Construction details on a handy service instrument which substitutes for chokes, field coils, transformers, etc.

THE unit to be described can be found in one form or another in many service shops but rarely will you find one as complete and useful as this one.

The unit is economical to build and many of the components can be found in the well-known "junk box". Any investment that has to be made will be repaid manifold in the time it saves in repairing radios, TV sets, and amplifiers.

For example, with this unit in the repair shop it is not necessary to remove the speaker when the set is being hauled in for servicing. This eliminates the possibility of puncturing the cone or otherwise damaging the speaker. The only occasion on which it would be necessary to bring the speaker into the shop would be if the technician felt that the trouble was with the circuit associated with the speaker or the speaker itself.

The outstanding features of this unit include its versatility, the ease with which it can be used, and the few test leads that are required. The unit can be used to replace chokes, field coils, output transformers, speakers, and resistors.

The test speaker may be switched directly to the output transformer in the unit thereby eliminating need for additional leads to an external test speaker.

The primary of the output transformer may be used single-ended or push-pull with either 7000 ohms or 10,000 ohms input impedance. The impedance used will match or closely match all popular output tubes to make it sufficiently universal so that no appreciable difference in quality or power will be noticed. For single-ended input, pin jacks J_1 and J_3 are used. Push-pull input is obtained by connecting J_2 for "B+" and jacks J_1 and J_3 to the tube plates. The input impedance is determined by checking with the tube manual.

The output of the transformer in the test unit is switched by means of S_2 to give either the best match or the desired match.

Setting switch S_2 to "Direct" connects the built-in test speaker directly to the output transformer. By turning the switch to "V.C.", the voice coil of the test speaker is switched to the output terminals, allowing use of the speaker for purely test or substitute purposes.

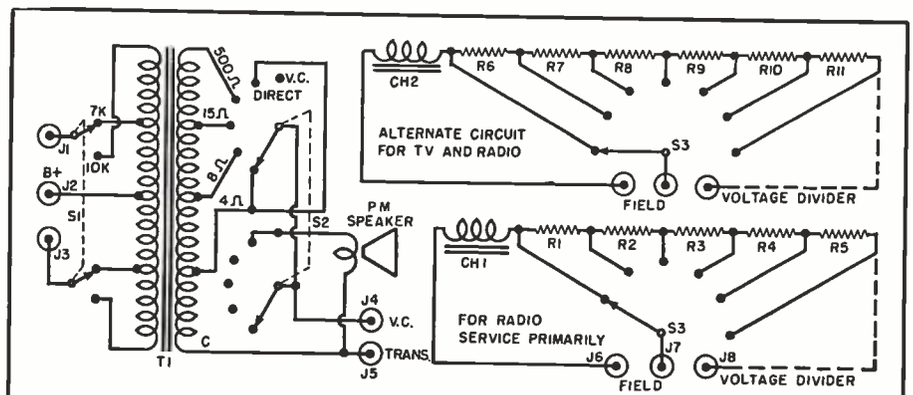
The speaker in the test unit is a 7" PM job with a large magnet so that it will reproduce with good quality when used with high power consoles, auto radios, and amplifiers. The value of the substitute field and choke may vary.

The unit described was constructed primarily for radio work but an alternate circuit for use in both radio and TV servicing has been incorporated for those seeking this type of test instrument.

The unit is designed so that at all times the choke is placed first in the filtering circuit to provide high a.c. reactance to the ripple frequency. Should the d.c. resistance of the field or choke in the set be larger than the choke in the unit, series resistors can be switched in by means of S_3 until the correct or nearest value is obtained. The value of the total resistance is not critical.

A substitute field and choke circuit (shown dotted on the schematic) is provided if required. By bringing the last resistor of the network out to a pin jack on the front panel, the resistive network, including the choke, can be used as a voltage divider network. With this application in mind, 20 watt resistors were used to prevent overheating. (*Continued on page* 78)

Fig. 2. Complete schematic diagram of unit. Notice that alternate circuits are provided depending on whether service work is primarily radio or radio and TV combined.

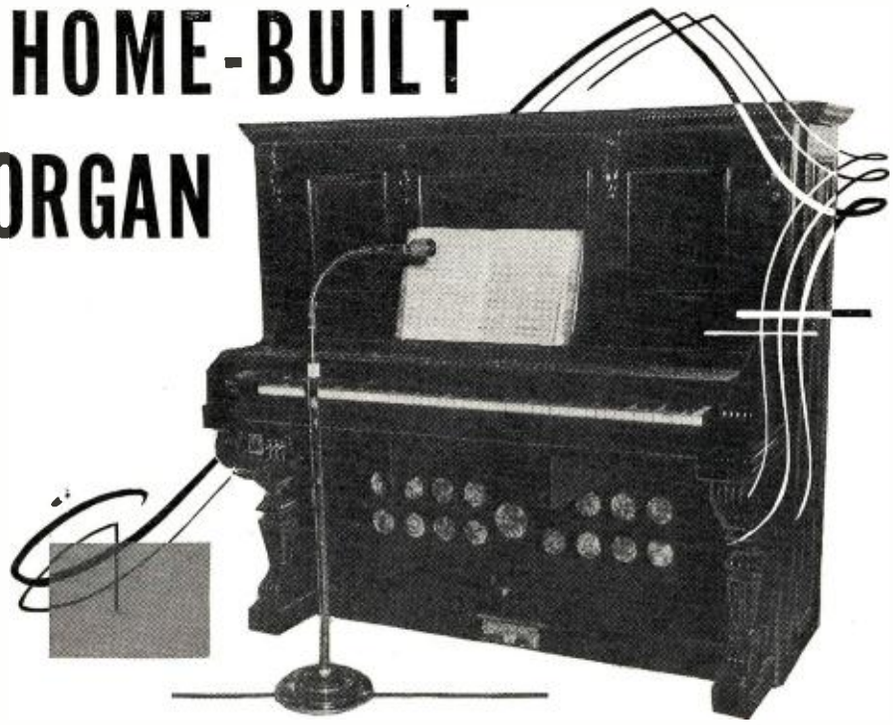


R_1, R_7—200 ohm, 20 w. res.
R_2, R_8—400 ohm, 20 w. res.
R_3, R_4, R_5, R_9, R_{10}, R_{11}—500 ohm, 20 w. res.
R_6—350 ohm, 20 w. res.
CH_1—Smoothing choke, 15 hy. @ 75 ma., 400 ohms d.c. (Stancor C-1002 or equiv.)
CH_2—Smoothing choke, 2.3 hy. @ 150 ma., 60 ohms d.c. (Stancor C-2304 or equiv.)
T_1—Output trans. 10,000/7000 ohms to 500, 15, 8, and 4 ohms (Stancor A-3304 or equiv.)
S_1—D.p.d.t. rotary switch (Mallory #3222J)
S_2—D.p.6-pos. rotary switch (Mallory #3226J)
S_3—S.p.11-pos. adj. rotary switch (Mallory #1311L)
J_1, J_2, J_3, J_4, J_5, J_6, J_7, J_8—Pin jack
Speaker—7" PM loudspeaker

FUN WITH A HOME-BUILT ELECTRONIC ORGAN

By

JIM KIRK, W6DEG, W6JKX



The complete unit ready for action. The piano bench, which was removed so that the speakers could be seen, normally slides under control panel and the volume paddles.

Details on a novel instrument which can provide some interesting tonal effects for a modest cash outlay.

HERE is a new musical novelty which can provide endless hours of enjoyment and entertainment. It consists basically of an "organ" section of 64 notes for playing regular organ chords, and a "melody" or "solo" section of 23 notes, played one note at a time. The "melody" section has a *vibrato* control and a 5-position switch for obtaining various tonal effects.

You can have lots of fun with this rig once it is built and adjusted. You can even have fun building and adjusting it—but that is another story. You don't have to be a musician to enjoy playing this organ—you don't even have to know how to read music. The melody attachment is a cinch for anyone to play with one finger and by ear. It sounds good alone, with the *vibrato* turned on. Of course, to make it sound really good, you need to add chords for harmony but they can be easily learned. There are many schools that will teach you, by mail, to play the piano the modern way. They will generally teach you how to read the melody line, play octaves with the right hand, and add chords with your left. This wasn't the way I learned but several radio customers have shown me various mail order courses that they have used.

With this outfit you play one note at a time with the left hand and add chords with your right, that is, if you want to use the melody attachment. You can leave it turned off or omit it entirely and play the outfit in the orthodox way—if you are a musician.

In the author's opinion you will want to use the melody section, accompanying it by chords on the other section. The *vibrato* dresses it up and the tone colors add variety. The big improvements over my former instrument ("An Electronic Musical Novelty," August, 1950 issue of RADIO & TELEVISION NEWS) are the *vibrato* and tone color on the solo section and improved tone on every note, and the addition of a volume control on both sections. The improved tone is especially noticeable on the low notes. They formerly sounded hard and raspy but are now deep and sonorous.

When I entertain friends with this outfit, I often play one piece three ways. I generally use the telephone because I can play to many who can not visit me in person. I tell them, over the mike, that I am going to play the piece three ways—and for them to take their pick. First I play it as an organ solo. I use tone color number three and lots of volume on the melody attachment to make it stand out. The organ chords are in the background. Then comes a "saxophone solo accompanied by organ." I use tone color number four and not so much volume because it is not required, but enough to make it stand out over the organ chords. Then I use low volume on both melody and organ and sing into the mike. The *vibrato* is used all the time because there is no point in not using it. The *vibrato* switch is turned to "off" when originally tuning to "center frequency."

The reason for choosing 23 notes to the left of the keyboard is that it just works out right. Those are the notes you will need to provide the melody for all popular songs, including the composition that uses such extremes of low and high notes, "My Heart Cries for You."

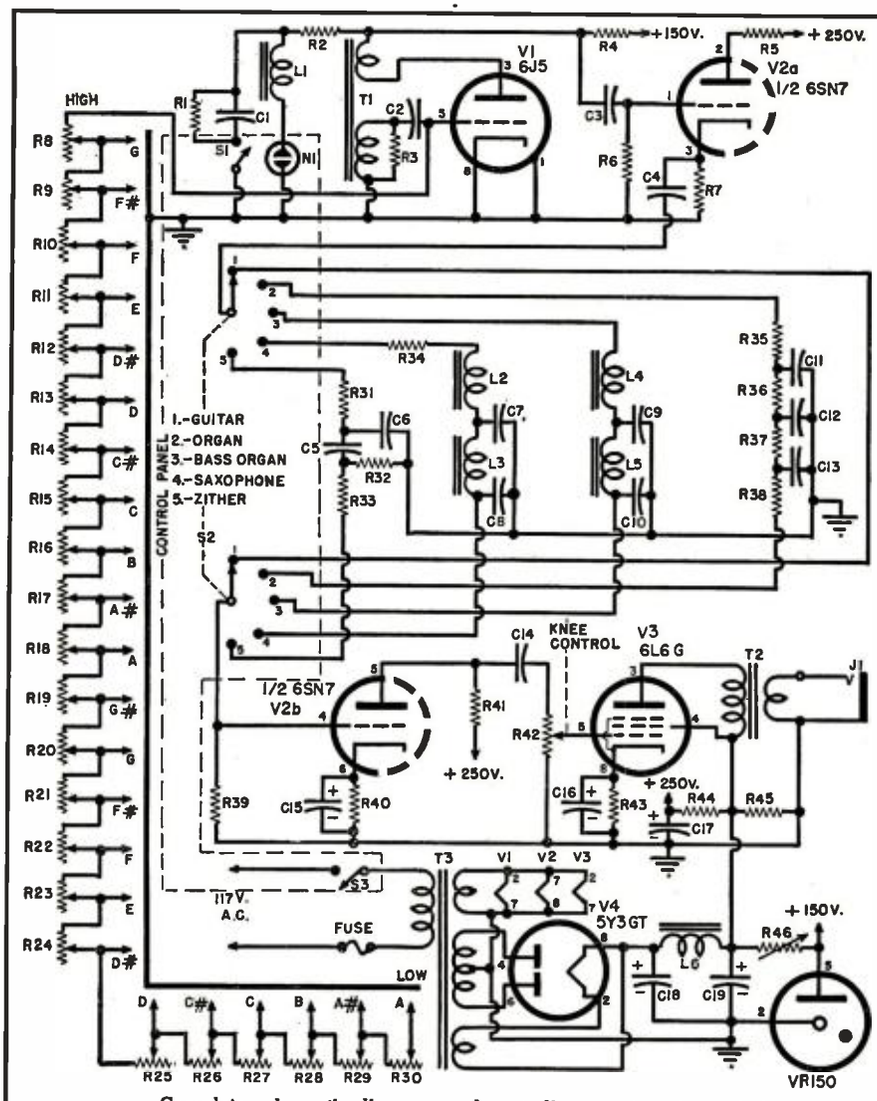
This contraption is comparatively inexpensive. All parts used in my old instrument have been incorporated in the new unit. The majority of the additional parts required come from war surplus, although standard parts may be substituted if you don't have access to surplus components.

There is nothing very tricky about building this unit. You need only one contact for each key and no special additional keyboard for the melody attachment. You do not need to be a cabinet maker to supply a cabinet. Caution! Do not immediately take a crowbar and sledge hammer to your piano! Better do as I did—build the organ up experimentally first. When you get to the point where you think it sounds better than your piano—then go ahead and tear the insides out of the piano. The heaviest part of the piano is the "harp" and you will find that the piano moves around much easier when that is removed. It would, of course, be cheaper and better in the long run if you could find some junk piano which could be used for this construction. How the piano sounds is not a factor at all—just so that the cabinet and keys are in good condition.

The panels are of Masonite and are standard size—three 8¾" x 19" and three 12¼" x 19". In my experimental organ I used aluminum for the panels because aluminum is easy to work and provides a ground return. I could not buy aluminum panels this time so I used aluminum chassis—but they, too, are gone. A "Mini-rack" style rack holds the panels. Aluminum angle was not available for this rack. Brass was available but it was expensive so I settled for steel angle ¾" x ¾" x ⅛", although steel is hard to saw, drill, and tap.

All panel markings are blueprints and the numbers on each panel refer to drawing numbers. I always have blueprints for everything I build as they are handy for servicing or making future changes.

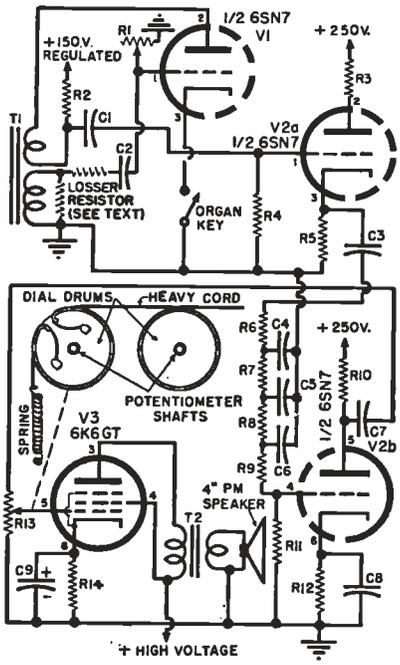
The volume controls are mounted as close as possible to the tubes they con-



Complete schematic diagram and parts list covering the melody attachment. Although the author used surplus components in his construction, standard parts obtainable from regular radio parts outlets may be used.

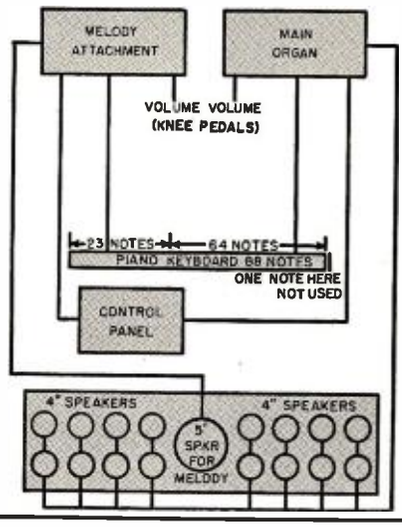
R_1—15 megohm, ½ w. res.
R_2—1 megohm, ½ w. res.
R_3, R_4—100,000 ohm, ½ w. res. (in BC 456)
R_5, R_{34}, R_{35}, R_{41}—30,000 ohm, 1 w. res. (in BC 456)
R_6—510,000 ohm, ½ w. res. (in BC 456)
R_7, R_{40}—1300 ohm, 1 w. res. (in BC 456)
R_8, R_9, R_{10}, R_{11}, R_{12}, R_{13}, R_{14}, R_{15}, R_{16}, R_{17}, R_{18}, R_{19}, R_{20}, R_{21}, R_{22}, R_{23}, R_{24}, R_{25}, R_{26}, R_{27}, R_{28}, R_{29}, R_{30}—50,000 ohm pot.
R_{31}, R_{36}, R_{37}, R_{38}—51,000 ohm, ½ w. res. (in BC 456)
R_{32}, R_{33}, R_{39}—22,000 ohm, ½ w. res. (in BC 456)
R_{42}—500,000 ohm
R_{43}—600 ohm, 5 w. wirewound res.
R_{44}—5000 ohm, 10 w. wirewound res.
R_{45}—20,000 ohm, 10 w. wirewound res. (in BC 456)
R_{46}—5000 ohm, 10 w. wirewound var. res.
C_1—.25 μfd., 400 v. cond.
C_2—.01 μfd., 600 v. cond.
C_3—.1 μfd., 600 v. cond.
C_4, C_{14}—.5 μfd., 400 v. cond. (#5418 in BC 456)
C_5, C_6, C_7, C_8, C_9, C_{10}, C_{11}, C_{12}, C_{13}—.006 μfd. mica cond. (in BC 456)
C_{15}, C_{16}—25 μfd., 25 v. elec. cond (#5417 in BC 456)
C_{17}, C_{18}, C_{19}—8 μfd., 450 v. elec. cond.
L_1, L_4, L_5—#6306 from BC 456 or Stancor A-53-C (use secondary winding)
L_2, L_3—#6261 from BC 456 or by experiment (see text)
L_6—Filter choke, 2.3 hy. @ 150 ma. (Stancor C-2304 or equiv.)
T_1—#6306 from BC 456 or Stancor A-53-C
T_2—Speaker output trans. 5000 ohms to v.c., Stancor A 3310 or equiv.)
T_3—Power trans. 372-0-372 v. @ 145 ma., 6.3 v. @ 5 amps., 5 v. @ 3 amps. (Halldorson S-74 or equiv.)
N_1—NE-51 neon bulb
S_1—S.p.s.t. switch (Vibrato "on-off")
S_2—D.p.5-pos. switch ("Tone color" sw.)
S_3—S.p.s.t. switch (Melody "on-off")
J_1—Phone jack (to speaker)
V_1—6J5 tube
V_2—6SN7 tube
V_3—6L6G tube
V_4—5Y3GT tube
1—VR150 tube

Simplified schematic of main organ. Sixteen audio channels and sixteen volume controls are used to reproduce sixty-four different keys, 4 keys to a channel.



R_1, R_{13}—500,000 ohm pot.
R_2—100,000 ohm, ½ w. res. (in BC 456)
R_3, R_7, R_8, R_9, R_{10}—551,000 ohm, ½ w. res. (in BC 456)
R_4—510,000 ohm, ½ w. res. (in BC 456)
R_5, R_{12}—1300 ohm, 1 w. res. (in BC 456)
R_6—30,000 ohm, 1 w. res. (in BC 456)
R_{11}—22,000 ohm, ½ w. res. (in BC 456)
R_{14}—600 ohm, 5 w. res.
C_1—.1 μfd., 600 v. cond.
C_2, C_4—.01 μfd., 600 v. cond.
C_3, C_7—.5 μfd., 400 v. cond. (#5418 in BC 456)
C_5, C_6—.006 μfd. mica cond. (in BC 456)
C_8, C_9—25 μfd., 25 v. elec. cond. (#5417 in BC 456)
T_1—#6306 in BC 456 or Stancor A-53-C
T_2—Speaker output trans., 7000 ohms to v.c. (Stancor A-3878 or equiv.)
Spkr.—4" PM speaker
V_1, V_2—6SN7 tube
V_3—6K6GT tube

Block diagram of the "new" electronic organ. The melody attachment plays one note at a time. Has switched vibrato and switched effects. It also has its own speaker and power pack. The main organ has 16 speakers and uses 4 notes to an audio channel. Each audio channel has amplifiers and filters to improve tone. Volume controls on each audio channel are ganged and controlled by the knee.



trol in order to avoid hum. The chassis on the larger panels are mounted near the center of the panel. The volume controls are mounted in the center of the front edge of the chassis. Instead of using knobs on the volume controls, little inexpensive (two cents apiece) dial drums are fastened to the shafts. They are crimped to match the half-round shafts and are cemented in place. If the potentiometers have brass shafts, the dial drums can be soldered. On the extreme left-hand potentiometer a spring holds the dial in minimum volume position and all the dial drums are ganged by a heavy dial cord running over pulleys to the knee (organ swell) hinged paddle. It works surprisingly well. It is neither necessary nor desirable to have zero volume. You need only the range from soft to very loud. This makes the scheme simpler because the dial cord does not need to travel far.

The switch controlling tone color had to be mounted near the circuits it controls so a sprocket and chain connects the switch shaft to the shaft mounted under the keyboard.

It is a good idea to experiment with the "losser" resistor. The value of the resistor and whether it is placed in series or parallel depend on the transformer used and the pitch desired. The "losser" resistor not only improves the tone but makes the oscillator more stable so that the organ does not need to be retuned. The greater the value of resistance you use in series, the higher the note becomes and the greater the drop in output. You do not need to worry about the output because you have the amplifiers—but the limits are where the tone is too high for the potentiometer or the oscillator stops oscillating.

A wide field for experiment is in the tone color field. You can try all kinds of filters and name the result. I do not guarantee that tone #4 will sound like a saxophone—I only repeat what one listener named it, and I agreed.

	Note	Freq.		Note	Freq.		Note	Freq.
Low	G♯	51		F	175		D♯	622
	A	55		F♯	185		E	659
	A♯	58		G	196		F	698
	B	61		G♯	208		F♯	740
	C	65		A	220		G	784
	C♯	69		A♯	233		G♯	830
	D	73		B	247		A	880
	D♯	77	Middle	C	262		A♯	932
	E	82		C♯	277		B	987
	F	87		D	294		C	1047
	F♯	92		D♯	311		C♯	1109
	G	98		E	330		D	1175
	G♯	103		F	349		D♯	1245
	A	110		F♯	370		E	1319
	A♯	117		G	392		F	1397
	B	123		G♯	415		F♯	1480
	C	131		A	440		G	1569
	C♯	139		A♯	466		G♯	1661
	D	147		B	493		A	1760
	D♯	156		C	523		A♯	1865
	E	165		C♯	554		B	1976
				D	587			

Notes included in the main organ along with the frequency for each note.

I favor the chart method of tuning (described in the previously-mentioned article appearing in the August 1950 issue). This is one of those instances where something that theoretically just won't work—does! I can prove it. I can turn the potentiometers every which way and set that 440 cycle "A" by WWV and a calibrated oscillator and oscilloscope. Then I can tune an octave by the chart method and find that the next highest "A" is 880 cycles —as it should be!

My mike is attached to a separate audio amplifier and the speaker is placed near the telephone. An oscilloscope is hooked to the amplifier. It is handy for adjusting the volume controls and for tuning and shows up interesting variations with the tone colors—but it is an unnecessary refinement.

The melody attachment is tuned an octave below the original musical score. This was originally done to get the instrument within my "vocal range" thus eliminating *falsetto* singing. I believe the lower solo sounds better than the treble and I would suggest leaving it tuned to that range.

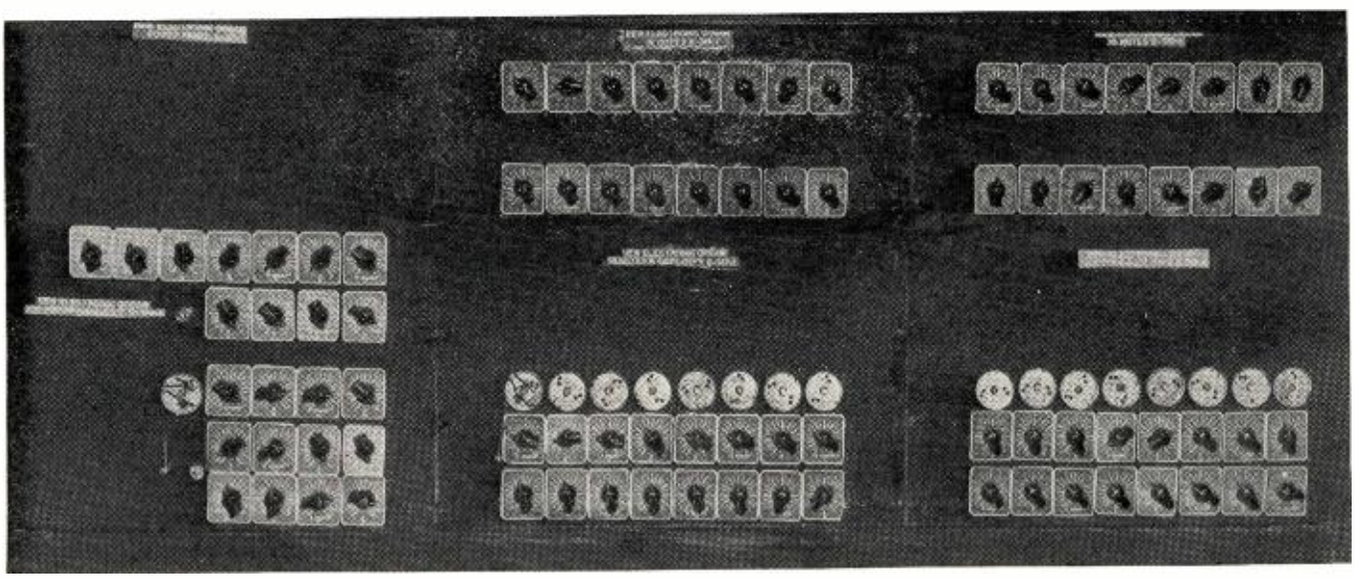
There is one disadvantage to the method of keying used in the melody attachment. Due to the open grid which exists when no key is depressed, a "plop" is heard about once every seven seconds. The frequency of this click depends on the capacity in the keying wires as well as other factors. This is one reason why I located the melody attachment close to its keys. Since the volume control is pulled to minimum by the spring when no key is depressed, this click is barely audible. When you press the paddle for

(*Continued on page* 101)

	Note	Freq.
High	G	392
	F♯	370
	F	349
	E	330
	D♯	311
	D	294
	C♯	277
Middle	C	262
	B	247
	A♯	233
	A	220
	G♯	208
	G	196
	F♯	185
	F	175
	E	165
	D♯	156
	D	147
	C♯	139
	C	131
	B	123
	A♯	117
	A	110

Notes and frequencies in melody attachment.

Piano with the front cover removed to show the "works." Panels left to right are the upper-power panel: 16 notes with potentiometers for the lower melody attachment. The neon pilot light is on the front panel but is not visible when the cover is on. The neon glows steadily with the vibrato off and flashes when the vibrato switch is closed: 16 notes and the ganged volume controls.



INSTALLING MOBILE EQUIPMENT

The author's automobile showing use of a "tie-down" hook to make entry into garages and other low-clearance spots easier.

By D. K. JOHNSON, W5RPO

There is money in two-way radio work providing you have the proper tools and the requisite "know-how".

BEFORE World War II when mention was made of mobile "two-way" radio, immediate thought was given to police and fire department radio systems. Such organizations were originally the only ones qualified to obtain licenses and who were interested in using mobile communications. Since that time, the use of radio to communicate with mobile equipment has mushroomed into a major phase of the radio industry. Taxicabs, buses, service and emergency vehicles have all formed extensive communication networks, utilizing considerable radio equipment and representing a respectable buying power in the radio and electronic field.

If one compares the equipment used by police departments operating on 1640 kilocycles and similar frequencies, with the equipment now used in the 30-50 megacycle and the 150-160 megacycle band, the vast changes make the short span of time in which these changes took place, seem much longer. The era of "screwdrivers and chewing gum" has passed. To service this new equipment requires a thorough knowledge of its principles of operation, plus a rather extensive array of test equipment. In many cases the amount of test equipment may be limited, but a greater length of time is required for each repair job.

In the course of maintaining approximately two hundred mobile radio units, in the 30-50, 150-160, and 450 megacycle bands, many simplified, rapid means of installing and servicing such units have been discovered. Many of these "kinks" are simple, but have saved many hours of valuable time.

Occasionally, the average small radio shop will be asked to install a mobile radio unit in a truck, car, or other type of vehicle. Often the shop owner will hesitate due to inexperience, insufficient knowledge of the equipment, and possibly because of the lack of the proper license. Installation of such equipment does not require the possession of any license, but be certain that any and all tests are made by or under the supervision of the holder of a Second or First Class Radio Telephone License. Any adjustments to the equipment that might affect the radiation of the transmitter in any way, must be made by a licensed technician.

The installation of mobile equipment need not be a "big" job, requiring the major portion of a day. Actually it can be done on the average automobile in a little less than an hour. This installation time is the result of considerable practice and a complete knowledge of the equipment. The correct tools also play a large part in quickly and properly installing mobile radio equipment.

First, examine the car, truck, or vehicle in which the equipment is to be installed. Locate the proper position for the control head in such a way as to be convenient for the operator and yet not interfere with the operation of the vehicle. Generally, right handed operation is to be preferred with the control head mounted in the center, underneath the flange of the dash on the vehicle. The hanger for the microphone should be readily accessible and hold the microphone firmly. In order that no unnecessary holes mar the appearance of the dashboard, mount the microphone hanger on one of the knock-out panels normally used for the broadcast radio, clock, or other accessories, if such a place is available. Such a procedure allows the replacement of the panel, which can be done for a few pennies, when the equipment is to be removed.

In most installations it is necessary to pass wires through the fire wall of the vehicle. The "speed-drill" that has proved very effective for this purpose is a large tapered punch. A punch about fourteen inches long with eight inches of taper from three-quarters of an inch to a point, is very suitable. The advantages of punching the holes are many. It is possible to punch a hole in places where a drill cannot reach. The hole made by the punch will have a "rolled" edge and will not cut the insulation of the wire. The rapidity with which a hole can be made by a punch is amazing when compared to the time required for drilling and reaming a hole.

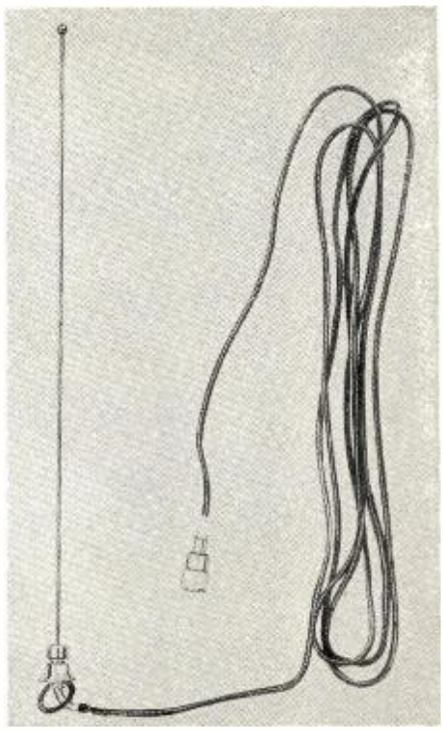
Many pro and con arguments may be advanced for running control cables inside or outside the vehicle. In most automobiles, for long trouble-free cable life, the inside installation gains favor. A small hole in the fiber partition between the rear seat and the trunk allows the cables to pass from the trunk, under the rear seat and floor mat, along the drive shaft housing on the right-hand side to the control head on the dash. By keeping the cables close to the drive shaft housing, the cables are not walked on and do not cause ridges or wrinkles in the floor mat. The placement on the right-hand side of the drive shaft housing prevents interference with the accelerator pedal when passing under the front floor mat. Some type of protective covering is required where the cables pass under the rear seat to

prevent sharp edges from cutting the cables. Such a method of installing control cables provides rapid, safe, weatherproof cable installation. This method eliminates crawling under a vehicle to secure cables as is necessary in outside installations. Control cables placed outside also require some type of weatherproof sheath in order to give reasonable cable life. On certain truck or bus installations it is necessary to place cables out in the weather. In such cases, protective covering should be used.

The placement of the transmitter-receiver unit is often a bone of contention. Most automobiles have a "hump" in the forepart of the trunk to allow for vertical clearance of the differential. This ridge, when large enough, is a good location for the unit. It places the unit where it will not interfere with the normal luggage space of the trunk. The unit may be mounted with self-tapping *Parker-Kalon* screws. If it is necessary to place the unit on the floor of the trunk, due to physical size or for convenience in service, check for clearance between the floor of the trunk and the gasoline tank which is usually directly beneath. Use screws which will not puncture the tank. Place the unit is such a position that when luggage is placed in the trunk, it will not strike the cables or connectors. This often prevents future trouble from this source. In some cases it is beneficial to mount the unit on a piece of plyboard and fasten the board to the floor of the trunk. This is a means of reaching areas of the trunk floor that are not directly above the gasoline tank. Some users believe that the board also gives a certain resiliency which provides protection for the equipment against mechanical shock.

With reference to shock mounting the equipment, the best solution is, *don't*. Some types of equipment available are provided with shock mounting. Even these have disadvantages. Many technicians attempt to mount the units on sponge rubber or spring material in order to ease the bumps for the equipment. A shock-mounted installation must be very carefully engineered for the individual vehicle in order for it to be helpful rather than detrimental. Most radio technicians are not equipped to make such an installation. Unless you are fully familar with the engineering principles involved in a proper shock mounting, fasten the equipment solidly to the vehicle and allow the rubber tires to do the job. Most available mobile equipment is constructed to operate under extremely rugged and adverse conditions and unless the manufacturer definitely recommends a particular type of mounting, fasten the transmitter unit firmly to the floor of the vehicle.

When the unit, cables, and control head have been mounted to the satisfaction of both the user and the installer, only one item remains before turning the switch—installing the antenna. The procedure for mounting the antenna will be determined somewhat by the operating frequency of the equipment and the type of antenna to be employed. Equipment operating in the 30-50 megacycle range will undoubtedly use the conventional one-quarter wavelength whip with some type of spring mount or base. The base for the antenna may be mounted on any type of surface as long as it is reasonably flat for at least the area of the base itself. This area is generally a circle approximately four inches in diameter. Choose a location for the antenna which will keep it as clear of the body of the car as possible and also provide a certain amount of height. Normally this location will be above rear fender or on the flat surface found above the luggage compartment door on most types of automobiles. Be certain that clearance is present inside the trunk and that there are no seams or flanges on the underside of the location chosen. There are several means of cutting the necessary hole for the antenna base. One of the various types of hole cutters will do nicely. The method of drilling a circle of small holes and removing the center may also be used. The edges of the hole are concealed so that an extremely smooth edge is not necessary. Clean paint and undercoating material from the underside of the surface surrounding the hole. In mounting the spring base, be sure that good ground connections are made by the grounding screws. Improper grounds at this point very seriously affect the performance of the radio installation. After the spring base has been bolted into position, loosen the orienting screws and place the spring as near to vertical as possible. Attach the whip antenna and after checking vertical positioning, lock the spring into position. The addition of a "tie-down" hook, while not provided by the manufacturer, is greatly appreciated by the user. A small piece of steel wire should be bent into the figure "S." This should be placed in such a position that it can be reached through the window of the vehicle for releasing the antenna. Mount the hook with a very short self-tapping screw on the drip moulding above the window. A piece of plastic or rubber sleeving placed over the wire will prevent rattle.



Mobile antenna for 152-162 mc. band. Antenna is mounted through metal roof of car. Car top serves as a ground plane.

Equipment operating in the 150-160 megacycle band requires a different type of antenna and accordingly presents different problems in installation. There are two popular types of antennas in use: the quarter-wave coaxial type which utilizes a quarter wavelength coaxial skirt to provide vertical directivity, and the more popular roof-top or "hat-pin" antenna. The coaxial type of antenna is generally mounted in much the same man-

(*Continued on page* 110)

Over-all view of completed installation showing placement of antenna and units.

THE SPOOK

ANOTHER WEIRD EFFECT TO HAUNT TV

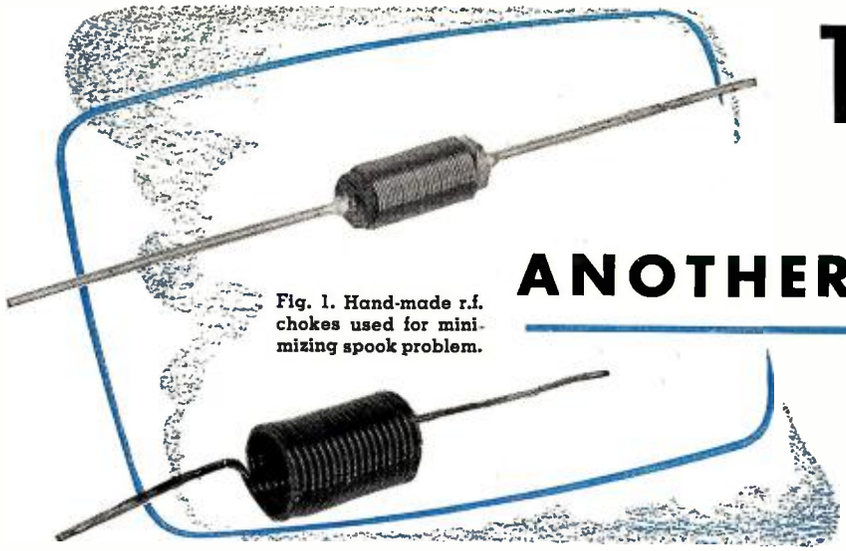


Fig. 1. Hand-made r.f. chokes used for minimizing spook problem.

By

M. B. KNIGHT

Tube Department, Radio Corporation of America

A simple solution to the problem of electromagnetic radiation from horizontal deflection circuits of set.

A NUMBER of interesting phenomena, sometimes not anticipated in fundamental studies, have cropped up in the electronic art. These phenomena often are identified by colorful names which are intriguing in themselves. The "spook," an interference effect in television receivers, may be destined to take its place in the language of the trade with such terms as "ghost," "barks," "motorboat," "birdies," "snow," and "jitter."

Description of Spook

The spook originates as electromagnetic radiation from the horizontal deflection circuits of television receivers and is picked up by the sensitive r.f. or i.f. circuits of the receivers. Like any other signal in the r.f. or i.f. circuits, the spook signal is amplified, detected, and applied to the grid or cathode circuit of the kinescope. When seen in the picture, it appears as a narrow vertical band very close to the left-hand edge of the raster and resembles the more familiar interference from Barkhausen oscillations in the horizontal-output tube. If the television signal is weak compared to the spook signal, the line is black and has ragged edges as shown in Fig. 2. If the television signal is of normal strength, the line is not black but has within its margins crawling diagonal lines which are caused by heterodyning between the television signal and the spook signal. The appearance of the spook when the television signal is of normal strength is shown in Fig. 3. Despite the similarity to Barkhausen oscillation, several distinguishing features establish the spook as a separate effect: (1) The line is always in the same place in the raster, very near the left-hand edge. (2) The interference, if picked up in the r.f. circuits, is always strongest on the lower-frequency channels, whereas Barkhausen may be more pronounced on either the low or high-frequency channels. (3) Experiments show that the radiation does not come from the horizontal-output tube, nor do the usual cures for Barkhausen oscillation, such as magnets, have any effect on it.

Actually, the spook seldom has a serious degrading effect upon receiver performance. Because of its location on the raster, it is usually within the blanking period and it is almost always off the kinescope screen because receivers are normally adjusted to have a good margin of deflection width. The more common degrading influence of the spook is that it upsets the receiver synchronizing circuits. Because of the action of the detector circuit, the spook shows up in the video circuits as a pulse in the "black" direction, similar to the sync pulses. If it is of sufficient amplitude, the spook pulse will pass through the sync amplifier along with the regular sync pulses and may impair the operation of the horizontal a.f.c. circuits.

Occasionally, two receivers are close enough together so that one picks up the spook interference from the other. The resulting picture disturbance is quite objectionable; if the receivers are tuned to different stations (the line-scanning frequencies of which may differ slightly), the spook line may move back and forth across the picture.

Discovery of Spook

To the best of our knowledge, the spook phenomenon passed unnoticed, or at least uncommented upon, for three or four years of commercial receiver production. There are several reasons for this delay. First, because of the usual practice of scanning beyond the kinescope mask, the spook line is rarely seen. Second, because the intensity of the spook radiation is a function of the deflection power, it has become more evident as larger kinescopes, having larger deflection angles and accelerating voltages, have come into popular use. Third, the older deflection circuits were susceptible to Barkhausen oscillations, and the spook, even if observed, could easily be dismissed as Barkhausen.

The advent of modern high-efficiency deflection circuits, however, called attention to the spook as a unique effect. The writer's first encounter with the spook occurred about two years ago during the development of the *RCA*-223T1 horizontal-deflection transformer. The narrow vertical band appeared to be due to Barkhausen oscillation; further investigation, however, showed that cause to be unlikely because careful measurements established that the plate voltage of the horizontal-output tube was not negative at any time during the scanning cycle. Other engineers observed the effect at about the same time and established that it was not Barkhausen. No parasitic oscillation could be found and the mysterious nature of the effect caused it to be dubbed the "spook." The name seemed apt and has persisted. The effect was distressing to receiver designers, mainly because of its elusive nature, and efforts were made by the writer to locate the cause. After some investigation, a reasonable explanation was found, and methods of minimizing the interference were easily devised.

How Spook Is Generated

In the investigation of the nature and cause of the spook, a separate

television receiver was used to search for the most prominent source of radiation. Although some radiation could be detected from most parts of the deflection circuit, the damper tube and its leads produced the strongest radiation.

Scrutiny of the current waveforms in the horizontal deflection circuit showed that the spook line appears at the same instant that the damper tube begins conduction, approximately one microsecond after the completion of retrace. The damper tube plate current rises from zero to its maximum value of 350 to 400 milliamperes very rapidly. The rise time of the current was not measured precisely, but available equipment indicated that it was 0.1 microsecond or less. At any rate, it was apparent that the electromagnetic fields associated with such a rapid change of current and voltage must contain many high-frequency harmonics. It could be expected, therefore, that the high-frequency harmonics could be radiated to the signal circuits of the receiver.

This theory was checked by exploring the radiation spectrum with a communications receiver. The receiver was tuned from about 300 kilocycles to 18 megacycles and a signal was detected at every harmonic of 15,750 cycles. A more significant observation was that no other signal was detected. The intensity of the harmonics diminished steadily as the receiver was tuned to higher frequencies. In addition, spook interference was found to be most severe on television Channel 2 and was successively less severe on higher-frequency channels. If the harmonics were being radiated as a result of the rapid plate-current change in the damper tube, it would be assumed that high-frequency harmonics would be of less amplitude than low-frequency harmonics.

Small r.f. chokes were placed in the leads to the damper tube at the socket and the radiation was reduced considerably. The residual radiation came almost entirely from the internal structure of the tube itself. Further tests confirmed that the interference originated with the rapid change in the damper-tube plate current.

Minimizing Spook Interference

The rapid rise of plate current in the damper tube is inherent in the proper operation of deflection circuits. Practical means for slowing down the increase in current are not at hand, and it is not expected, therefore, that the spook can be eliminated entirely. It is possible, however, to reduce considerably the detrimental effects.

One approach to the problem of reducing spook interference is to minimize the susceptibility of the r.f. and i.f. circuits to the radiation by physically separating the r.f. and i.f. circuits from the deflection circuits. This separation is chiefly a chassis design problem; good chassis layout in this respect is normal in commercial receivers. The technician is more concerned with the installation of the receiver; he should be sure that the antenna lead-in is dressed away from the deflection circuits. Not much can be done along this line if an in-cabinet antenna is used.

A second approach to this problem is to minimize the radiation from the deflection circuits. Because the damper tube and its leads can be thought of as a transmitting antenna which radiates the spook, a logical approach is to make the transmitting antenna as small as possible and to provide a shield between this "antenna" and the receiver r.f. and i.f. circuits. It was mentioned before that insertion of r.f. chokes in the leads to the damper tube limited the "antenna" to the tube structure itself. The value of the chokes is not critical, but must be large enough to be effective in the television band without being so large that ringing is caused in the deflection circuit. Chokes having inductance values between 1 microhenry and 5 microhenrys are suitable and are available commercially. Chokes for the plate and cathode circuits can be made by winding approximately 30 turns of AWG #28 enamel or *Formex* wire on a one-watt resistor. Ordinarily, it is not important to insert chokes in the heater circuit. If heater chokes are used, however, wire at least as large as AWG #20 should be used to carry the heater current. The stiffness of this size wire makes a coil form unnecessary; a coil of approximately 20 turns about ⅜ inch in diameter is adequate. Fig. 1 illustrates typical hand-made chokes.

After chokes have been placed in the damper tube leads, it is desirable to shield the tube from the receiver r.f. and i.f. circuits. The high-voltage enclosures used in most receivers provide adequate shielding. The shield should be inspected to see that it is grounded at as many points as possible. If there are any large holes in the enclosure, they may be covered with ordinary copper wire screen to improve the effectiveness of the shield. Capacitive coupling between the damper tube and any leads which come out of the high-voltage enclosure should be minimized by careful lead dress. A close-fitting shield around the tube, however, is neither necessary nor desirable because of the resultant increase in bulb temperature.

In the commercially popular autotransformer and direct-drive types of deflection circuits, experience has indicated that spook interference can be greatly reduced by the addition of only one r.f. choke. In such circuits, most of the radiation usually comes from the "B+" lead which is connected to the plate of the damper tube. (The cathode lead is quite well shielded by the high-voltage enclosure.) The r.f. choke, therefore, should be placed in the plate lead of the damper tube at the socket. The addition of a condenser of approximately 100 $\mu\mu$fd. between the chassis and the "B+" side of the choke may give further improvement.

The techniques suggested for reducing spook interference are not all-inclusive. Each type of deflection circuit and each mechanical layout requires individual attention. It is expected, however, that an understanding of the source of the interference will be of help to the troubleshooter when spook problems appear. -30-

Fig. 2. Appearance of "spook" interference with weak signal.

Fig. 3. "Spook" interference with signal of normal strength.

AN R. F. HIGH-VOLTAGE SUPPLY FOR YOUR CRO

By
LOUIS E. GARNER

Borrow a trick from TV set manufacturers and improve performance of your scope.

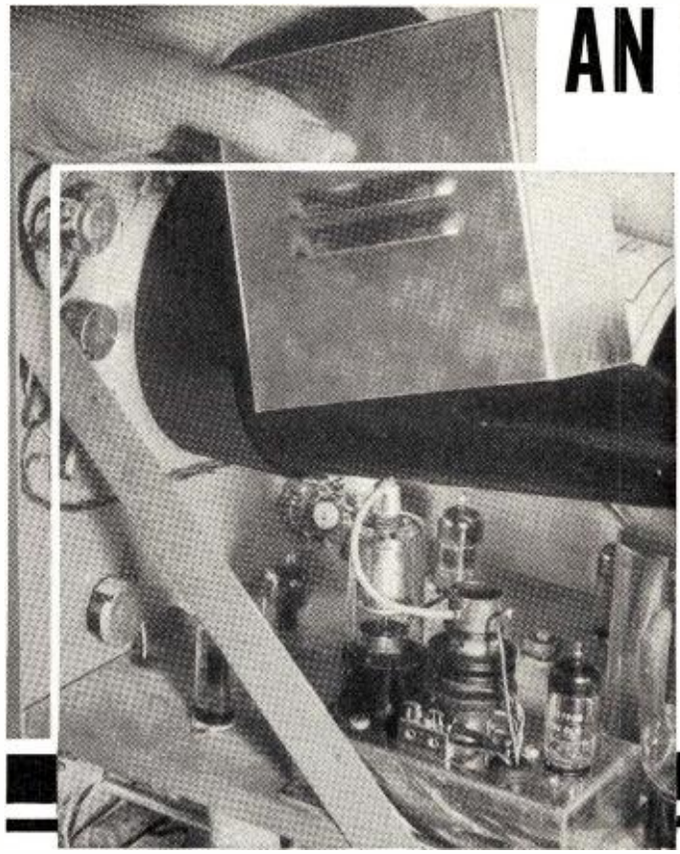


Fig. 1. Commercial scope in which the 60-cycle supply has been replaced by the high-voltage supply described in this article.

WHEN r.f.-type high-voltage power supplies first became popular, television receiver manufacturers immediately recognized their advantages and most of the electrostatic TV receivers manufactured employed such supplies. Even a few electromagnetic sets were made in which r.f.-type high voltage supplies were used (instead of the currently popular kickback type of high-voltage supply). Cathode-ray oscilloscope manufacturers, for one reason or another, have not been too quick to incorporate such supplies in their instruments.

There are a few relatively expensive laboratory-type scopes available in which such supplies are used (in modified form), but the majority of scopes sold employ a 60-cycle high-voltage supply, generally requiring a special power transformer and utilizing a circuit similar to that shown in Fig. 4.

The same advantages which made the r.f. high-voltage supply so ideal for TV work apply to its application as the high-voltage supply for a CRO. First, as a high impedance supply, it is safer to work with. Secondly, because of the high frequencies used, it is relatively easy to get adequate filtering with comparatively low capacity (and hence low cost) filter condensers. This fact is doubly important in that a great degree of freedom from 60-cycle intensity modulation can thereby be achieved.

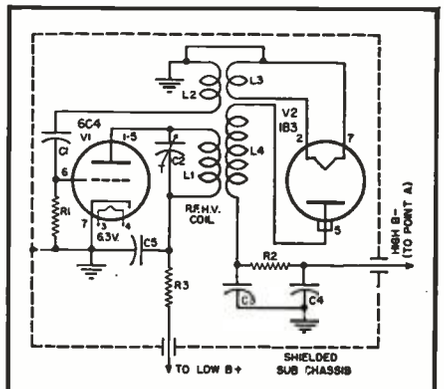
Coupled with these facts is the ease of obtaining higher d.c. voltages which result not only in greater spot brightness, but also in a sharper and clearer trace. High spot brightness is especially important when working with rapid sweeps and with sharp pulses. When pulses or square waves with a short rise time are observed, the leading edge of the signal may be lost entirely unless a high degree of spot brightness can be achieved.

These factors alone make it desirable to add such a supply to an existing CRO, as was done by the author. For new scope construction, several additional advantages accrue to those just listed. First, the need for a special scope transformer (see Fig. 4) is eliminated, and an ordinary receiver power supply transformer may be used for the scope. In these days of increasing parts shortages this is an important advantage. In addition, however, the need for high-capacity, high-voltage filter condensers is eliminated.

Unfortunately, the r.f. high-voltage power supplies used in TV receivers cannot be used directly in the average CRO without modification. For the most part, these supplies deliver from 4500 to 6000 volts. Since the average service-type scope employs from 900 to 1500 volts as accelerating potential, going to a voltage this much higher might cause a number of undesirable effects. First, of course, almost all coupling condensers to the deflecting plates would have to be replaced. All controls in the high voltage circuit (such as the *"Intensity"* control) would have to be better insulated from ground. The sensitivity of the scope would be reduced severely, and it might even become necessary to incorporate additional stages to obtain even partially satisfactory gain. And, finally, most TV r.f. high-voltage supplies deliver a voltage that is positive with respect to ground while the majority of scopes require an accelerating potential negative with respect to ground (see Fig. 4).

It is possible, however, to make basic modifications in the average r.f. high-voltage supply so that from 1500 to 2500 volts d.c. are supplied, and with a potential negative with respect to ground. This moderate increase in accelerating potential, while giving a noticeably brighter and sharper spot, is generally not enough to require changes in other parts of the scope nor to reduce the sensitivity appreciably. (*NOTE:* the loss in sensitivity is

Fig. 2. Circuit diagram of the r.f. high-voltage supply to be used with scopes.



R_1—22,000 ohm, ½ w. res.
R_2—50,000 ohm, 1 w. res.
R_3—4700 ohm. 1 w. res. (see text)
C_1—.001 µfd., 600 v. cond.
C_2—270 µµfd. trimmer cond.
C_3, C_4—.001 µfd., 2500 v. molded paper cond. (see text)
C_5—.02 µfd., 600 v. cond.
L_1, L_2, L_3, L_4—Standard high-voltage r.f. coil (see text)
V_1—6C4 tube (see text)
V_2—1B3 tube (see text)

due to the increased "stiffness" of an electron beam produced by a high accelerating voltage.)

Circuit Description

The circuit used by the author is given in Fig. 2. As can be seen, a triode tube, V_1, is connected as a tickler feedback oscillator, with secondary coils L_3 and L_4 coupled to the primary coil L_1. L_4 has many more turns than L_1 so that a voltage step-up occurs between primary and secondary windings due to the turns-ratio. In addition, however, C_2 may be adjusted to change the oscillator frequency. By careful adjustment, the oscillator frequency may be made equal to the resonant frequency of L_4 plus the distributed wiring capacities and the internal capacity of the rectifier tube V_2. Thus, resonance step-up may be added to the turns-ratio voltage step-up to increase the r.f. voltage applied to the rectifier tube.

A specially-designed rectifier tube is used so that its filament may be supplied directly from the r.f. oscillator by means of L_3.

Thus far, as we have seen, the r.f. supply is quite conventional. But there are differences between the circuit shown in Fig. 2 and conventional TV high-voltage supplies. In most TV high-voltage supplies, the lower end of L_4 is connected to the lower end of L_1 and the high-voltage output is obtained from the filament (cathode) of V_2, which is left ungrounded. In such a case, the high d.c. voltage obtained is positive with respect to ground.

To make the necessary changes in a TV high-voltage supply, first identify winding L_4 by carefully tracing the wiring. Disconnect the lower end of this coil, and use this as the d.c. supply source (connected to R_2 and filter condenser C_3). Connect the filament of the rectifier tube directly to ground. In this manner, an accelerating potential, negative with respect to ground, may be easily obtained.

For those few scopes in which an accelerating potential positive with respect to chassis ground is required, the more conventional circuit may be employed, as shown in Fig. 3.

Construction Hints

For best results, the entire r.f. high-voltage supply should be constructed on a separate chassis, and a complete shield provided. When care is taken in layout and construction, the r.f. supply may be directly substituted for the 60-cycle type of high-voltage supply without any chassis changes in the scope proper.

Fig. 5 is a view of a commercially-built CRO in which a 60-cycle high-voltage supply, similar to that shown in Fig. 4, is employed, supplying approximately 1500 volts. The small rectifier tube (5Y3) is the high voltage rectifier.

Fig. 1 is the same scope with an r.f. high-voltage supply substituted for the 60-cycle supply. The shield of the r.f. supply has been removed to show details of construction. In order to incorporate the r.f. supply in this particular scope, it was only necessary to drill four small holes in the chassis for mounting screws. It wasn't even necessary to remove the high-voltage rectifier tube socket! Filament ground and low "B plus," as well as high "B minus" leads, were brought down through the key-hole of the former high-voltage rectifier tube socket.

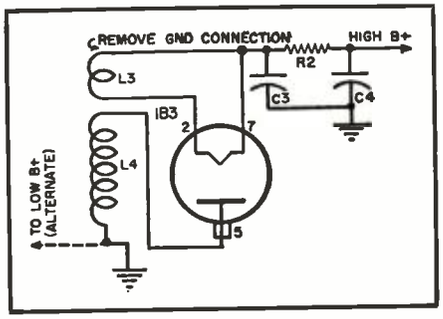


Fig. 3. How the r.f. high-voltage supply is connected into those oscilloscopes having an accelerating potential positive with respect to the chassis ground.

The author used a special coil obtained from *Stanwyck* for L_1, L_2, and L_4, adding L_3 by using two turns of plastic insulated #20 gauge wire. If the proper coil is not available to the builder, use a conventional TV r.f. high-voltage supply coil (which can be obtained from almost any wholesale radio supply house), removing one or more "pi's" from the high-voltage winding as may be necessary to obtain the desired high voltage.

V_1 may be a 6C4, 6C5, 6J5, triode-connected 6AQ5, 6V6, 6K6, or any similar tube. As the tubes are varied, or as the low "B plus" obtained from the CRO low-voltage power supply varies, it may be found desirable to alter the values of R_1 or R_2 to obtain optimum results. Particular care should be taken that the maximum voltage applied to the plate of V_1 does not exceed the maximum rating recommended by the tube manufacturer for the tube used. Increase R_2 as much as is necessary to accomplish this.

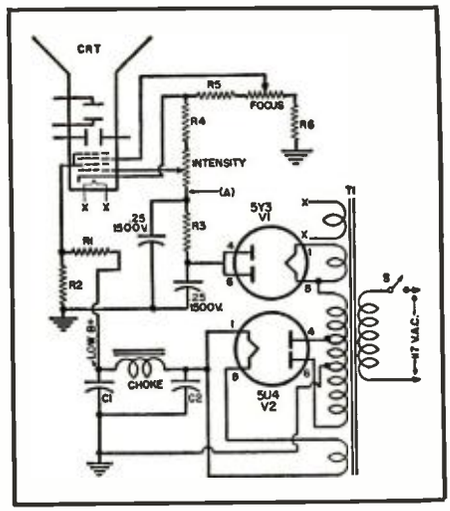


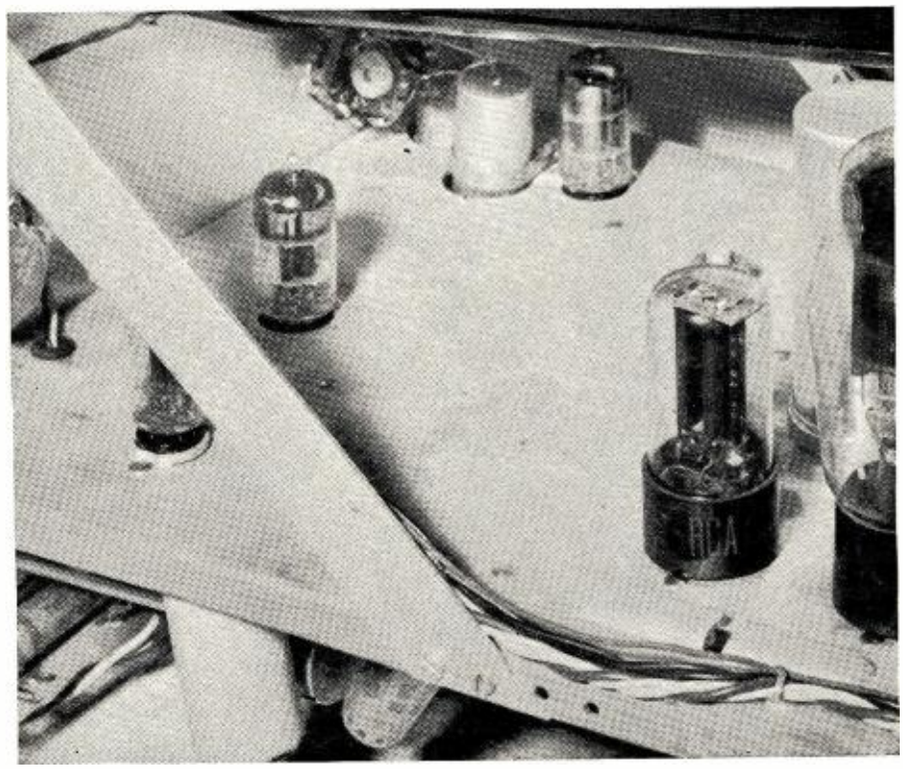
Fig. 4. A conventional oscilloscope circuit which uses a 60-cycle h.v. supply.

The rectifier tube, V_2, may be a type 1B3, which is easily obtained, but, if preferred, the builder may use tubes designed for a similar application such as miniature types 1X2 and 1V2.

The high-voltage filter condensers, C_3 and C_4, may be varied to suit the voltages obtained. The author used 2500 volt condensers since his supply delivered approximately 2300 volts. If a lower output voltage is to be used, condensers with a lower working volt-

(*Continued on page* 167)

Fig. 5. Top view of scope (Fig. 1) before r.f. high-voltage supply was added.



STRING-BELT TURNTABLES

By
ALBERT H. TAYLOR

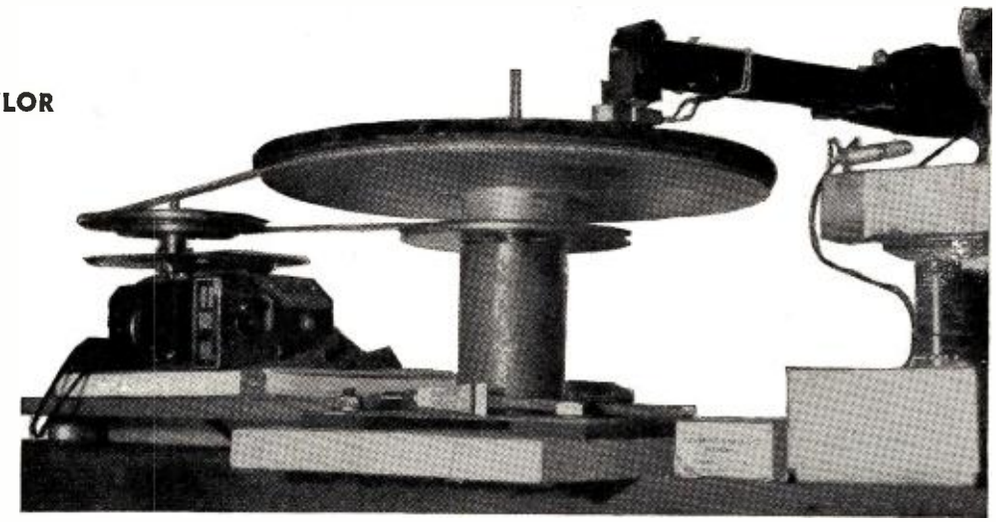


Fig. 1. String-belt turntable and motor for three speeds. The light under the pickup silhouettes the diamond to facilitate placing it accurately in the record groove.

Complete construction details for building a belt-driven turntable which has a minimum of wow, rumble, or flutter.

TURNTABLES in mass-produced home record players are usually unworthy of a good reproducing system. The light pressed-metal plates never saw a lathe, the center pegs are often out of true, and hum and vibration are coupled to the pickup. This writer has never seen any really good commercially-built turntables except high-priced broadcast station models. For those of us with high-fidelity tastes and low-fidelity purses, the only recourse is to build our own.

The belt-driven turntable, although used by *Western Electric* in at least one broadcast station reproducer and by *Universal* in a professional recorder, seems to have been overlooked by enthusiasts. It offers a simple and relatively inexpensive way to beat the bugbears of hum, mechanical vibration, and wow, and also to accommodate the several record speeds now in vogue and any others yet to come. The work that must be hired done, if one has no lathe, can be kept to a minimum and carried out by any conscientious machinist on a 12" lathe such as many garages have. The driving motor can be almost anything that runs at some constant speed, though for most users the obvious motor to use is one from some inexpensive available single-speed turntable.

S.S. White endless round dental drill belting is recommended for the belts and is made in various stock lengths. However, the author prefers to splice a still better belt from chalk line, macramé cord, or cod line, using the Transmission Splice[1, 2]. This splice makes no bump and holds even at very high speeds. Tweezers and a big needle and perhaps a reading glass are recommended for the job. In either case, the belt groove in all pulleys must have a flat bottom ⅛" wide for accurate speed ratios with these belts. The ⅛" depth will do but ¼" demands less critical alignment to keep the belts on. Once the turntable gets going, the belts do not slip at all unless the pulleys are too small.

Whatever motor is used, the relative sizes of the motor and turntable pulleys for each desired speed must satisfy the equation:

$$\frac{d_m}{d_t} = \frac{s_t}{s_m} \quad \ldots\ldots\ldots (1)$$

where:

d_m = motor pulley dia. at bottom of belt groove
d_t = turntable dia. at bottom of belt groove
s_m = motor speed in rpm
s_t = turntable speed in rpm

A high-speed motor, such as an 1800 or 3600 rpm unit, would require a two-step reduction with two belts and an intermediate countershaft bearing two pulleys in order to avoid using small pulleys that will slip. The equation then becomes:

$$\frac{d_m d_2}{d_1 d_1} = \frac{s_t}{s_m} \quad \ldots\ldots\ldots (2)$$

where:

d_1 = dia. at groove bottom of countershaft pulley belted to motor
d_2 = dia. at groove bottom of countershaft pulley belted to turntable

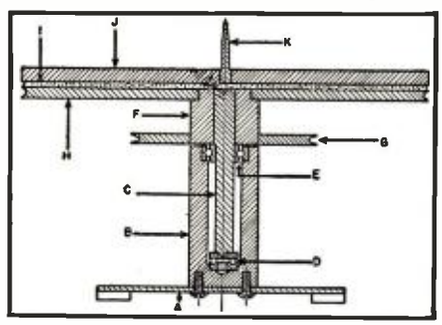
This was the drive which the author saw on a *Universal* recorder.

If the belt-driven turntable is 12" (outer diameter), the diameter at the bottom of the groove is 11.75". Table 1 gives the groove-bottom diameters of the motor pulleys for driving the turntable at the present three record speeds with a 78.26 rpm motor. Overall diameters will, in all cases, be ½" greater if the grooves are ¼" deep as recommended. This is the simplest arrangement but it requires a large and heavy three-step pulley on the motor. An alternative is to put an additional pulley underneath the turntable and make its diameter equal to that of one of the motor pulley steps, say 5.004". The belt positions are then as given in Table 2. A further reduction in the required steel can be achieved by making the second step of the motor pulley 2.875" at the groove bottom as indicated in Table 3.

Of course, the turntable could be driven at all speeds by a single pulley underneath and a small three-step pulley on the motor; but this would save no more material and might make the motor pulley for 33⅓ rpm so small that it would slip. It would only be worth risking in an ornamental installation where the belt must be kept out of sight under a deck.

Fig. 1 shows the author's turntable with the belt arranged to drive it at 33⅓ rpm with a 78.26 rpm motor. The pulley combinations for the three speeds are given in Table 3. The motor, which is shock-mounted to isolate its hum and vibration from the turntable pedestal and the pickup base, is simply slid toward or away from the turntable to keep the belt tight with the various pulley combinations. It could be on skids or rollers with a cord and a weight over the end of the shelf, or stationary with an idler to take up slack; but all this is unnecessary. Alignment is preserved by shoving chocks of the right thickness under the motor. With a longer belt and/or agate fishpole guides put on before the belt is spliced, no height adjustment would be necessary. This very simple arrangement has been wholly satisfactory for twelve years. Undesired

Fig. 2. Cross section of turntable shown in Fig. 1—the author's "deluxe" version. See text for identification of the parts.



sounds are completely eliminated and even a very noisy, hunting, eccentric synchronous motor formerly used made no trouble so long as the belt was not drawn too tight. The terrific moment of inertia of the turntable absorbed any pulsations that managed to get through the belt.

The writer prefers the simplicity and visible action of this open installation; but should some enthusiast's wife find it unsightly, it could readily be put into a conventional cabinet of ordinary width by putting the motor underneath and leading a lengthened belt around guide pulleys such as those sold by *Cenco* for physics laboratories. The belt could even be shifted by a lever with the help of the fishpole guides, which are analogous to the chain-shifting "derailleurs" used on French bicycles.

Details of Turntable

In Fig. 3 the turntable of Fig. 1 is removed from its pedestal and inverted to show the bearings. Only the top race of the lower thrust bearing is shown, the rest of it remaining on the pedestal. Fig. 2 shows the same turntable to scale in cross section. The lettered parts, as illustrated in Fig. 2 are as follows:

A. Base, ⅛" sheet steel
B. Pedestal, bored from 2" steel rod stock
C. Shaft, turned from ⅝" or ¾" steel rod stock
D. Ball thrust bearing; this bearing also centers when loaded
E. Radial ball bearing, metric size just under ⅝"
F. Hub, turned from 2" steel rod stock. Press fit on part C
G. Auxiliary drive pulley, turned from ¼" steel. Groove bottom diameter 5.00", o.d. 5½". Press fit on part F
H. Main plate, turned from ¼" steel. Groove bottom diameter 11.75", o.d. 12". Press fit against shoulder on part F
I. ⅛" sponge rubber pad
J. Upper plate, ground on *Blanchard* grinder from ⅜" hot-rolled machine steel. Turntable cloth glued on top after painting with red lead. Weight 17 lbs. In 1940 this plate cost $2.00 for steel and $6.00 for machining. Machining additional plates at same setup was quoted at $1.50 each
K. Removable peg, turned from brass. It should have an accurate slip fit with part J.

Note! The finishing cuts on parts F and H were taken and the groove in part H was turned *after* assembly of parts C, F, and H and with the assembly mounted between centers in a lathe. Part G was added 11 years later.

Observe that this deluxe turntable is elaborately protected against mechanical noise coupling even from its own bearings. The massive upper plate and peg have no contact with any other parts save through the sponge rubber pad. They are centered by using a *Starrett* toolpost indicator (lying under the turntable in Fig. 1) against the peg or the rim, or by poking an accurately fitted pointed rod through the hole in the big plate (part J) and a hole made by temporarily removing a disc from the rubber, to engage the center hole in the shaft (part C). One could also use a pickup on a perfectly true record (if there is one), mount a small mirror on the arm, train a flashlight on it, and watch the reflected spot on a distant wall. Once centered, the plate stays put indefinitely. It can be cemented if the cement dries slowly enough to allow centering.

A heavy auxiliary plate thus cushioned has also been used on various turntables directly. It is very effective provided they don't wobble and their bearings will stand the load. It is usually necessary to saw off the original uncushioned peg.

The long removable peg has proven a great convenience in handling records without stopping and starting the

(*Continued on page* 168)

TT RPM	MOTOR PULLEY	TT PULLEY
33⅓	5.004	11.750
45	6.756	11.750
78.26	11.750	11.750

Table 1. Groove-bottom diameters of the motor pulleys for driving the turntable at the present three record speeds using a 78.26 revolutions-per-minute motor.

TT RPM	MOTOR PULLEY	TT PULLEY
33⅓	5.004	11.750
45	6.756	11.750
78.26	5.004	5.004

Table 2. Belt positions when an additional pulley is used underneath the turntable. In this instance the diameter equals that of one of the motor pulley steps. See text.

TT RPM	MOTOR PULLEY	TT PULLEY
33⅓	5.004	11.750
45	2.875	5.004
78.26	5.004	5.004

Table 3. Groove bottoms to permit a reduction in the amount of steel required in the construction. This is achieved by making the second step of the motor pulley 2.875 inches at groove bottom. See text.

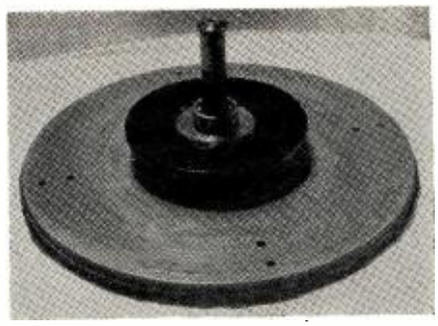


Fig. 3. Turntable (Fig. 1) showing bearings.

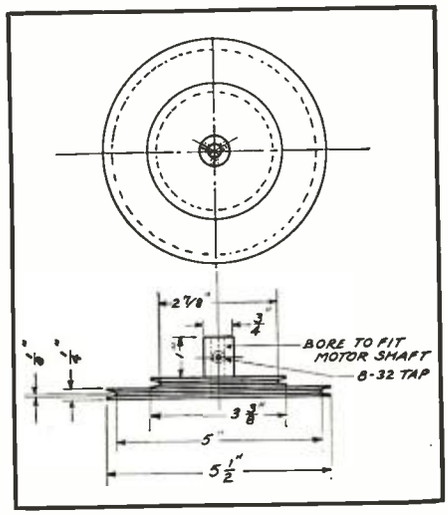


Fig. 4. Design of two-step motor pulley used in Fig. 1. With it, a 78.26 rpm motor will drive a turntable of 11.75" groove-bottom diameter at three disc speeds.

Fig. 5. A long, removable peg with a shoulder facilitates the changing of records.

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE

A WINDY SUBJECT

BARNEY stormed into the service shop in his usual going-to-a-fire manner but stopped short as he caught sight of Mac, his employer, sitting at the service bench toying with several soda straws.

"So!" the youth said accusingly. "You and Miss Perkins wait until I am away to have a round of sodas sent in, eh? Of all the sneaky, low-down, back-biting, ungrateful, penny-pinching—"

"Whoa, Buster, whoa!" Mac interrupted. "Hell apparently hath no fury like that of a glutton who thinks he has missed out on something to eat, but this time you are blowing your top over nothing. These straws are not the debris of secret gorging on the part of Matilda and myself. I was just using them for some experimenting."

"What kind of experimenting?" Barney demanded suspiciously.

"Sunday I spent several hours driving around looking at the damage done to TV antennas by that big wind we had Saturday night. In several cases I saw damage that puzzled me, and I am using these straws for model masts and towers, employing light thread for guy wires, in an attempt to discover why the antennas were damaged in the way they were."

"They really took a licking, didn't they?"

"Yes, but considering that some of those gusts were estimated to hit peaks of 80 miles-an-hour, it is surprising there was not more damage. Insurance men tell me they do not think they will have more than one claim in every eight installations covered. In view of the high and elaborate antenna systems that must be used to get a signal in this ultra-fringe area, that percentage is amazingly low."

"I think that fifty-mile-an-hour wind we had about a year ago mussed up the signal-sniffers a lot worse."

"You're right, and it is interesting to note that the big damage done then was to pipe-mast installations, while this time the pipe jobs came through practically unscathed."

"Why do you suppose that was?"

"The boys learned then that just guying the top of a twenty-foot section of pipe is simply not enough; so practically every pipe-mast is now guyed both at the top and in the middle. This, when properly done, makes a very sturdy job; and on top of that the pipe-masts seldom go higher than twenty or thirty feet. Tower jobs, on the other hand, are rarely shorter than this and often go up to better than a hundred feet. Then, too, we are likely to rely more on the rigidity of the tower and fail to give it the adequate guying we would give a flexible pipe. This is all well and good in a stiff breeze, but when the wind reaches a gale, as it did here Saturday night, good guying becomes as important to the tower as it does to the pipe."

"What happened to the antennas mostly?"

"A variety of things. In each case the wind hunted out the weakest point of the installation. In many cases the guy wires either broke or tore loose from their moorings and let the whole business crash to the ground. In other instances a top guy broke while the lower ones held, and then the tower usually broke square off just above or just below the bottom guys. More common were the cases in which the antenna masts bent over or broke off just above the motor, or the cases in which the pipe on which the motor was mounted suffered the same fate. Lots of the conicals lost antenna elements, and I saw one conical in which an insulating block had broken, allowing half of the antenna to fall to the ground.

"Few yagis shed their elements, but a great many of them either turned on the mast or turned the mast in the tower clamps so that they ended up pointing the wrong way. Fellows repairing the damage tell of a few cases in which an antenna with a large surface in a vertical plane, supported on top of a high tower, actually twisted the tower itself and did such a good job of wracking the structure that practically every rivet was loosened."

"What would you say were the installation mistakes that let all this happen?"

"Well, first, let's remember that these 'mistakes' are very easy to spot when looking through the spectacles of hind-sight, as we are now; but before we had a chance to see what a strong wind can do, we'd probably have made the same errors. Let's call them 'lessons of experience' rather than mistakes.

"The first lesson is: don't try to go too high for the guying area available. When a broadcast station puts up an antenna, it puts it in the middle of several acres of ground so that it can be supported as it should; but a TV owner often tries to go nearly as high and keep all of his guy stations inside his own small city lot. If you ever helped raise a tower, you know that when you are standing close to the base with a guy, you have a heck of a time holding the tower upright in even a slight breeze; but if you back off so the guy makes about a 45 degree angle with the tower, you can hold it easily with one hand. When guys must be anchored close to the base, they are subjected to terrific strain, and a large part of their strength is wasted in a force that tries to telescope the tower endways.

"Another fault lies in locating the guys 'conveniently' rather than where they should be. 'Make it easier to mow,' 'Make 'em less conspicious,' and 'Want to keep 'em all on the house' are some of the excuses given for failing to support the tower equally in all directions, and this invariably leads to trouble. Not guying often enough is another error. When the tower manufacturer recommends guying every thirty feet, he means just that; and if you go over thirty feet, he means that you should use two sets of guys even if you do not go on up to sixty feet. I can show you with these straws that if you fail to do this, a big antenna can exert a leverage against the restraint of guy wires affixed only to the top and make the tower buckle in the middle.

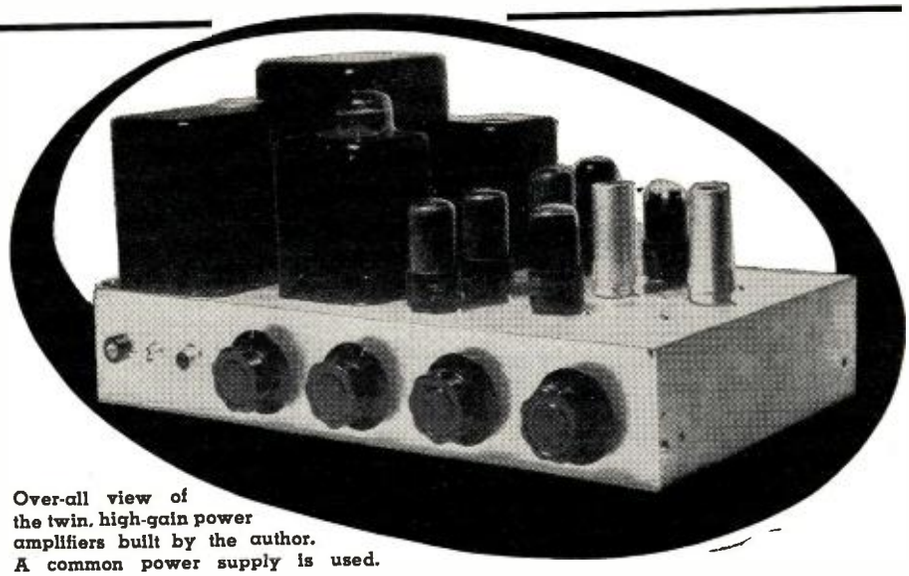
"Improper anchoring of guys is another common weakness. Antenna towers are usually put up on calm

(*Continued on page* 132)

BINAURAL SOUND REPRODUCTION

By

GLEN SOUTHWORTH



Over-all view of the twin, high-gain power amplifiers built by the author. A common power supply is used.

A discussion of binaural reproduction and a description of equipment suitable for producing this type of effect.

THE reproduction of sound in its proper spatial perspective has been of interest to engineers and musicians since the early thirties, and various demonstrations of the desirable effects obtainable have been made from time to time, including special radio broadcasts and motion picture sound tracks as well as concert hall performances.

There are several decided benefits to be gained by reproducing sound over two or more separate channels. In the case of music, spatial perspective makes it possible to localize individual instruments, thereby giving added clarity. Similarly, counterpoint is more easily perceived and the listener may use a flexible form of tone or balance control through his location in the listening environment or by manipulation of the gain controls of the various channels thus changing the audible intensity of particular instruments rather than frequency ranges.

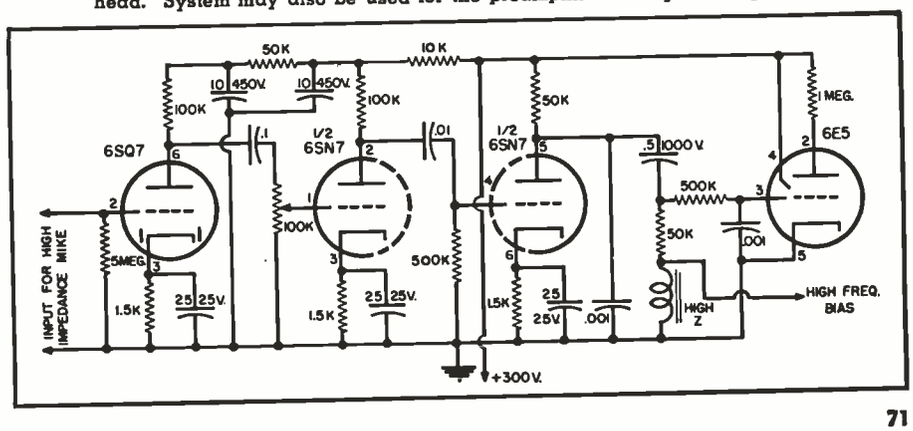
Although most often considered from the standpoint of high quality music, binaural reproduction has useful applications in virtually every phase of sound work. The use of spatial perspective in public address and sound reinforcement should be of interest and the increasing development of this technique is to be expected in both the motion picture and the radio broadcast fields. Likewise, in the expanding field of business recording multiple channel techniques hold promise of clearer, more intelligible conference records.

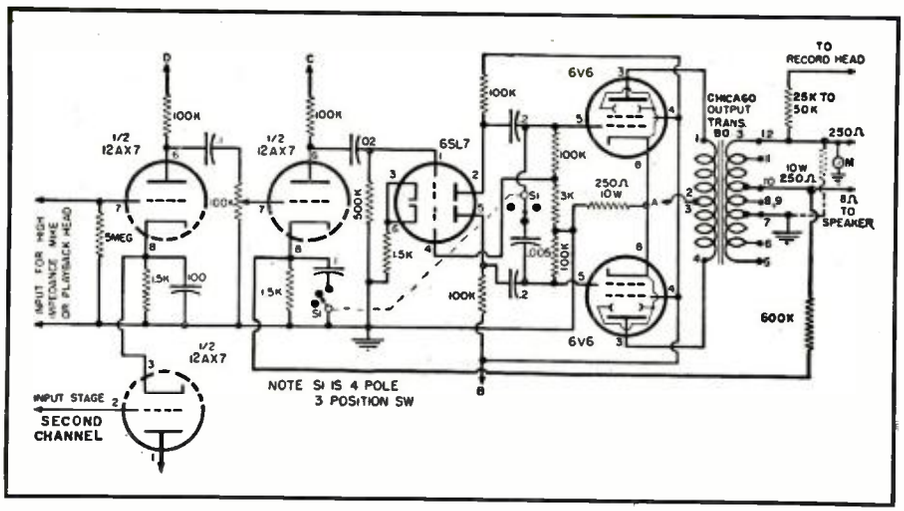
In general, there are two main techniques of binaural recording and reproduction. One of these is to use two or more microphones widely separated in order to pick up various sound sources with a minimum of interaction. In practice, usually two or three reproducing channels are considered sufficient. A second system is known as the "artificial head" and uses two identical microphones spaced about six inches apart and with a mass of some material separating them. While the first system works on the basis of sound amplitude, the artificial head works on the basis of phase differences at low and medium frequencies and amplitude discrimination at the high frequencies. Although a system of this kind can be very effective, inasmuch as only two channels are required to give the illusion of a complete spatial spread, it suffers from the fact that the two channels, from microphones to loudspeakers, should be very nearly identical. As very wide phase differences can be caused by acoustics in the auditioning location and the listener's position therein, this type of reproduction does not seem too satisfactory for group listening and appears to work best with headphones, which exclude the effect of outside acoustics.

Up until recent years the development of binaural reproduction seems to have been retarded by the lack of convenient recording techniques. Although phonograph records have been made with two separate sound tracks, tracking error can cause a considerable lack of synchronization unless the playback heads are suspended from an overhead bar, in which case they will track correctly, like the conventional overhead cutting mechanisms. However, the problem of starting the two needles in the correct grooves still remains. Recording on film has been used with success for multiple sound track operation but is generally a somewhat expensive and inconvenient operation.

The development of tape recording to its present state provides an almost ideal medium for multiple channel recording, and a number of relatively inexpensive dual-track recorders currently available may be adapted for the simultaneous recording of two separate sound tracks. If desired, no modifications need be made on the original machine other than the mounting of an additional half track record-playback head on the tape mechanism in such a manner as to cover the unrecorded half of the tape. A separate recording amplifier and bias supply may then be

A simple, three-stage amplifier for recording with a high impedance tape head. System may also be used for the preamplifier during the playback.





One of the two identical high-gain power amplifiers used in the dual-channel system. Both amplifiers are constructed on the same chassis and use a common power supply. Audio voltage for the tape recording is secured from the 250-ohm taps on the output transformers while individual vu meters are likewise connected to the 250-ohm impedances. Lettered connections go to corresponding terminals on power supply diagram.

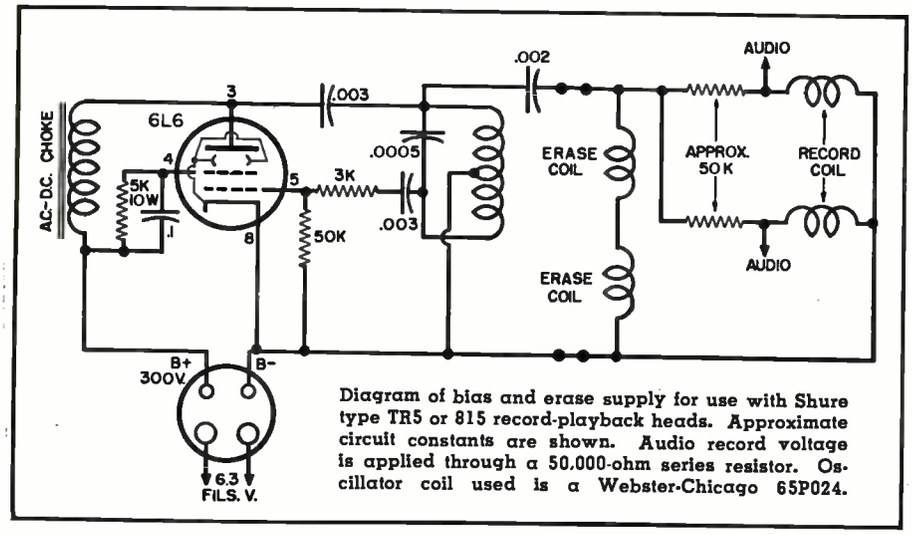
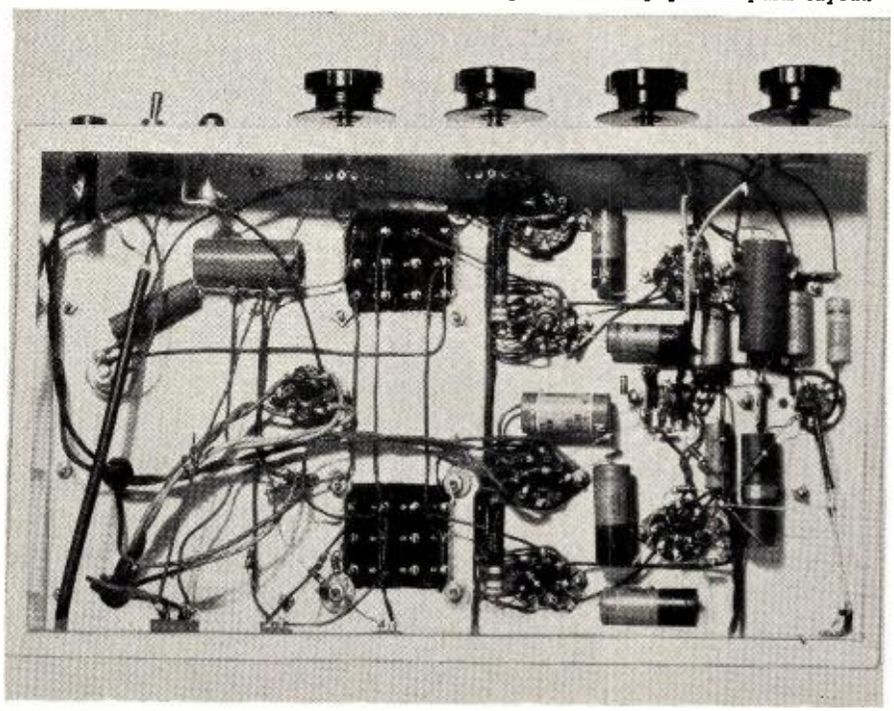


Diagram of bias and erase supply for use with Shure type TR5 or 815 record-playback heads. Approximate circuit constants are shown. Audio record voltage is applied through a 50,000-ohm series resistor. Oscillator coil used is a Webster-Chicago 65P024.

Under chassis view of two-channel amplifier system showing general parts layout.



connected to the extra head whenever it is desired to make multiple channel recordings.

It should be noted that the ability to record and play back two simultaneous recordings has several decided advantages in conventional monaural sound work. One example of this is the recording made for broadcast or other purposes at a remote location. In many instances the only indication of audio quality is obtained from a set of headphones with which it is hard to make accurate judgments as to tonal balance. By widely spacing the microphones for the two separate channels a wide variation of tonal structure may be obtained and the two channels may subsequently be mixed in the studio for best balance. Similarly, dubbing may be easily accomplished with only one machine and without loss of fidelity by monitoring the original sound track while inserting the desired material on the other track and later playing both tracks simultaneously. Likewise, benefits from the standpoint of reliability may be expected due to the fact that the use of two channels in making an original recording gives an extra safety factor in the event that one of the tracks is defective due to faulty microphone connections, amplifier, or clogged tape head.

The accompanying photographs and schematics illustrate an experimental two-channel system built by the author. In order to have as versatile a unit as possible, two separate power amplifiers were constructed on the same chassis with sufficient gain for either microphones or magnetic playback heads. As a result, the system may be used for public address or sound reenforcement, such as in stage productions, for either tape or disc recording, and for dual-channel playback. Similarly, it may be easily adapted for dual-channel operation from conventional sources such as radio or phonograph recordings by attenuating the high frequencies in one channel and the lows in the other, thus giving a semblance of binaural reproduction.

A number of design features of the two-channel system should be noted for the benefit of the constructor. It should be realized that the main point of distinction between magnetic recording and other systems is in the use of high frequency bias. For this reason the bias supply of the recording system has been designed as a separate unit in the event that the experimenter already has equipment available for use. The *Shure* type TR5 or 815 dual-track recording heads used by the author require a peak recording current of from .2 to .5 milliampere which is easily obtained by feeding the record coil from the 250- to 500-ohm output winding of an amplifier through a 25,000- to 50,000-ohm series resistor. Thus, any high gain amplifier capable of delivering 10 to 20 volts across 50,000 ohms may be used in combination with a suitable

high frequency bias supply for recording purposes.

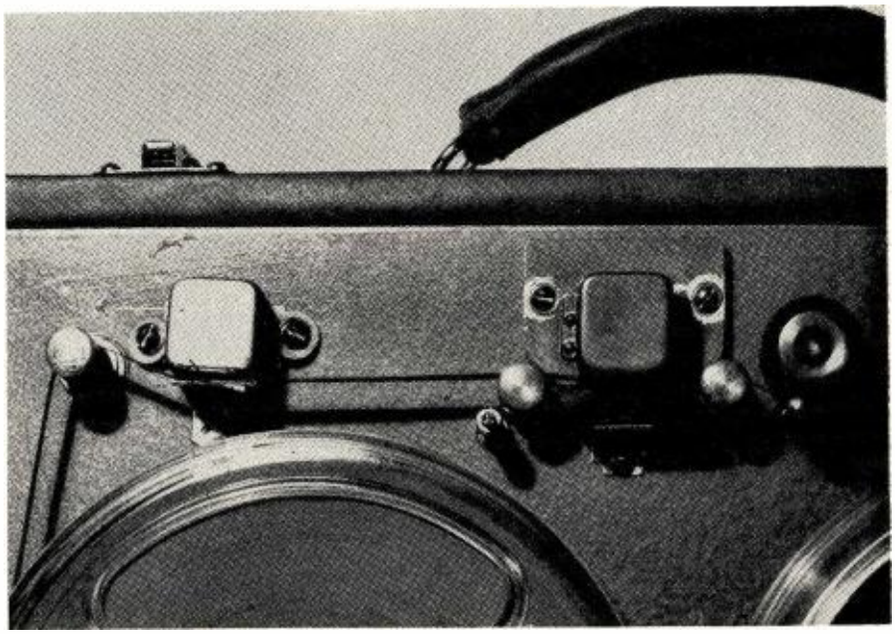
Due to the relatively low output of the tape during the playback cycle, precautions must be taken to keep the noise level of the amplifier and associated equipment as low as possible. The effects of ground loops in introducing hum are well known, but a problem of increasing proportions is that of reducing other noises such as hiss. In many instances, the plate resistors of the input stages, as well as the cathode resistors, if not adequately bypassed, may cause a great deal of high frequency noise of an objectionable nature and for best results highly stable resistors should be used in these locations. Although the nominal impedance of the type TR5 record-playback head is about 1600 ohms it appears to work quite satisfactorily into the 500-ohm impedance of an input transformer such as the *Chicago* type BI-7 and provides a considerable amount of additional hum and noise-free gain. Similarly, the use of input transformers of this nature is necessary in order to take advantage of the desirable qualities of professional low-impedance microphones. If used they should be mounted as far from the power transformer as possible, and connected by means of low capacity microphone cable.

A common power supply is used for the two amplifier channels and is shown using a choke input filter to provide a lower voltage for longer component life. If higher output is desired, additional plate voltage can be obtained by placing another filter condenser between the rectifier cathode and ground. High quality output transformers with balanced high and low impedance windings are used, making the system adaptable for use with conventional speakers or for driving telephone lines or remote speakers for special purposes. In the circuit shown, simultaneous tone control of both channels is accomplished by a multiple switch although the channels may be individually controlled if desired.

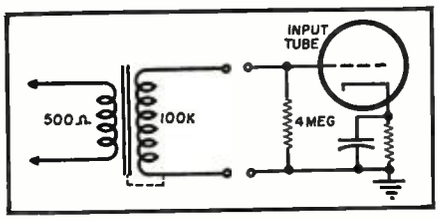
Changeover from record to playback cycles is accomplished manually by removing the recording head connections from the output sockets and inserting them at the microphone input and likewise connecting the loudspeakers to the output. Although not as convenient, this arrangement is much more flexible and less complicated than if automatic switching of the circuit elements were used.

In mounting an additional record-playback head on a tape mechanism, several factors should be considered. One of the first of these is to be sure that the head is not positioned in such a manner as to cause serious hum pickup from motor or transformer fields. A second factor of importance is to insure that the tape will be pulled smoothly across the head with a minimum of flutter or side sway. Small tape guides with quarter-inch slots and a pressure brush may be desirable to minimize these effects, but should not introduce too much drag on the tape. If it is necessary to play tapes of a multiple channel nature on more than one machine the distances between the two playback heads must be kept to close tolerances. A variation of one-sixteenth inch may be acceptable if widely spaced microphones are used, or for dubbing purposes, as at the 7.5 inch tape speed this will correspond to a delay of

(*Continued on page* 100)



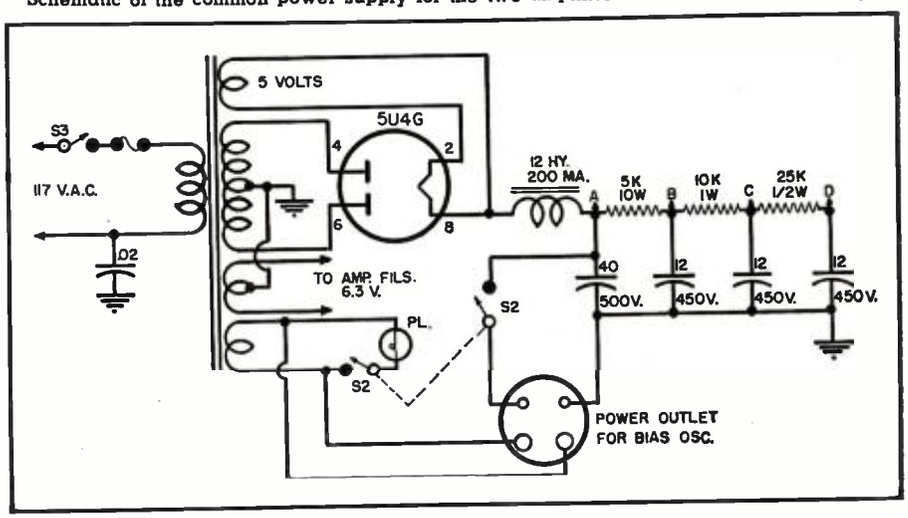
Close-up view of the tape recorder showing how second recording head is mounted.



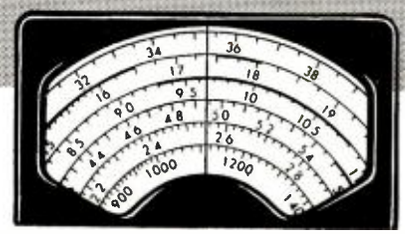
Connection for low impedance microphones. Input transformer should be as far from power transformer as possible and a few feet of low capacity mike cable used to connect high impedance side of transformer to grid of the input tube.

The high-frequency bias supply can be constructed on a compact and separate chassis. If the builder has this equipment available he may use it instead of building this unit—which is why it was built separately.

Schematic of the common power supply for the two amplifier channels and bias supply.



International SHORT-WAVE



Compiled by KENNETH R. BOORD

IT IS a pleasure to dedicate the March *ISW DEPARTMENT* to *Kol Zion Lagolah ("The Voice of Zion)"* of the World Zionist Organization, P. O. Box 754, Jerusalem, Israel. Thanks for this material go to Anson Boice, Connecticut, editor for the "United 49'ers Radio Society"; Deborah Landman of the English Section, *Kol Zion Lagolah,* and to *"KARNENU,"* the Jewish National Fund's monthly magazine.

As the clock struck midnight on March 11, 1950, a new voice went vibrating across the world. A man in London, twiddling knobs, suddenly heard a Londoner speak in Jerusalem. A Parisian Zionist caught the news of Israel coming over the ether in pure Parisian French. A SWL at a receiving set in Boston was astonished to pick up a commentary on Middle East affairs in Yiddish. Ever since that first venture in the atmosphere, *Kol Zion Lagolah* has broadcast every "night" from Jerusalem for three quarters of an hour in three languages (this broadcasting time has now been extended and includes periods in *English,* French, Yiddish, and Hebrew).

Naturally, the English Service has the largest potential audience, but this is limited largely to European listeners and to SWL's in other parts of the world who have powerful receivers. However, rebroadcasts of *Kol Zion* programs are achieving much popularity in the United States and Canada where 70 stations which operate from widely dispersed towns present weekly "Vistas of Israel" and a *Kol Zion* liaison office by this time should have been opened in the United States. A half-year's visit to Israel by one of the script-writers of the Jewish Theological Seminary program, "The Eternal Light," which is aired over the network of the *National Broadcasting Company,* brought Jerusalem nearer to New York City.

Kol Zion started with one recording machine and a dozen tapes! The shortage of producers, studios, English-perfect actors, and above all, scripts, has never vanquished the small, stubborn team responsible for the English Service. Even for Israel—which specializes in adapting square pegs to round holes—the personnel embraces a goodly variety of backgrounds—Geoffrey Wigoder, Oxford Rabbinical scholar, supervises the efforts of Edward Ellison, foreign correspondent; Deborah Landman, formerly a social worker, and Anita Davis, ex-Unity Theater actress. None of the staff had radio experience before they began to turn their lofty Arab mansion into a flurry of flying manuscripts and sudden atmospherics. Yet somehow, programs get written and plaintive liturgical melodies mingle with the more lively Hora.

The National Institutions—the World Zionist Organization, Keren Hayesod, and Keren Kayemeth Leisrael—together finance *Kol Zion Lagolah.* Under the direction of Mordechai Avida, it has proved a first-class ally in linking the scattered legions of Zionism by spreading information on the work being accomplished.

That dry, statistical word "afforestation" took on new life when *Kol Zion* visited the Weizmann Forest and described Viscount Samuel and Lord Nathan planting the first saplings. Afterwards, the late President Weizmann heard the recordings as he lay ill in his Rehovot home. Recently, Swedish audiences had the chance of listening to speeches honoring the late Count Bernadotte at the inauguration of the Bernadotte Forest.

Sandwiched between Hebrew lessons and a quiz on Jewish history, a series of talks and tunes of the Chassidic Rabbis come to charm lovers of the picturesque.

"Music—which occupies a large percentage of broadcasting hours—is able to convey our strange heterogenous Israel better than any other medium," *Kol Zion* officials point out. "Before the Israel Philharmonic left on its American tour, *Kol Zion* recorded a rehearsal with Leonard Bernstein's directions and suggestions, together with an interview later sent to the United States and rebroadcast there."

National events together with the Orchestra's tour received their full share of publicity. The Maccabiah and Independence Day programs carried thousands of isolated Jewish families into the heart of Israel to hear for themselves the singing and cheering. Greatest "live" success to date has been the coverage of the 23rd Zionist Congress in Jerusalem. At last, *Kol Zion* enjoyed adequate studio facilities and an up-to-the-minute system of reporting, even recording the simultaneous *English* translations from Hebrew and Yiddish speeches.

The mere fact that *Kol Zion* comes straight from Israel is enough to ensure an eager audience—however little Hebrew its members comprehend. A letter from one grateful listener in Ireland—blind—or from the Scottish grandfather who "was allowed to stay up and listen with the family" com-

(*Continued on page* 122)

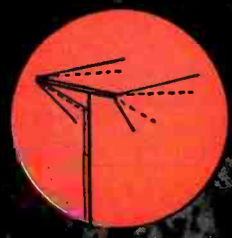
(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

Sylvia Berger, scriptwriter for "The Eternal Light" program (aired over the NBC in the United States), makes a recording in an immigrant village in Israel.

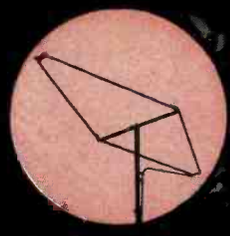
Corner Reflector No. UHF400

"Bowtie-Flector" No. UHF600

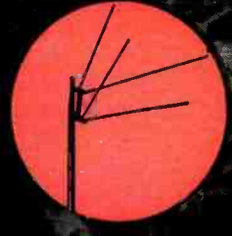


Ultra V-Beam No. UHF500

YAGIS No. UHF300 Series for Channels 14 to 83



Rhombic No. UHF 200



"Double-Vee" No. UHF100

When there are new worlds to conquer, JFD will do it!
Now our engineers have combined the famous JFD VHF Jetenna and UHF bowtie antenna into a miracle performer that pulls in all channels—from 2 to 83. Use it with the especially developed filter network* for perfect reception, completely free of inter-spectrum interference. Pre-assembled construction, all aluminum, even to solid aluminum dowels.

Write for the new 1953 JFD dealer almanac on your letterhead—36 pages of the widest TV antenna and accessory line in the industry.

*optional

JFD
UHF - VHF

it's out of this world!

new, VHF-UHF All-Channel Antenna
the Jet 283

one antenna—one transmission line for all channels from 2 to 83

JFD MFG. CO., Brooklyn 4, N. Y., Bensonhurst 6-9200
world's largest manufacturer of tv antennas and accessories

Burton browne advertising

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL**	CHANNEL	FREQUENCY (mc.)	POWER (Video)*
Alabama	Birmingham	WSGN-TV	42	638-644	1000
"	Birmingham	WJLN-TV	48	674-680	230
Arizona	Tucson	KCNA-TV	9	186-192	25
California	Bakersfield	.....	29	560-566	20.5
"	Los Angeles	KPIK	22	518-524	540
Colorado	Colorado Springs	KKTV	11	198-204	250
Connecticut	New London	.....	26	542-548	105
Florida	Lakeland	.....	16	482-488	85
"	W. Palm Beach	WIRK-TV	21	512-518	22
Idaho	Boise	.....	7	174-180	51
Illinois	Danville	WDAN-TV	24	530-536	19
"	Peoria	WTVH-TV	19	500-506	95
Indiana	Lafayette	.....	59	740-746	20
Louisiana	Baton Rouge	.....	40	626-632	290
"	Lake Charles	.....	25	536-542	20
"	Monroe	KNOE-TV	8	180-186	175
"	Monroe	KFAZ	43	644-650	77
Maine	Bangor	WABI-TV	5	76-82	1.9
Maryland	Baltimore	.....	60	746-752	105
Michigan	Muskegon	.....	35	596-602	269
Mississippi	Meridian	.....	30	566-572	210
Missouri	Festus	.....	14	470-476	170
Nevada	Reno	.....	8	180-186	3
New York	Buffalo	.....	59	740-746	91
"	Buffalo	WBUF	17	488-494	165
"	Watertown	.....	48	674-680	185
Ohio	Lima	WIMA-TV	35	596-602	91
"	Zanesville	WHIZ-TV	50	686-692	91
Oklahoma	Lawton	.....	7	174-180	10
Pennsylvania	Altoona	.....	10	192-198	316
"	Bethlehem	WLEV-TV	51	692-698	2.25
"	Harrisburg	WHP-TV	55	716-722	240
"	Johnstown	.....	56	722-728	91
"	New Castle	WKST-TV	45	656-662	20.5
"	Reading	WHUM-TV	61	752-758	260
"	Reading	WEEU-TV	33	584-590	225
"	Scranton	WTVU	73	824-830	11
"	Scranton	WGBI-TV	22	518-524	290
"	York	WNOW-TV	49	680-686	96
"	York	WSBA-TV	43	644-650	170
"	Wilkes-Barre	WBRE-TV	28	554-560	1000
"	Wilkes-Barre	WILK-TV	34	590-596	250
"	Williamsport	WRAK-TV	36	602-608	21
"	Philadelphia	WIP-TV	29	560-566	275
South Carolina	Charleston	WCSC-TV	5	76-82	100
"	Columbia	WCOS-TV	25	536-542	89
"	Columbia	WNOK-TV	67	788-794	680
South Dakota	Sioux Falls	KELO-TV	11	198-204	57
Tennessee	Chattanooga	WOUC	49	680-686	20
"	Chattanooga	WTVT	43	644-650	275
Texas	Amarillo	KGNC-TV	4	66-72	100
"	Amarillo	KFDA-TV	10	192-198	56
"	Austin	.....	18	494-500	216.5
"	Austin	KTBC-TV	7	174-180	109.6
"	Austin	KTVA	24	530-536	280
"	El Paso	KTSM-TV	9	186-192	64
"	El Paso	KROD-TV	4	66-72	56.3
"	El Paso	KEPO-TV	13	210-216	120
"	Galveston	KGUL-TV	11	198-204	59

*ERP = (effective radiated power). **Call letters without TV suffix from application files and subject to change; except where included in calls such as KKTV or WTVT. . . = Call letters to be announced.

Good-pay jobs. A business of your own.

OPPORTUNITIES FOR GOOD-PAY JOBS in Television are within your reach when you study TV Servicing by the RCA Institutes Home Study Method. Or perhaps you would like to start a TV Service business of your own.

If you are not satisfied with the way your future now stacks up, see how easily you can change the course of your career. RCA Institutes Home Study Course in TV Servicing is helping thousands of other people to better jobs. It can help you. Right now thousands of opportunities are going begging. There is a critical shortage of trained TV servicemen. This is *your* big opportunity.

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The entire course is divided into ten units of several individual lessons. You study them at home in your spare time. Lesson-by-lesson you learn the theory and step-by-step procedures of installing TV antennas, of servicing and trouble-shooting TV receivers. Hundreds of pictures and diagrams help you understand the how-it-works information and the how-to-do-it techniques. You will be amazed how easily you absorb the knowledge of each lesson, how quickly you train yourself to become an experienced technician.

Experienced engineers and faculty prepared the course, grade your lessons

The RCA Institutes course was written and planned by instructors with years of specialized experience in training men by home-study and resident-school methods. The course embodies RCA's background of television experience plus knowledge gained in training several thousand technicians. A study of the course parallels an apprentice's training. Your lessons are carefully examined and accurately graded by friendly teachers who are interested in helping you to succeed.

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Founded in 1909, RCA Institutes, Inc. has been in continuous operation for the past 44 years. Its wide experience and extensive educational facilities give students, just like you, unsurpassed technical training in the highly specialized field of radio-television-electronics.

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Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name _____
(please print)

Address _____

City _____ Zone _____ State _____

RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

U.H.F. Antennas

(*Continued from page* 55)

siderably. This applies to vertical placement as well as to horizontal position.

Keep lead-in lines from separate v.h.f. and u.h.f. antennas away from each other. Any undesirable u.h.f. signals picked up by the v.h.f. array can be transferred from the v.h.f. lead-in line to the u.h.f. lead-in line if the two lines come close enough to each other. Generally a six-inch separation will prevent this type of signal transfer.

In areas where there is no trouble from ghosts, choosing the best location for the u.h.f. antenna can be quickly carried out using a field intensity meter. Since u.h.f. meters are not yet available, any of the v.h.f. instruments which use a *Standard Coil* tuner can be adapted to u.h.f. by simply replacing some of the unused v.h.f. channel strips with appropriate u.h.f. strips. *Simpson, Transvision,* and *Approved Electronics* field intensity meters fall in this category.

The type of antenna to be used will depend, to a large extent, on the strength of the received signal and on the interference conditions existing at that location. Near the transmitter, a simple array such as the fan dipole may prove quite satisfactory. Farther out, a stacked "V", a parabola, or even a rhombic array may be required. These are capable of greater gain and sharper directivity, if this latter feature is required. In very weak signal areas, stacked dipoles, yagis, and stacked rhombics would probably bring in whatever signal is present.

In u.h.f. installations, the admonition to raise the antenna as high as possible will generally pay off. That is, a definite signal increase with height is generally noticeable, although exceptions will be encountered from time to time. Of course, this must be tempered by the fact that the higher the antenna, the greater the amount of lead-in required and sometimes the increased lead loss can offset the stronger signal.

The increase in signal strength with height is not a smooth transition, but rather one that varies between minimum and maximum. Thus, as you go up, the signal strength will rise, then decrease somewhat with further height, then rise again, etc. This variation is due to the fact that the signal present at the antenna is a combination of a direct ray and a ground reflected ray. Where these two rays combine in-phase, signal strength is high; where they combine out-of-phase, signal strength obviously would be lowered.

You may also find a similar variation as you move the antenna horizontally although here the presence of buildings, towers, foliage, hills, etc., has a greater disturbing effect.

The rise in operating frequency brings with it additional effects aside from those already noted. For one thing, the ability of the wave to pass around objects and obstacles in its path decreases as the size of these objects approach and exceed the wavelength of the passing signal. Thus, a high tower or a long chimney stack may appear inconsequential to frequencies of 50 mc. or less; to 550 mc. waves, it may become quite formidable, and in many instances, unpassable. Also, at ultra-high frequencies it has been observed that the growth of leaves and other foliage in the spring and summer can reduce the strength of otherwise strong signals. Sometimes, a usable picture in the winter will become completely unusable in the spring and summer. This point must be kept well in mind during fall and winter installations when foliage may be sparse or missing. In the summer, with the greenery in full bloom, signal areas found to be useful can be depended upon to maintain or even increase in signal intensity during the colder months of the year.

The sensitiveness of short waves to small and moderately sized obstacles is further demonstrated when indoor u.h.f. antennas are utilized. It has been found that these are generally unsatisfactory except in the strongest signal areas and even here, wide fluctuations in signal strengths have frequently been found to occur whenever anyone walked in front of the antenna. Where it is impossible to erect roof antennas, due to certain restrictions, then window-mounted arrays are next preferred. Only as a last resort should indoor antennas be attempted.

EDITOR'S NOTE: Those desiring additional information on u.h.f. practices are referred to Mr. Kiver's forthcoming book "U.H.F. Antennas, Converters, and Tuners" to be published by Howard W. Sams & Co., Inc., 2203 E. 46th St., Indianapolis 5, Indiana.

-30-

Speaker Tester

(*Continued from page* 58)

The physical layout of the unit (see Fig. 1) is not important as there is no oscillation problem. It can be set up and wired in any manner, such as on a panel, in a wooden case, or in any other available housing.

The dials were made by marking the proper values and letters on cardboard cut to dial size then covered with a thin sheet of *Plexiglas.* The panel mounting nuts on the switches also serve to hold down the dials and their covers.

For fast servicing with popular-brand radio and TV sets, plugs may be made with the proper test leads to enable the technician to quickly plug the substitute speaker into the set. This eliminates extra handling and makeshift connections.

-30-

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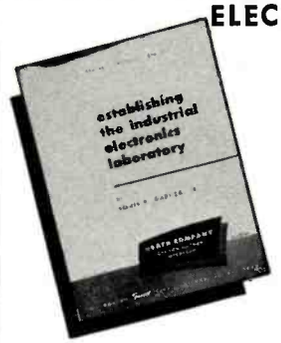
Here is complete first-hand information written in a refreshing authoritative style by a man with over a quarter century of experience in radio and TV work. In this booklet John T. Frye discusses all factors involved in establishing a service business. Consideration is given to the type of business, location, selection of tools and instruments, bookkeeping procedures, job records, business promotion, and other similar subjects. Full explanation of the method used in computing service charges and how to establish a rate which will insure a fair and profitable return on your investment will prove very helpful. This booklet is available to Heathkit customers at no charge. Write for your free copy.

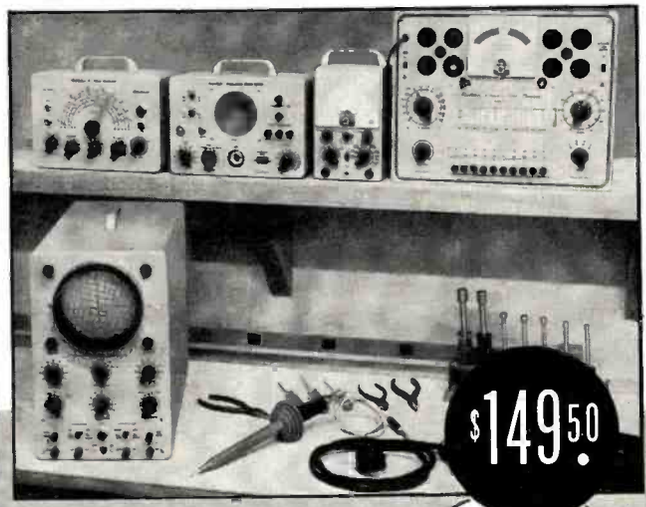
ESTABLISHING THE INDUSTRIAL ELECTRONICS LABORATORY

BY LOUIS B. GARNER, JR.



A service offered by the Heath Company for the direct assistance of those involved in laboratory work. In this booklet, by Louis B. Garner, Jr., full consideration has been given to all factors required in establishing an electronics laboratory. Information regarding the type of laboratory—laboratory layout—space allotment—lighting and service facilities—personnel—heating and air conditioning, etc. Work benches, as well as other details such as desks, shelves, cabinets, drafting tables, stools, etc., are discussed. This valuable booklet is offered to Heathkit customers at no charge. Write for your free copy.

BASIC SERVICE SHOP



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7 Complete KITS

- Oscilloscope
- VTVM
- Signal Generator
- Signal Tracer
- Tube Checker
- TV Picture Adapter
- High Voltage Probe

This group of instruments represents a typical combination of basic test equipment required for Radio and TV service work. Here is emphatic proof of the tremendous economy offered only by Heathkits. Seven basic equipment items for less money than the price quoted for a single commercially available instrument such as a general purpose oscilloscope. A serviceman can easily assemble this entire group of instruments in 45 actual working hours.

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11 Complete KITS

- Oscilloscope
- Voltage Calibrator
- Electronic Switch
- VTVM
- AC VTVM
- Power Supply
- Q Meter
- Decade Resistance
- Decade Condenser
- Resistance Substitution Box
- Audio Oscillator

This combination of eleven typical instruments required for any Electronics Laboratory, clearly illustrates the economy offered by the purchase of Heathkit equipment. Practically an entire basic laboratory for the price of one piece of factory built equipment. These instruments can be assembled by a laboratory technician in approximately 55 actual working hours.

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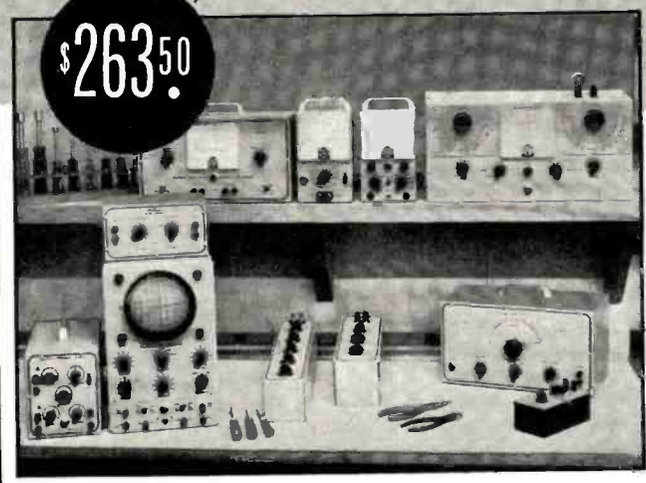

Additional information regarding these instruments will be found on the following pages. Write to the Heath Company for a free catalogue listing all Heathkits—schematics—specifications and applications.

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NEW *Heathkit* "Q" METER KIT

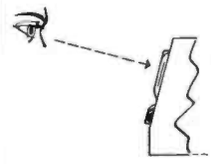
• A HIGH QUALITY Q METER AT LOW COST.

MODEL QM-1
SHIPPING
WT. 12 LBS.

$39.50

Measures Q and inductance of coils.

Measures Q and capacity of capacitors.



Slant face cabinet for ease in reading the meter.

- First Q METER within the price range of all.
- Read Q's of 0-500 directly on calibrated scale.
- Stable oscillator supplies R.F. frequencies of 150 kc to 18 megacycles.
- Calibrated capacitor with range of 40 mmf to 450 mmf with vernier of ±3 mmf.
- Simple, easy operation.
- Can be used to measure small inductances or capacitors.
- Measures Q of condensers, RF resistance and distributed capacity of coils.
- Measures capacity by substitution, capacity by resonance, inductance by resonance.
- Slanted panel for convenient operation.

Another outstanding example of progressive HEATHKIT engineering. Now a highly desirable Q METER within the price range of all laboratories, schools and experimenters. No longer is it necessary to deny yourself the many measurement advantages offered by this instrument.

Use the new HEATHKIT Q METER for the following simple basic measurements: capacity by substitution, capacity by resonance, inductance by resonance and Q at the OPERATING frequency all can be read on the calibrated scales. The method used to obtain information regarding the Q of condensers, RF resistance, distributed capacity in coils, etc., is only slightly more involved. In the HEATHKIT Q METER, the generated RF signal is coupled through a cathode follower and injected across a low impedance condenser which is included in the resonant circuit under test. Large 4½" 50 microampere Simpson meter reads Q directly. The resonating condenser and vernier condenser are calibrated in mmf for substitution method capacity tests. The resonating condenser is also calibrated in effective capacity for resonance tests. The inductance calibration serves for rapid determination of the approximate inductance of a coil. The HEATHKIT Q METER has a generator frequency range of 150 kc to 18 megacycles. Vernier capacity covers ± 3 mmf and the resonating condenser is calibrated from 40 mmf to 450 mmf actual capacity or 40 mmf to 350 mmf effective capacity. Meter reads Q directly up to 250. Higher and lower full scale readings can be obtained by varying the injection voltage levels.

The entire kit consists of 12AT7, 6AL5, 6C4, OD3 and 6X5 tubes, 50 microampere Simpson meter, power transformer, cabinet and all other parts necessary for construction as well as instructions for assembling, testing and operation of the completed instrument.

Heathkit DECADE RESISTANCE KIT

The HEATHKIT DECADE RESISTANCE KIT is widely used by schools, experimenters and laboratories because of the extremely wide resistance range offered and the useful, dependable service provided. The DECADE consists of 5 rotary 2 deck ceramic wafer switches with silver plated contacts and twenty 1% precision resistors in a circuit which provides the resistance range of 1 ohm to 99,999 ohms in 1 ohm steps. The HEATHKIT DECADE RESISTANCE KIT is simple to construct and is housed in a beautiful polished birch cabinet with an attractive panel. The DECADE will furnish years of accurate trouble-free service.

Individual decade sections of above can be purchased separately for special applications.

MODEL DR-1
SHIPPING
WT. 4 LBS.

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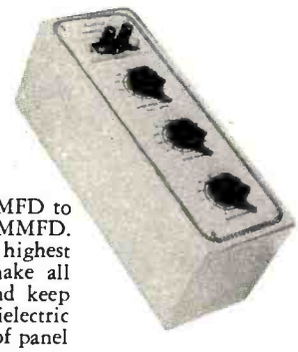
NEW *Heathkit* DECADE CONDENSER KIT

Extremely useful in all experimental and design work such as determination of condenser values for: compensating networks, filters, bridge impedances, tuned circuits, etc. *Uses all precision silver mica condensers within ±1% accuracy.* Values run in three decades from 100 MMFD to 0.111 MFD in steps of 100 MMFD. Smooth acting, positive detent, highest quality ceramic wafer switches make all capacitor values easy to set up and keep losses to a minimum. Low loss dielectric terminal board mounts on outside of panel for easy cleaning. Heathkit binding posts accommodate a wide variety of test leads. Comes complete with all parts, including polished birch cabinet.

Individual decade sections of above can be purchased separately.



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WT. 4 LBS.

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CABLE ARLAB-N Y

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* OSCILLOSCOPE KIT

• NEW WIDE BAND VERTICAL AMPLIFIER ± 2 DB 10 CYCLES TO 1 MC.

Direct plate connections for modulation tests.

Displays TV sync pulses correctly.

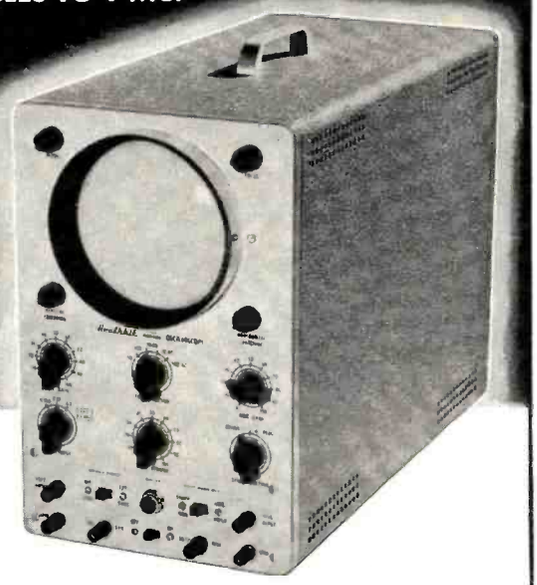
Useful to 5 mc.

Good square wave response at 100 kc.

MODEL O-8

SHIPPING WT. 29 LBS.

$43.50



- New wider band vertical amplifier ± 2 db from 10 cycles to 1 megacycle useful to over 5 megacycles.
- High sensitivity in vertical amplifier. .025 volts RMS per inch deflection.
- New 3 step input attenuator inpuf ranges X1, X10, X100.
- Terminal board and rear cabinet opening provisions for direct connections to deflecting plates.
- Newly styled formed and ventilated aluminum cabinet.
- Wide band sweep generator, 15 cycles to over 100 kc. Will synchronize with 5 megacycle signal.
- 10 tube circuit featuring push pull operation of vertical and horizantal amplifiers.
- Internal synchronization on either positive or negative peaks.
- Reproduces faithfully the front and back parches of TV sync pulses. Excellent square wave reproduction to over 100 kc.
- Optional Intensifier kit available for 2200 volt operation.

Proudly announcing the new 1953 HEATHKIT Model O-8 OSCILLOSCOPE featuring the finest performance ever offered in this extremely popular kit instrument. Improved wider band vertical amplifier featuring a new 3-step input attenuator affording smooth control of the excellent .025 volts per inch vertical sensitivity. Possibility of overloading the vertical input circuit is minimized. Greater band width in the vertical channel is a decided advantage to TV service men. Permits clear observation of all TV sync pulse detail and excellent square wave reproduction over 100 kc. A handsome, ventilated cabinet with smooth rounded corners and a snug fitting drawn panel adds to the smartly styled professional appearance. Longer life is assured through cooler instrument operation. Push pull output stages in both vertical and horizontal amplifiers for balanced deflection of the spot. All of the many fine features of the previous model have been retained. Rear cabinet access to terminal board for direct connection to CR plates. The entire kit of all 10 tubes, parts, cabinet and panel as well as detailed construction manual for assembly and operation of the instrument included.

Heathkit SCOPE DEMODULATOR PROBE KIT

Trouble shooting or aligning TV, RF, IF and video stages requires demodulation of high frequency signals before Oscilloscope observation. The HEATHKIT SCOPE DEMODULATOR PROBE KIT was specifically developed for this application. Kit consists of a probe housing, crystal diode detector circuit, shielded cable and spade lugs Assembly is simple and the probe will quickly prove its usefulness as an Oscilloscope accessory

No. 337
SHIP. WT. 1 LB.
$4.50

NEW *Heathkit* VOLTAGE CALIBRATOR KIT

MODEL VC-1
SHIPPING WT. 5 LBS.
$9.50

Use the Heathkit Voltage Calibrator with your oscilloscope to measure peak-to-peak TV complex waveshapes. TV manufacturer's specifications indicate correct peak-to-peak voltages and this kit will permit making these important measurements.

A big help to engineers in circuit work. Makes peak-to-peak voltage measurements of complex waveshapes of all kinds. Flat topped semi-square wave output of calibrator assures fast and easy measurement of any voltage between .01 and 100V peak-to-peak.

The Voltage Calibrator can remain connected to your oscilloscope at all times for instant use. "Signal" position connects signal under study directly through calibrator and into scope input circuit for direct observation. Eliminates transfering leads from calibrator *A wonderful scope accessory.*

Heathkit ELECTRONIC SWITCH KIT

A few dollars spent for this accessory will increase the usefulness of a scope immeasurably An electronic switch will open up a whole new field of scope applications for you. The S-2 allows TWO SIGNALS to be observed at the SAME TIME — this important feature allows you to immediately spot phase shift, clipping, distortion, etc The two signals under observation can be superimposed or separated for individual study Each signal input has an individual gain control for properly adjusting scope trace patterns. Has both coarse and fine frequency controls for adjusting switching time. Multivibrator switching frequency is from less than 10 cps to over 2000 cps in three overlapping ranges. Kit comes complete including 5 tubes, power transformer, all controls, instruction manual, etc *Every scope owner should have one!*

MODEL S-2
SHIPPING WT. 11 LBS.
$19.50

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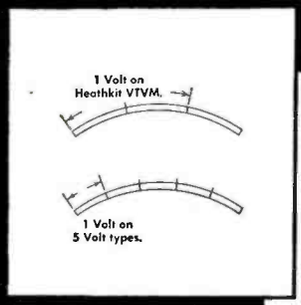
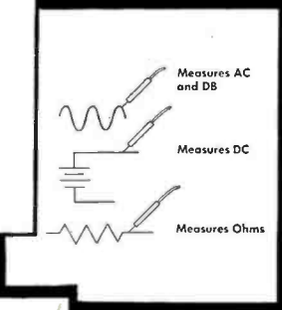
Heathkit VACUUM TUBE VOLTMETER KIT

• NEW 1½ VOLT RANGE ON 1953 VTVM.

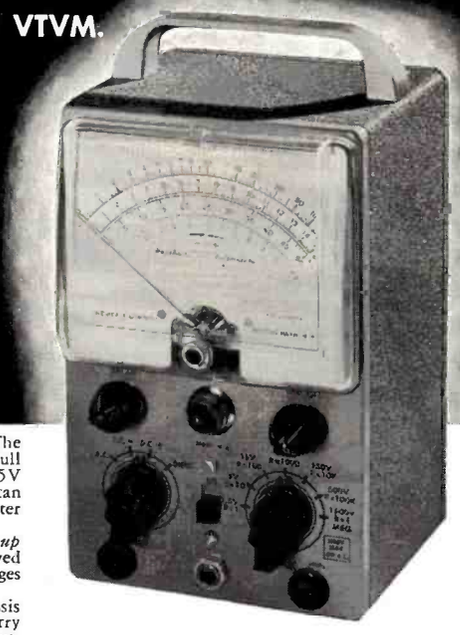
MODEL V-6

SHIPPING WT., 7 LBS.





$24.50



- New 1½ volt low range gives over 2" of scale per volt instead of less than ¾" found on 5 volt range type.
- Increased accuracy due to expanded scales.
- New 1500 volt DC high range gives 50% greater coverage.
- Seven ranges in all. 1½, 5, 15, 50, 150, 500 and 1500 volts DC (1000 volts maximum AC only).
- Provides proper service ranges 150 volts for AC DC work and 500 volts for AC type service.
- High input impedance, 11 megohms minimizes circuit loading.
- Variety of accessory probe kits available.
- 1% precision resistors in multiplier circuits.
- 200 microampere Simpson meter.
- Center scale zero adjust.
- Transformer operated.
- Test leads included.
- New cabinet styling.
- Large, clearly marked meter scales indicate ohms, AC volts, DC volts and DB.

The 1953 Heathkit V-6 VTVM has improved ranges! The lowest range has been moved way down to 1.5V full scale. This gives 3½" of actual scale length for the 1.5V covered — *that's 2⅓ inches per volt!!* Now you can make your low level measurements faster and with greater accuracy.

And the upper range has been moved up. *Readings up to 1500V DC* can be readily made with new, improved VTVM — plus readings up to 1000V on AC. Higher ranges for extended use.

New vertical chassis mounting gives added chassis space for really easy wiring — no tight corners to worry about. Uses only highest quality components throughout, Simpson 200 microampere meter movement combined with 1% precision resistors in multiplier circuit insure highly accurate and dependable readings.

AC and DC voltage ranges are 0-1.5V-5V-15V-50V-150V-500V-1500V. (1000V max. reading on AC) — a total of seven ranges for convenient, accurate readings. Instrument also measures resistance from .1 ohm to over 1 billion ohms in seven handy ranges of RX1, X10, X100, X1000, X10K, X1 Meg., — all convenient multiples of 10 with no skips. Has Db scale in red for easy indentification.

New panel has tough *baked on enamel finish* for freedom from scratches and maximum durability. Modern styled, formed, compact cabinet with rounded edges and crackle finish is truly handsome.

Comprehensive, detailed instruction manual with step-by-step instructions, figures, pictorials, etc. makes assembly a cinch.

Be sure and look over the special accessory VTVM probes below — for added usefulness.

Heathkit R. F. PROBE KIT

SHIP. WT 1 LBS. **$5.50**

No. 309

Extends RF range of HEATHKIT 11 megohm VTVM to 250 megacycles ± 10%.

Heathkit 30,000 V. D.C. PROBE KIT

SHIP. WT. 2 LBS. **$5.50**

No. 336

Provides DC multiplication factor of 100 for any 11 megohm VTVM.

Heathkit PEAK TO PEAK VOLTAGE PROBE KIT

SHIP. WT. 2 LBS. **$6.50**

No. 338

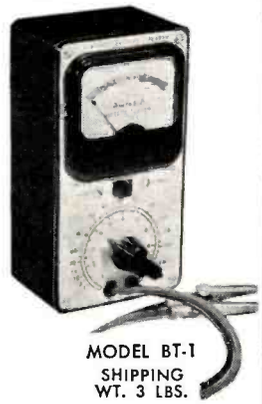
Reads on DC scale of any 11 megohm VTVM 5 kc to 5 megacycle range.

NEW Heathkit BATTERY TESTER KIT

The new Heathkit Battery Tester measures all types of dry batteries between 1½ volts and 150 volts under actual load conditions. Readings are made directly on a three-color GOOD-WEAK-REPLACE scale that your customers can readily understand. Operation is extremely simple and merely requires that the leads be connected to the battery under test. Only one control to adjust in addition to a panel switch for A or B battery types.

The Heathkit Battery Tester features compact assembly. An accurate meter movement and wire wound control mount in the portable, rugged plastic case.

Use the BT-1 to check portable radio batteries, hearing aid batteries, lantern batteries and photo flash gun batteries.



MODEL BT-1

SHIPPING WT. 3 LBS.

$7.50

Heathkit AC VACUUM TUBE VOLTMETER KIT

A new AC VTVM that makes possible those sensitive AC measurements required by laboratories, audio enthusiasts and experimenters. Ten full scale ranges of .01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts RMS. 10 DB ranges from −52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 kc. Simpson 200 microampere meter with large plainly marked meter scales. Precision multiplier resistors. Two amplifier stages using miniature tubes. A unique bridge rectifier meter circuit and a clean layout of parts. Order the AV-2 today and become acquainted with the interesting possibilities offered by this instrument.

MODEL AV-2

SHIPPING WT. 5 LBS.

$29.50

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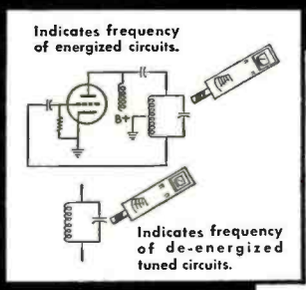
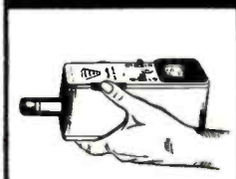
NEW *Heathkit* GRID DIP METER KIT

• CONVENIENT ONE HAND OPERATION.




Complete unit easily held and operated with one hand.

MODEL GD-1

SHIPPING WT. 4 LBS.

$19.50

- New GRID DIP METER with assembled calibrated coils.
- Uses quality Simpson 500 microampere meter.
- One hand operation, extremely compact. Only 2½" wide by 3" high by 7" long.
- Variable meter sensitivity control.
- Uses newest type 6AF4 high frequency triode in a Colpitts oscillator circuit.
- Continuous coverage from 2 megacycles to over 250 megacycles in 6 ranges.
- Head phone monitoring jack.
- AC power transformer operated for maximum safety.

Here is the GRID DIP METER KIT you have been asking for. This new HEATHKIT instrument is compact, highly sensitive and easy to use. Housed in a handsome formed aluminum cabinet—rounded corners—durable oven baked finish on panel and cabinet. The entire instrument can be easily held and operated in one hand, tuning accomplished with the thumb wheel drive. This excellent design feature leaves the other hand entirely free for making circuit adjustments. The instrument with many applications — with oscillator energized, use it for finding the resonant frequency of tuned circuits, locating parasitics, determining characteristics of filter circuits, roughly tuning transmitter stages with power off, and neutralizing transmitters. Useful in TV and radio repair work for alignment of traps, filters, IF stages, peaking and compensation networks within the 2 to 250 megacycle range. With the oscillator not energized, the instrument acts as an absorption wave meter and indicates the frequency of radiating power sources. Locates spurious oscillations, as a relative indication of power in various transmitter stages, etc. Phone jack permits monitoring of AM transmitter for determination of radiated hum, audio quality, etc. (Head phones not included). Complete kit includes plug-in coils, tube, all necessary parts and detailed assembly and instruction manual.

Heathkit IMPEDANCE BRIDGE KIT

MODEL IB-1B

SHIPPING WT. 15 LBS.

$69.50

The HEATHKIT IMPEDANCE BRIDGE is especially useful in educational training programs, industrial laboratories and for experimental work. Use it for measuring AC and DC resistance value of resistors, determination of condenser capacitance and dissipation factor, finding coil inductance and storage factor, electrical measurements work, etc. Quality components: GR 1000 cycle hummer, GR main control, Mallory ceramic wafer silver plated contact switches, ½% precision resistors, etc. The basic circuit is a self powered, 4 arm bridge. Choice of Wheatstone, Capacitance comparison, Maxwell or Hay bridge circuits. Resistance from 10 milliohm to 10 megohm. Capacitance 10 mmf to 100 mfd. Inductance 10 microhenry to 100 henries. Dissipation factor .002 to 1. Storage factor (Q) 1 to 1000. The IMPEDANCE BRIDGE has provisions for external generator use for measurement at other than the 1000 cycle level. Take the guess work out of electrical measurements. The HEATHKIT IMPEDANCE BRIDGE mounted in a beautiful polished birch cabinet with large easy reading panel calibrations will furnish years of accurate, trouble free measurement service.

Heathkit HANDITESTER KIT

The HEATHKIT Model M-1 HANDITESTER fulfills requirements for a portable volt ohm milliammeter. This kit features precision 1% resistors, 3 deck switch for trouble free mounting of parts, specially designed battery bracket, smooth acting ohms adjust control, beautiful molded bakelite case and a 400 microampere meter movement. 5 convenient AC and DC voltage ranges as follows: 10 - 30 - 300 - 1000 - 5000 volts. Ohms ranges 0 - 3000 and 0 - 300,000. DC milliampere ranges 0 - 10 milliamperes and 0 - 100 milliamperes. The instrument is easily assembled from complete instructions and pictorial diagrams. Test leads are included. Carry the HEATHKIT M-1 HANDITESTER in your tool box at all times for those simple jobs and eliminate that extra trip for additional testing equipment.

MODEL M-1

SHIPPING WT. 3 LBS.

$13.50

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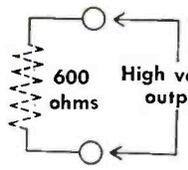
NEW *Heathkit* AUDIO GENERATOR KIT

• RANGE EXTENDED TO 1 MEGACYCLE

MODEL AG-8

SHIPPING WT. 16 LBS.

$29.50



Low impedance output
High voltage output

Sine wave output from 20 cycles to 1 megacycle.

- Improved design — new low price.
- Frequency coverage in five ranges from 20 cycles per second to 1 megacycle.
- Response flat 1 DB from 20 cycles to 400 kilocycles. Down 3 DB at 600 kilocycles. Down only 8 DB at 1 megacycle.
- Five calibrated output voltage ranges, continuously variable 1 mv, 10 mv, 100 mv, 1 v, 10 v.
- Low impedance output circuit. 600 ohms.
- Distortion less than .4 of 1% from 100 cycles per second through the audible range.
- New HEATHKIT universal type binding posts.
- Durable infra-red baked enamel panel.
- Transformer operated for safe operation.
- Sturdy, ventilated steel cabinet.

A new Audio Generator with features heretofore found in only the most expensive generators. Such features as complete coverage from 20 cycles to 1 Mc — response flat ±1 db from 20 cycles to 400 Kc, down 3 db at 600 Kc and down only 8 db at 1 Mc.

And it has calibrated output . . . Calibrated continuously variable and step attenuator output controls allow you to easily set calibrated output voltage. Moreover, distortion is less than .4 of 1% from 100 cps through the audible range.

Oscillator section consists of a two stage resistance coupled amplifier (6SJ7 and 6AK6) utilizing both positive and negative feedback for oscillator operation and reduction of distortion. Oscillator section drives a cathode follower output power amplifier (6AK6) which isolates the oscillator from variations in load and presents a low impedance output (600 Ohms). Power supply is transformer operated and utilizes 6X5 rectifier with 2 sections of RC filtering.

An unbeatable dollar value — for here is an audio generator with wide frequency coverage, excellent frequency response, stepped and continuously variable calibrated output, high signal level, low impedance output, and low inherent distortion.

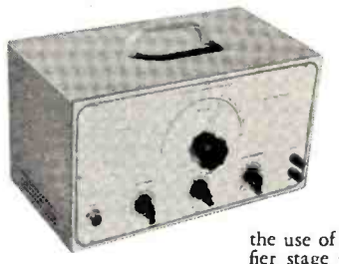
Heathkit AUDIO FREQUENCY METER KIT

The HEATHKIT AUDIO FREQUENCY METER provides a simple and easy way to check unknown audio frequencies from 10 cycles to 100 kc between 3 and 300 volts RMS. The instrument features 7 ranges for accuracy and wide coverage. The meter itself has a quality 200 microampere Simpson movement and large clearly marked scales. The AUDIO FREQUENCY METER is transformer operated and features a voltage regulator tube to maintain constant plate voltage on the second stage. Kit supplied complete with all necessary construction material and a detailed construction manual.

SHIPPING WT. 15 LBS.

MODEL AF-1 $34.50

NEW *Heathkit* AUDIO OSCILLATOR KIT



A new Audio Oscillator with both sine and square wave coverage from 20 to 20,000 cycles . . . An instrument designed to completely fulfill the needs of the audio engineer and enthusiast — Has numerous advantages such as high level output (up to 10V obtainable across the entire range), distortion less than .6%, and low impedance output.

Special design features include the use of a thermistor in the second amplifier stage for keeping the output essentially flat across the entire range.

A cathode coupled clipper circuit produces good, clean, square waves with rise time of only 2 microseconds. Oscillator section uses 1% precision resistors in range multiplier circuit for greatest accuracy.

You'll like the operation of this fine new kit.

MODEL AO-1
SHIPPING WT. 14 LBS.

$24.50

Heathkit SQUARE WAVE GENERATOR KIT

The HEATHKIT SQUARE WAVE GENERATOR is an excellent square wave frequency source with wide range coverage from 10 cycles to 100 kc continuously variable. This feature makes it useful for TV and wide band amplifier work as well as audio experimentation. The output voltage is continuously variable between 0 and 20 volts. The circuitry consists of a multivibrator stage, a clipping and squaring stage and a cathode follower low impedance output stage. The power supply is transformer operated and utilizes a full wave rectifier circuit with two sections of filtering. Another excellent HEATHKIT value at this remarkable low price. Kit includes all necessary construction material as well as complete instruction manual for assembly and operation.

MODEL SQ-1
SHIPPING WT. 14 LBS.

$29.50

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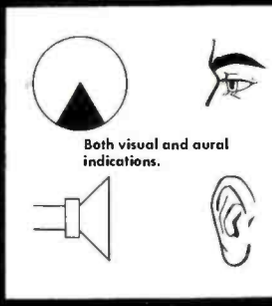
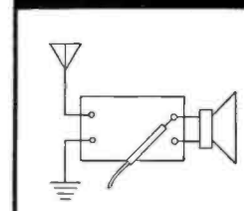
NEW *Heathkit* VISUAL-AURAL SIGNAL TRACER KIT

• NEW NOISE LOCATOR AND WATTMETER CIRCUITS.



Both visual and aural indications.



Traces signals from antenna clear through speaker.

MODEL T-3

SHIPPING WT. 8 LBS.

$22.50

- Permits visual signal observation as well as aural operation.
- Two separate input channels.
- Tremendous RF channel sensitivity. Adequate for actual signal detection at receiver input.
- Separate high gain RF and low gain audio channels.
- A unique and useful noise locater circuit.
- Built-in calibrated wattmeter.
- Two separate shielded probes for RF and audio application.
- Additional test leads supplied.
- Substitution test speaker and output transformer eliminates necessity for speaker removal in service work.
- Utility amplifier. Check record changers, tuners, microphones, instrument pickups, etc.
- VTVM and Scope panel terminals.
- 5 tube transformer operated circuit.

The new HEATHKIT VISUAL AURAL SIGNAL TRACER represents one of the most convenient and useful instruments the service man can use in AM, FM and TV service work. The electron ray beam indicator constantly monitors both input channels for visual observation of the signal. Now, see and hear the signal level for easier estimation of signal strength and gain per stage in a receiver circuit. Separate high gain channel and special shielded demodulator probe for RF circuit work. Low gain channel for audio circuit investigation and for use as a noise locater. In this feature, approximately 200 volts DC is applied to a suspected circuit component and the action of the voltage in the component can be seen and heard to determine satisfactory operation. This feature alone will prove tremendously helpful in locating the source of objectionable noises in coils, transformers, resistors, condensers, cold solder joints, controls, etc. A convenient wattmeter permits rapid preliminary check for voltage distribution circuit breakdown as well as transformer failures. Use the T-3 as a universal test speaker and substitution transformer and save service time by eliminating the necessity for speaker removal on every service call. Additional service uses are: as a utility amplifier for checking the output of record changers, tuners, microphones, instrument pickups, etc. Separate panel terminals permit utilization of other shop equipment such as your Oscilloscope or VTVM. Entire kit supplied complete with 5 tubes, all necessary construction material along with a detailed step by step instruction manual for the assembly and operation of the instrument.

NEW *Heathkit* CONDENSER CHECKER KIT

MODEL C-3

SHIPPING WT. 7 LBS.

$19.50

Announcing the new improved Model C-3 HEATHKIT CONDENSER housed in a new smartly styled professional appearing cabinet featuring rounded corners and snug fitting drawn panel. Adequate provisions for ventilation insures longer instrument life through cooler operation. Use the C-3 to accurately measure those unknown condenser and resistor values. All readings of condensers and resistors are read directly on the calibrated scales. Range of condenser measurements is from .00001 mfd to 1000 mfd. Calibrated resistance measurements can be made from 100 ohms to 5 megohms. A leakage test with a choice of 5 DC polarizing voltages will quickly indicate condenser operating quality under actual voltage load conditions. The spring return leakage test switch automatically discharges the condenser under test and eliminates shock hazard. An electron ray beam indicator tube is used in a new leakage test circuit for added sensitivity. The instrument is transformer operated for safety and will prove an extremely welcome addition to your shop equipment. The kit is furnished complete with all necessary parts, test leads and includes a step by step detailed construction manual for assembly and operation.

Heathkit TV ALIGNMENT GENERATOR KIT

MODEL TS-2

SHIPPING WT. 20 LBS.

$39.50

Here is an excellent TV ALIGNMENT GENERATOR designed to do TV service work quickly, easily and properly. The Model TS-2 when used in conjunction with an Oscilloscope provides a means of correctly aligning TV receivers. The instrument furnishes a frequency modulated signal covering in 2 bands the range of 10 to 90 megacycles and 150 to 230 megacycles. An absorption type frequency marker covers from 20 to 75 megacycles in 2 ranges: therefore you have a simple, convenient means of checking IF's independent of oscillator calibration. Sweep width is variable from 0 to 12 megacycles. Other excellent features are horizontal sweep voltage controlled with a phasing control — both step and continuously variable attentuation for setting the output signal to the desired level — a convenient stand by switch — and blanking for establishing a single trace with a base reference level. Make your work easier, save time and repair with confidence. Order your HEATHKIT TV ALIGNMENT GENERATOR now.

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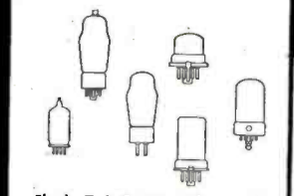
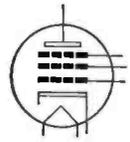
Heathkit TUBE CHECKER KIT



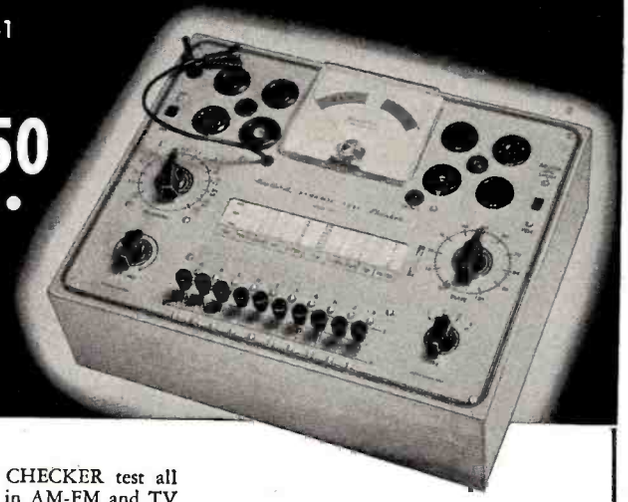
Checks 7, 8, 9 prong tubes, octals, loctals, 7 and 9 prong miniatures, 5 prong Hytrons, pilot lights.



Checks for opens, shorts, emission, filament and filament tap continuity.

MODEL TC-1
SHIPPING
WT. 12 LBS.

$29.50



- Beautiful counter type birch cabinet.
- 4½" Simpson 3 color meter.
- Simplified setup procedure.
- Built-in gear driven roll chart.
- Checks emission, shorted elements, open elements and continuity.
- Complete protection against obsolescence.
- Sockets for every modern tube.
- Blank for new types.
- Individual element switches.
- Contact type pilot light test socket.
- Line adjust control.

PORTABLE TUBE CHECKER KIT MODEL TC-1P

Same as TC-1 except supplied with polished birch cabinet (with removable lid) instead of counter type cabinet. Shipping weight 14 lbs..... **$34.50**

No. 365 Polished Birch Tube Checker Cabinet only. Shipping Weight 7 lbs..... **$7.50**

With the HEATHKIT TC-1 TUBE CHECKER test all types of tubes commonly encountered in AM-FM and TV receiver circuits. Test setup procedure is simplified, rapid and flexible. Tube quality is read directly on a beautiful 4½" Simpson three color BAD - ? - GOOD scale that your customers can readily understand. Panel sockets accommodate 4, 5, 6 and 7 prong tubes, octals, loctals, 7 and 9 prong miniatures, 5 prong Hytrons, a blank socket for new tubes and a contact type socket for quick checking of pilot lights. Built-in gear driven roll chart for instant reference. Neon short indicator, individual three position lever switch for each tube element, spring return test switch, line set control to compensate for supply voltage variations. At this low price, no service man need be without the advantages offered by the HEATHKIT TUBE CHECKER.

Heathkit TV PICTURE TUBE TEST ADAPTER

Use your HEATHKIT TUBE CHECKER with this new TV TEST ADAPTER to determine picture tube quality. Check for emission and shorts, independent of TV power supply. Consists of standard 12 pin TV tube socket, 4 feet of cable, octal socket connector and data sheet. Quickly prove TV picture tube condition to yourself and your customer.

No. 355
Ship. Wt. 1 lb.
$4.50

Heathkit RESISTANCE SUBSTITUTION BOX KIT

MODEL RS-1
SHIPPING
WT. 3 LBS.

$5.50

NEW HEATHKIT RESISTANCE SUBSTITUTION BOX KIT provides switch selection of any single one of 36 RTMA 1 watt 10% standard value resistors, ranging from 15 ohms to 10 megohms. This coverage available in 2 ranges in decades of 15, 22, 33, 47, 68 and 100. Housed in rugged plastic cabinet featuring new HEATHKIT universal type binding posts. The entire kit priced less than the retail value of the resistors alone.

Heathkit BATTERY ELIMINATOR KIT

A clean 6 volt d-c supply source is definitely required for successful automobile radio servicing. Has a continuously variable d-c output from 0 to 8 volts. It can be safely operated at a steady 10 ampere level and will deliver up to 15 amperes for intermittent periods. The voltage output terminals are completely isolated from the chassis to accommodate additional service applications such as supplying bias voltages or d-c substitution voltages for battery operated tube filament circuits.

The output of the Battery Eliminator is constantly monitored by a d-c voltmeter and a d-c ammeter. The circuit features an automatic overload relay of self resetting type. For additional protection, a panel mounting fuse is provided. Build this kit in a few hours and pocket a substantial savings.

MODEL BE-3
SHIPPING
WT. 20 LBS.

$24.50

Heathkit VIBRATOR TESTER KIT

Repair time is valuable, and the Heathkit Vibrator Tester will save you hours of work. Instantly tells the condition of the vibrator under test — and the check is thorough and complete. Checks vibrator for proper starting, and the easy-to-read meter indicates the quality of output on large BAD-GOOD scales. Tests both interrupter and selfrectifier types of vibrators. Five different sockets for checking hundreds of vibrators.

Operates from any battery eliminator capable of delivering continuously variable voltage from 4 - 6V at 4 amps. The Heathkit BE-3 Battery Eliminator is ideal for operating this kit.

Faulty vibrators can be spotted within seconds and you're free to go on to other service jobs.

MODEL VT-1
SHIPPING
WT. 7 LBS.

$14.50

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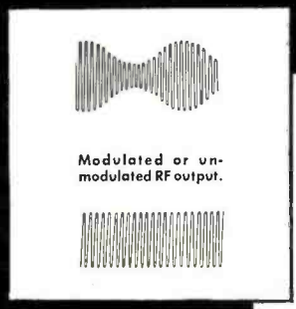
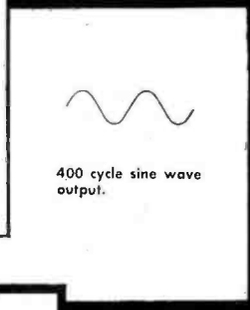
CABLE ARLAB-N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

Heathkit SIGNAL GENERATOR KIT





MODEL SG-7

SHIPPING WT. 7 LBS.

$19.50

- Step attenuated RF ouput.
- 6 to 1 vernier dial ratio.
- Turret mounted coil sub-assembly.
- Pre-calibrated and adjusted coils.
- Hartley RF oscillator circuit.
- Colpitts oscillator 400 cycle sine wave output.
- Modulated or unmodulated RF output.
- Frequency coverage on fundamentals 160 kc to 50 megacycles in five ranges. 51 megacycles to 150 megacycles on calibrated harmonics.
- RF output in excess of 100,000 microvolts.
- Audio output 1½ to 2 volts.
- AC transformer operated.
- Professionally styled cabinet.
- Infra red baked enamel panel.

The new HEATHKIT Model SG-7 SIGNAL GENERATOR easily fulfills requirements for a controllable, modulated or unmodulated source of variable frequency. A convenient 400 cycle sine wave output is available for audio work. All RF oscillator coils are precision wound and adjusted to calibration before shipment thereby assuring maximum accuracy. The coils, band switch and tuning condenser all mount as a turret assembly so as to offer the advantage of short wiring leads and easy mounting of parts. The RF output circuit is of the low impedance type obtained by the use of cathode coupling to the output jacks. The level of RF output is varied by means of the RF step and RF output control. Use the HEATHKIT SG-7 as an RF signal source modulated or unmodulated for radio repair, laboratory work, experimental testing, 400 cycle sine wave audio testing, checking RF stages, alignment of both AM and FM IF stages, marker generator for TV alignment, etc. The kit is transformer operated and utilizes miniature tubes for ease in handling high frequency. Panel jacks and a convenient switching system permit either external or internal modulation. The entire kit is supplied complete with tubes and all necessary material as well as a detailed step by step instruction manual for the assembly and operation of the instrument.

Heathkit INTERMODULATION ANALYZER KIT

MODEL IM-1

SHIPPING WT. 18 LBS.

$39.50

The HEATHKIT MODEL IM-1 is an extremely versatile instrument specifically designed for measuring the degree of interaction between two signals caused by a specific piece of apparatus, or a chain of equipment. It is primarily intended for tests of audio equipment but may be used in other applications such as making tests of microphones, records, recording equipment, phonograph pickups and loud speakers. Use it for checking tape or disc recordings, as a sensitive AC voltmeter, as a high pass noise meter for adjusting tape bias, cutting needle pitch or other applications. High and low test frequency source, intermodulation section, power supply and AC voltmeter all in one complete unit. Percent intermodulation is directly read on three calibrated ranges, 30%, 10% and 3% full scale. Both 4 to 1 and 1 to 1 ratios of low to high frequencies easily set up. At this low kit price YOU can enjoy the benefits of Intermodulation analysis for accurate audio interpretations.

Heathkit LABORATORY REGULATED POWER SUPPLY KIT

MODEL PS-2

SHIPPING WT. 20 LBS.

$29.50

New HEATHKIT LABORATORY POWER SUPPLY provides continuously variable regulated DC voltage output from 160 volts to 400 volts depending on load. Panel terminals supply separate 6.3 V. AC supply at 4 amperes for filament circuits. A 3½" plastic cased panel mounted meter provides accurate metered output for either voltage of current measurements. Exceptionally low ripple content of .012% admirably qualifies the HEATHKIT LABORATORY POWER SUPPLY for high gain audio applications. Ideal for laboratory work requiring a reference voltage for meter calibration or for plotting tube characteristics. In service work, it can be used as a separate variable voltage supply to determine the desirable operating voltage in a specific circuit. Use it as a DC substitution voltage in trouble shooting TV circuits exhibiting symptoms of extraneous undesirable components in plate supply circuits. Entire kit, including all 5 tubes now available at this low price.

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CABLE: ARLAB-N.Y.

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

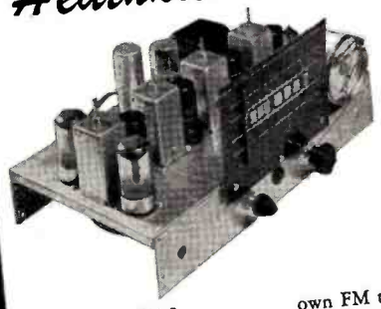
Heathkit WILLIAMSON TYPE AMPLIFIER KIT

The new HEATHKIT WILLIAMSON TYPE AMPLIFIER incorporates the latest improvements described in Audio Engineering's "Gilding the Lily." 5881 output tubes and a new Peerless output transformer with additional primary taps afford peak power output of well over 20 watts. Frequency response ±1 db from 10 cycles to 100 kc. allows reproduction of highs and lows with equal crispness and clarity. Harmonic and intermodulation distortion have been reduced to less than ½ of 1% at 5 watts. This eliminates the harsh unpleasant qualities which contribute to listening fatigue. Make this amplifier the heart of your radio system to achieve the fine reproduction that is the goal of all music lovers.

The HEATHKIT PREAMPLIFIER (available separately or in combination with the amplifier kit) features inputs for magnetic or low level cartridges, crystal pickups and tuners, turnover control for LP or 78 type records, individual bass and treble tone controls each providing up to 15 DB of boost or attenuation. Special notched shafts on preamplifier controls and switches adaptable to custom installation. The preamplifier can be mounted in any position and a liberal length of connecting cable is supplied. No radio experience is required to construct this amplifier. All punching, forming, or drilling has already been done. The complete kit includes all necessary parts as well as a detailed step by step construction manual with pictorial diagrams to greatly simplify the construction.

ACROSOUND TRANSFORMER OPTION. If desired, the output transformer with the kit will be the Acrosound output transformer, type TO-300. The use of this transformer permits ultra-linear operation as described in Audio Engineering's "Ultra-Linear Operation of the Williamson Amplifier."

Heathkit FM TUNER KIT



MODEL FM-2
SHIPPING
WT. 9 LBS.
$22.50

The HEATHKIT MODEL FM-2 TUNER specifically designed for simplified kit construction features a preassembled and adjusted tuning unit. Three double tuned IF transformers and a discriminator transformer are used in an 8 tube circuit. Smooth tuning is obtained through a 9 to 1 ratio vernier drive using a calibrated six inch slide rule type dial. The usual frequency coverage of 88 to 108 megacycles is provided. Experience the thrill of building your own FM tuner. Operate it through your amplifier or radio and enjoy all the advantages of true FM reception. Transformer operated power supply to simplify connections to all types of audio systems. The kit is supplied complete with all 8 tubes and necessary material required for construction. A complete instruction manual simplifies assembly and operation.

PRICES OF VARIOUS COMBINATIONS

W-2 Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. **$69.50**

W-2M Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only **$49.75**

W-3 Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. Shipped express only **$69.50**

W-3M Amplifier Kit (Incl. Main Amplifier with Acrosound Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only **$49.75**

WA-P1 Preamplifier Kit only. Shipping Weight 7 lbs. Shipped express or parcel post. **$19.75**

Heathkit ECONOMY 6 WATT AMPLIFIER KIT

MODEL A-7
SHIPPING
WT. 10 LBS.
$14.50

The HEATHKIT Model A-7 amplifier features beam power, push pull output with frequency response flat ±1½DB from 20 to 20,000 cycles. Separate volume, bass and treble controls. Two input circuits, output impedances of 4, 8, and 15 ohms. Peak power output rated at full 6 watts. High quality components, simplified layout, attractive gray finished chassis, break off type adjustable length control shafts and attractive lettered control panel.

THE MODEL A7A amplifier incorporates a preamplifier stage with special compensated network to provide the necessary voltage gain for operation with variable reluctance or low output level phono cartridges. Excellent gain for microphone operation in a moderate powered sound system.....**$16.50**

Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT

The HEATHKIT MODEL A-8 amplifier kit was designed to deliver high fidelity performance with adequate power output at moderate cost. The frequency response is within ± 1 DB from 20 to 20,000 cycles. Distortion at 3 DB below maximum power output at 1000 cycles is only .8%. The amplifier features a Chicago power transformer in a drawn steel case and a Peerless output transformer with output impedances of 4, 8, and 16 ohms available. Separate bass and treble tone controls permit wide range of tonal adjustment to meet the requirements of the most discerning listener. The amplifier uses a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter and two 6L6's in push pull output and a 5U4G rectifier. Two input jacks for either crystal or tuner operation. The kit includes all necessary material as well as a detailed step by step construction manual.

MODEL A-8
SHIPPING WT. 19 LBS.
$33.50

MODEL A8-A features an added 6SJ7 stage (preamplifier) for operating from a variable reluctance cartridge or other low output level phono pickups. Can also be used with a microphone. A 3 position panel switch affords the desired input service. **$35.50**

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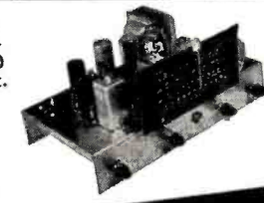
Heathkit SUPERHETERODYNE RECEIVER KITS

- **High gain dual iron core tuned type IF transformers**
- **AC transformer operation for safety**
- **Continuously variable tone control**
- **Sturdy punched and plated steel chassis**
- **Ideal for custom installation**
- **Full AVC action**
- **Inverse feedback for improved frequency response**
- **Kit supplied with all necessary construction material except speaker and cabinet. (Available separately if desired).**

6 tube all wave circuit. 3 ranges, continuous coverage 550 kc to over 20 megacycles, shipping wt. 11 lbs.

Model AR-1

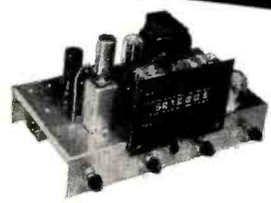
$23.50



5 tube broadcast band 550 to 1600 kc coverage, shipping wt. 11 lbs.

Model BR-1

$19.50



Two excellent radio receiver kits featuring clean design and open layout for simplified construction. Satisfy that urge to build your own radio receiver and select the model which meets your requirements. Both receivers feature continuously variable tone control, a radio phono switch and phono input and an AC receptacle for the phono motor. A six inch calibrated slide rule type dial with a 9 to 1 ratio vernier dial drive insures easy tuning.

SHIPPING INFORMATION

ON PARCEL POST ORDERS include postage for weight shown and insurance. (We insure all shipments.) Don't worry about sending more than the correct amount — if you send us too much, every extra cent will be promptly returned.

ON EXPRESS ORDERS do not include transportation charges. They will be collected by Express Agency on delivery.

ORDERS FROM CANADA must include full remittance for merchandise.

Orders processed on the same day received. Customers notified of unavoidable delay.

U. S. postal or express money orders, bank drafts or checks are acceptable. Do not send loose coins or stamps.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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. . . BENTON HARBOR 15, MICHIGAN

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(PLEASE PRINT)

SHIP VIA

- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	PRICE		QUANTITY	ITEM	PRICE	
	Heathkit Oscilloscope Kit—Model O-8 (29 lbs.)	$43.50			Heathkit Square Wave Gen. Kit—Model SQ-1 (14 lbs.)	$29.50	
	Heathkit Intensifier Kit (0-8 only) No. 339 (1 lb.)	7.50			Heathkit AC VTVM Kit—Model AV-2 (5 lbs.)	29.50	
	Heathkit Voltage Calibrator Kit—Model VC-1 (5 lbs.)	9.50			Heathkit Intermodulation Analyzer Kit—Model IM-1 (18 lbs.)	39.50	
	Heathkit Electronic Switch Kit—Model S-2 (11 lbs.)	19.50			Heathkit Regulated Power Supply Kit—Model PS-2 (20 lbs.)	29.50	
	Heathkit Scope Demodulator Probe Kit No. 337 (1 lb.)	4.50			Heathkit Handitester Kit—Model M-1 (3 lbs.)	13.50	
	Heathkit T.V. Alignment Generator Kit—Model TS-2 (20 lbs.)	39.50			Heathkit Decade Resistance Kit—Model DR-1 (4 lbs.)	19.50	
	Heathkit Q Meter Kit—Model QM-1 (12 lbs.)	39.50			Heathkit Decade Condenser Kit—Model DC-1 (4 lbs.)	16.50	
	Heathkit Grid Dip Meter Kit—Model GD-1 (4 lbs.)	19.50			Heathkit Impedance Bridge Kit—Model IB-1B (15 lbs.)	69.50	
	Heathkit VTVM Kit—Model V-6 (7 lbs.)	24.50			Heathkit Battery Tester Kit—Model BT-1 (3 lbs.)	7.50	
	Heathkit RF Probe Kit No. 309 (1 lb.)	5.50			Heathkit Resistance Substitution Box Kit—Model RS-1 (3 lbs.)	5.50	
	Heathkit HV Probe Kit No. 336 (2 lbs.)	5.50			Heathkit F.M. Tuner Kit—Model FM-2 (9 lbs.)	22.50	
	Heathkit Peak-to-Peak Volt. Probe Kit No. 338 (2 lbs.)	6.50			Heathkit Broadcast Receiver Kit—Model BR-1 (11 lbs.)	19.50	
	Heathkit Visual-Aural Signal Tracer Kit—Model T-3 (8 lbs.)	22.50			Heathkit Three Band Receiver Kit—Model AR-1 (11 lbs.)	23.50	
	Heathkit Condenser Checker Kit—Model C-3 (7 lbs.)	19.50			Heathkit Amplifier Kit—Model A-7 (10 lbs.)	14.50	
	Heathkit RF Signal Generator Kit—Model SG-7 (7 lbs.)	19.50			Heathkit Amplifier Kit—Model A-7A (10 lbs.)	16.50	
	Heathkit Tube Checker Kit—Model TC-1 (12 lbs.)	29.50			Heathkit Amplifier Kit—Model A-8 (19 lbs.)	33.50	
	Heathkit T.V. Tube Adapter No. 355 (1 lb.)	4.50			Heathkit Amplifier Kit—Model A-8A (19 lbs.)	35.50	
	Heathkit Battery Eliminator Kit—Model BE-3 (20 lbs.)	24.50			Williamson Type Amplifier Kit (Type) Shipped express only		
	Heathkit Vibrator Tester Kit—Model VT-1 (7 lbs.)	14.50			WA-P1 Preamplifier Kit (7 lbs.) (Shipped exp. or p.p.)	19.75	
	Heathkit Audio Generator Kit—Model AG-8 (16 lbs.)	29.50					
	Heathkit Audio Oscillator Kit—Model AO-1 (14 lbs.)	24.50					
	Heathkit Audio Frequency Meter Kit—Model AF-1 (15 lbs.)	34.50					

*Please ship C.O.D. ☐ Postage enclosed for_____lbs. Enclosed find ☐ Check ☐ Money Order for_____

Electronic Flash

(*Continued from page* 53)

speedlamp. Connect the line cord to the a.c. outlet. Turning a.c. supply switch S_1 on applies power to the step-up transformer. The procedure from this point is the same as for battery operation as outlined previously.

Incidentally it is advisable to use the a.c. pack to start the unit if the condensers need re-aging.

Using the Guide Numbers

In using the unit, the operation will be about the same, photographically speaking, with batteries or a.c. The most important characteristic is the proper use of the guide number for setting the lens aperture. Guide numbers for typical black and white and color films are given in Table 1. Tests should first be made with your photographic equipment to determine any modification of the guide numbers to suit your taste in negative density or contrast.

For example, the guide number for one lamp with "Super XX" film developed in D76 is 160. If the subject is ten feet away, the lens aperture is 160 divided by 10, or 16. The lens should therefore be set for an *f*/16 aperture.

Development beyond the normal time will result in higher guide numbers. For example, the guide number with "Super XX" film may be increased to 220 with extended developing. However, negative gradation and graininess are impaired. Excellent photographic quality that will delight the photographer will result from the use of the recommended guide numbers. The high shutter speed provided by speedflash relieves the photographer of concern with subject or camera movement. This feature, coupled with the use of small lens apertures, results in sharper pictures that exceed results from any other kind of lighting.

Using Two Speedlamps

Plug in both speedlamps and arrange them to suit your taste in lighting. One light at the camera and the other at 45° to the subject produces pleasing modeling and may be used as a starting arrangement. Use the guide numbers for two lamps as specified in Table 1 and proceed as for picture taking with one lamp.

In closing I would like to express my sincere appreciation to Mr. Sidney Chertok of *Sprague Electric* for his helpful suggestions.

—30—

TV TROUBLESHOOTING WITH AN AMMETER

By NICHOLAS B. COOK

"FOR radio and TV servicing—for almost any kind of electrical troubleshooting—a wattmeter saves hours of painstaking work every day." This is truthful advertising. It is an honest statement of fact, provided you have a wattmeter.

Yet for many technicians the cost of an instrument, even though moderate, is still a factor in the decision to buy or not to buy. And that is why many men feel that a wattmeter is something they can get along without, unwittingly foregoing the great utility and time-saving advantages that such an instrument offers.

But, fortunately, here for once is a case where you can have your cake and eat it too; you can save your money and still buy the near-equivalent of a wattmeter. The answer is, get an inexpensive ammeter. Catalogue listing—"Economy Model—$2.45."

The writer, thoroughly familiar with the capabilities of wattmeters, has been using a cheap 5-ampere a.c. ammeter on the service bench for many years. It is permanently wired in series with an a.c. outlet so that a set may be tested with the utmost convenience.

The value of an ammeter in auto radio testing is well known. You expect the average set to take 6 or 7 amperes. If the current goes beyond normal you know you have trouble. Without an ammeter the trouble would not be so quickly spotted.

Similarly, the a.c. ammeter gives an immediate indication of abnormal current drain in television receivers. Without this warning, a power transformer could go up in smoke while you're listening for clues. It takes only a minute or so for the high-voltage winding to become, like the fiery furnace, "seven times hotter, hotter than it ought to be." Usually the smoke pours out while the core is still cool.

A personal experience will emphasize this point. I had replaced a burned-out power transformer in a TV set. The low-voltage rectifier had failed and had been discarded by the customer. Before putting in a new 5U4 I checked the "B plus" line and found it clear. When the set was turned on, the ammeter showed a little better than 2 amperes (normal), then suddenly started climbing. At 4½ amperes I pulled the plug. Investigation revealed that the damper tube broke down as soon as plate voltage was applied. When a new 6X5 was installed, the pointer remained at 2 amperes. In this kind of testing, the great advantage of the ammeter lies in the fact that its indication of trouble is *immediate* and *continuous*.

In case of an abnormally high reading, removal of the rectifier tube (or tubes) tells at once whether the trouble is ahead of the tube or beyond it. Other components can be disconnected and restored in a logical procedure based upon ammeter readings.

The function of the ammeter, then, is to indicate *current*. Transformer windings and other components are burned out by *current*. In case of trouble, the most destructive variable is *current*. (A fair approximation of "normal amperes" can be obtained by dividing the rated "watts" by the rated "volts.")

In shooting trouble, our concern is not with *precisely how much* current. Faults are gluttons for amperes. Rather, all we need to know is that "too much is too much." This information we can get daily for a lifetime at a total investment of $2.45.

—30—

SYLVANIA PICTURE TUBES

Out-perform, out-last all others tested!

Fifty minutes *on* . . . ten minutes *off* . . . hour after hour for 500 consecutive hours, Sylvania Picture Tubes were tested side by side with the tubes of other leading manufacturers.

These intensive tests, made under punishing, accelerated voltages were conducted under supervision of an outside, independent laboratory. Checks were also taken over a 3-month period for emission, leakage, color, light out-put, grid control, and other characteristics.

Read the remarkable record.

The chart at right tells the story. Note that *only* Sylvania Picture Tubes showed no failures. And, in over-all point quality, *Sylvania won over all other brands by a wide margin.*

These important conclusions definitely place Sylvania Picture Tubes in the highest rank. They also mean the highest in trouble-free operation . . . better business . . . more satisfied customers for every dealer who orders Sylvania Picture Tubes. For full details about these important tests write today to: Sylvania Electric Products Inc., Dept. 3R-2103 1740 Broadway, New York 19, New York.

United States Testing Co.
1415 Park Ave., Hoboken, N. J.

Test No. E-5095
August 8, 1952

Manufacturer	Number of Tubes Tested	Number of Failures	Overall Point Quality
A	8	1	81
B	8	1	78
C	8	6	62
D	8	1	83
E	8	4	67
F	8	5	42
G	8	4	52
H	8	5	30
SYLVANIA	8	NONE	92

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

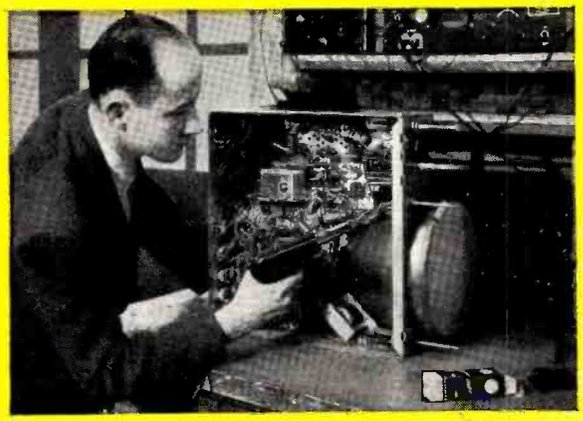
THEY INCREASED SERVICE

These service dealers weren't content to sit still and wait for repair jobs to come to them. Like hundreds of others who took part in G. E.'s big 1952 summer promotion, they went looking for business . . . and found it! Here are facts and figures that prove service promotion pays off!

"Every month showed bigger sales!"

"Because of our summer promotion, June service sales were 194 percent of May; July sales 223 percent. August service will equal or exceed July. Newspaper ads, mailing cards, TV spots, radio announcements—we used them all successfully."

LAURENCE T. SAMPLE
Electronic Television of Florida, Inc.
1003 S. W. 27th Ave., Miami, Fla.



"1952 business was far ahead!"

"Our promotion campaign consisted of three parts: (1) a special TV-check-up mailing, (2) general service mailings, (3) newspaper advertising that featured a prize contest. G-E-tube direct-mail cards were employed. . . . A comparison of our C. O. D. business during the two months shows a 72% increase, 1952 over 1951."

WILLIAM S. WEIL, JR.
Interstate Television Service Co.
1300 N. Third St., Philadelphia, Pa.

"We more than doubled service income."

"We spent half our 1952 advertising budget in an intensive service promotion, using direct-mail, newspaper space, and ads in local-events programs. As a result, our gross income was up 112% from the same months in 1951 when we had put no special emphasis on promotion."

E. J. HORSTMAN
Suburban Television Company
605 W. Hillgrove Ave., La Grange, Ill.

You can put your confidence in—

BUSINESS UP TO 123%!

Now you can do it!

1953's here. It's time to plan ahead for a bigger, better year—for more business through aggressive promotion. The G-E Tube Department can help you with sure-fire aids that work hard beginning the first day you use them. They're described in this brand-new 12-page catalog. You've seen how aids like these paid off for Sample, Weil, and Horstman. Make G. E.'s new catalog *your* blueprint for profits in '53!

Look what you can get!

- **Identification aids,** such as decals, clock, signs, and tube display cartons.
- **Advertising aids,** such as mailing pieces, newspaper ad mats, doorhangers, and streamers.
- **Business aids,** such as job tickets, calling cards, letterheads, and tube-test stickers.
- **Service aids,** such as tube puller, jumper cord, drop cloth, and shop garments.
- **Technical manuals and publications.**

SEE YOUR G-E TUBE DISTRIBUTOR TODAY!

He will be glad to help you get started! ***Or write direct to Tube Department, General Electric Company, Schenectady 5, N. Y.***

1878 75 1953 YEARS OF ELECTRICAL PROGRESS
Diamond Anniversary

GENERAL ELECTRIC

161-1A1

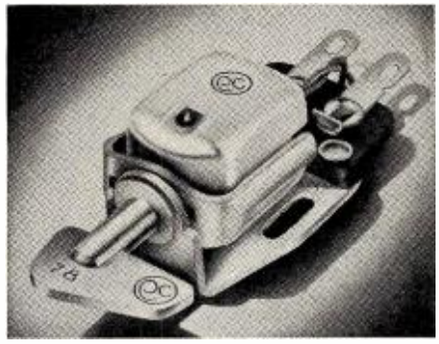
WHAT'S *New in Radio*

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

TURNOVER PICKUP

Pickering & Co., Oceanside, N. Y. has added the Model 260 turnover pickup to its line.

The new unit has an output of 30 millivolts at 10 cm-per-second and will



mount easily in any type arm. Detailed literature on the Model 260 is available on request.

WIRELESS INTERCOM

David Bogen Co., 29 Ninth Ave., NYC 14 has a new wireless intercom system on the market.

The "Twin" can be used with two or more stations, with all conversations heard by all stations in the system. Employing power lines as the carrier, the intercom uses a line noise suppression circuit in every unit. Each station contains a transmitter and receiver operating at 175 kc., a frequency which minimizes interference with radios, TV, and other electrical devices.

SMALL RELAYS

Automatic Electric Sales Corp., 1033 W. Van Buren, Chicago 7 has available bantam-sized class "S" relays in hermetically-sealed enclosures. The entire unit measures $2\frac{1}{32}$ x $\frac{31}{32}$ x $1\frac{1}{2}$ inches and weighs $1\frac{7}{8}$ oz. Mounting studs may be arranged on base or narrow side of housing.

The relay is designed for minimum inductance and maximum make-and-break speeds. It is tamperproof and atmosphere-protected and meets or betters all provisions of MIL-R 6106.

"MINI-PACK" POWER SUPPLY

Jersey City Technical Lab., 880 Bergen Ave., Jersey City 6, N. J. has developed a small selenium rectifier pack for service, experimental, or ham use.

The "Mini-Pack" is designed to plug into a standard a.c. female receptacle. Power is available at screw terminals which are extra long so that spade leads or alligator clips may be connected.

The Model R gives 108 volts regulated, low-ripple d.c. with an 0B2 regulator tube. The Model P is a voltage doubler, 10-watt power source, of low ripple d.c. The no-load voltage output is 330 volts.

CONTACT CLEANER

Chemical Electronics Corp., Irvington, N. Y. has developed a combination solvent, lubricator, restorer, and silencer for all electrical and electronic controls and contacts.

Known as the *"Ceco Restorer,"* the new solution is safe even for u.h.f. circuits. It does not affect inductance, capacitance, or resistance and is non-reactive to heat, cold, oil, or corrosives.

NEW SPEAKER LINE

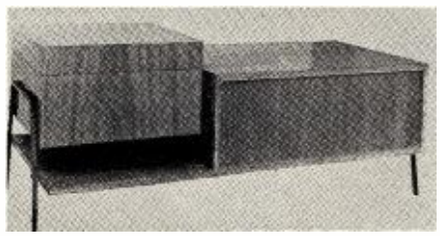
Carbonneau Industries, Grand Rapids, Mich. has added the "Gold Cup" speaker to its line of equipment.

The 10" unit is now available either with 2.15 oz. magnet, 1" voice coil or 1 oz. magnet with 1" voice coil. Either unit supplies flux in the air gap equivalent to speakers using up to 50% more magnet, according to the company.

UNIQUE CABINET

Jeff Markell Associates, 108 W. 14th St., NYC 11 has added a cocktail table, radio-phono cabinet to its line.

The RC-118 houses a changer, tuner, and amplifier in a compact piece of furniture. Space for the changer is in the step at left while the tuner and amplifier are housed in the long, lower



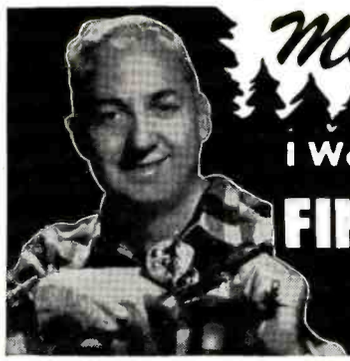
compartment. There is a magazine shelf under the changer compartment and the back is finished with a bookcase behind the tuner-amplifier. Legs are of half-inch square wrought iron.

It is available in twelve finish colors on birch, mahogany, korina, walnut, or oak.

INK FOR TAPE MARKING

Artone Color Corp., 21 W. Third St., NYC 12 has developed a new acetate ink for use on plastics, including recording tapes.

Available in seven colors as well as black and white, the new inks are also obtainable in either opaque or transparent consistencies. The new inks adhere without chipping off, crawling, or rubbing off. They are waterproof, flow



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$60.75 VALUE! Rod and 2 Reels, All Only $38.88

Pay only $7.80 down on this balanced Custom Crafted Spinning and Fly Casting Outfit! Outfit includes:

1) 1953 Airex "Mastereel" with extra spool, (sells alone for $22.75).
2) H-I's famous top quality Model 7 Auto Fly Reel, capacity 75 yd. G line. Free stripping, beautiful blue anodized finish, 1953 model. Reel value is $8.00.
3) H-I's finest Registered "Admiral" De Luxe Combination Spinning & Fly Casting Rod, $30.00 certified value—the finest quality individually Registered Rod specially made by H-I. 7 ft. length, 2 section Tubular Power Glass. Cloth Bag and solid fiber carrying case included.
4) Spinning and Fly Casting Instruction Booklets Included.

Rod, "Mastereel," and Auto Fly Reel, all for only.. $38.88
Rod and "Mastereel" only.....$31.95
Send $9.88 additional for an excellent assortment of accessories, including plenty of line for both reels, spinning & fly casting lures and all the necessities for successful use of your new outfit.

"MASTEREEL" and REGISTERED GLASS SPINNING ROD

Certified Value $50.25
Both Rod & Reel, Only..... $27.95

For value, top quality, and balanced action, this is the best Spinning Rod and Reel Combination in America. For the spinning fisherman who wants the finest! Outfit includes the supreme quality Airex "Bache Brown" Mastereel with extra spool, plus the Horrocks-Ibbotson "Admiral De Luxe" custom built individually Registered $27.50 value Power Glass Spinning Rod, available in your choice of 6½ ft. Solid Power Glass or 7 ft. Tubular Power Glass. Both rods have superior action and delicate balance, finest quality genuine specie cork grip, and popular 2 section tip for easy carrying. Lifetime stainless steel guides with beautiful 2 color fancy windings, cloth bag and solid fiber carrying case. Spinning Instruction Booklet included. State choice of 6½ ft. Solid or 7 ft. Tubular Glass Spinning Rod.

Rod and "Mastereel".....Both for $27.95
This Rod & Reel will handle lures from ¼ oz. to ⅝ oz. perfectly. All newest improvements in Spinning Rods & Reels for 1953 included! Mastereel separately is $22.75.

NEW 1953 MODELS

EXTRA SPECIAL

Send $4.95 for an excellent assortment of Spinning Lures and Spinning Accessories in a beautiful and handy big size transparent Plastic Utility Box, including 100 yards of soft monofilament or braided nylon spinning line in your choice of 4, 6, 8 or 10 lb. test.

SAVE $10.00! AIREX "SPINSTER" & GLASS ROD $18.50

Pay only $3.70 down—balance in 6 months on this budget priced but high quality Spinning Outfit consisting of 1) Famous Airex "Spinster" Reel—Greatly improved for '53—sells separately for $13.50; 2) New $15.00 Value 1953 Model H-1 Commodore Solid Power Glass 6 ft. 2 section Spinning Rod; and 3) Spinning Instruction Booklet. Remember—you get 30 days' Free Trial on Everything you buy at Klein's—no matter how you buy!

Total value $28.50. Klein's Full Price..... $18.50
Add $4.95 for complete Spinning Accessory Outfit which includes: beautiful Plastic Box, Extra Reel Spool, an excellent assortment of lures, and 100 yards of Nylon Spinning Line in your choice of 4, 6, 8, or 10 lb. test.

NEWEST SPINNING REELS

Spinning Reels:

1) Mitchell, made in France. Includes 2 interchangeable spools of 100 and 300 yard capacity. Available for right or left handed persons, specify..... $29.75
2) Orvis "Pelican" made in Italy. Exquisitely made, mechanically superb. Available for right or left handed persons, specify..... $28.50
3) Micron, custom made in Italy, preferred by many professionals. Reg. $41.50..... $37.50
Alcedo Model 2CS Heavy Duty, made in Italy (not illustrated). Ball Bearings, precision design and workmanship throughout. Reg. $38.50..... $34.50
4) Heddon "Spin Pal." Specify 100 or 200 yard capacity Spool, available for right or left handed persons, specify. Reg. $25.00..... $22.50
5) Airex "Beachcomber" Salt Water Spinning Reel; sells alone for $28.50 or for $44.50 complete with the $30.00 value Custom Built & Individually Registered H-I heavy duty 2 pc. 9 ft. length tubular Power Glass Salt Water Spinning Rod. Salt Water Rod and Reel Value is certified to be $58.50, both for..... $44.50

$34.35 H-I ROD & SHAKESPEARE AUTO FLY REEL $19.95

Reel Separately is $9.35

Pay only $4.00 down and take 6 full months to pay the balance on this great top quality Fly Casting Outfit! Outfit includes: 1) Shakespeare Tru-art Model 1837 Automatic & Free Stripping Fly Reel. Reel capacity 80 yards "G" line. A flick of the finger automatically takes up the free line. 2) H-I Tubular Power Glass $25.00 certified value "Admiral De Luxe" individually Registered and custom-crafted 3 section 8½ ft. Trout or 9 ft. Bass action Fly Rod. Only H-I with its slow and careful craftsmanship can turn out such magnificent action as you will find in these beautiful Registered Fly Rods. Cloth case and rod tube included. 3) Fly Casting Instruction Booklet.

$34.35 Value, all for only..... $19.95
Send only $4.95 for a $7.00 value genuine WEBER fly casting accessory outfit, including Weber fly line, leaders, line dressing and big selection of Weber flies for trout, panfish and bass. All in handy plastic box.

HEAVY DUTY OUTFIT

$27.30 Value **19.95**

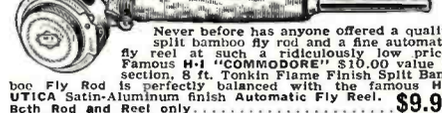
Only $4.00 Down on the Ideal Rod & Reel Combination for Deep Trolling in Fresh Water, for Musky Sucker casting, for Big Catfish and Carp or for General Salt Water, Boat or Pier Fishing. Outfit includes famous quality-built $12.00 Value H-1 #520 Heavy Duty Reel features star drag, level wind, push-button control, rugged construction. 150 yard capacity; $12 Value Solid Power Glass H-1 Model 3676 Rod has detachable wood handle with rubber butt cap. 60" tip, 6'6" overall length; 150 yds. 27 lb. test "Skirr" Nylon Line, $3.30 Value. Rod, Reel and Line.

Certified $27.30 value..... $19.95

SALE! Reg. $6.25 LANDING NET $3.49

Light weight, quality made, folding landing net. Genuine 100% Nylon netting. Handle extends from 30" to 39"—rubber grip. Weighs only 12 oz. Reg. $6.25, Sale Price $3.49

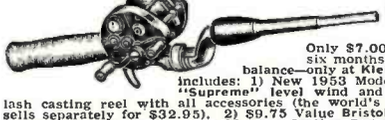
SAVE $6.55! H-I FLY ROD AND AUTOMATIC FLY REEL $9.95



Never before has anyone offered a quality split bamboo fly rod and a fine automatic fly reel at such a ridiculously low price! Famous H-I "COMMODORE" $10.00 value 2-section, 8 ft. Tonkin Flame Finish Split Bamboo Fly Rod is perfectly balanced with the famous H-I UTICA Satin-Aluminum finish Automatic Fly Reel.

Both Rod and Reel only..... $9.95
Add $2.95 for a nice assortment of Fly Lures and Leaders in a beautiful transparent Plastic Fly Box, including 25 yards of good quality level Fly Line.

$42.70 PFLUEGER "SUPREME" REEL & BRISTOL GLASS ROD



$34.95

Only $7.00 down and six months to pay the balance—only at Klein's. Outfit includes: 1) New 1953 Model Pflueger "Supreme" level wind and anti-backlash casting reel with all accessories (the world's finest reel sells separately for $32.95). 2) $9.75 Value Bristol Model 88—4½. 5 or 5½ ft. length solid glass Casting Rod with carrying case. Certified $42.70 Value.

Both for only..... $34.95
Klein's will furnish the $20.00 Value H-I Registered Tubular Power Glass custom built Casting Rod in your choice of 5 or 5½ ft. lengths—instead of the Bristol Rod. Registered H-I Rod and "Supreme" Reel both for..... $39.95

NEW! SHAKESPEARE PRESIDENT REEL—$26.70
New 1953 Model Shakespeare "President" Reel sells separately for $26.70. "President" with the Bristol Model 88 Glass Rod, both for $28.70, or with $20.00 Value H-I tubular Glass Rod for $33.70.

$17.70 BAIT CASTING OUTFIT $10.95

Shakespeare "Wonderreel" Alone Is $9.75

Outfit includes: 1) Shakespeare "Wonderreel". New 1953 first quality all metal Model 1920 level wind and anti-backlash. 2) Bristol Model 89 Solid Glass Casting Rod, an outstanding $7.95 value, which features thread locking offset reel seat of finest aluminum and live action tip with stainless steel guides, 4½ or 5 ft. length. Rod bag included. Total Value $17.70.

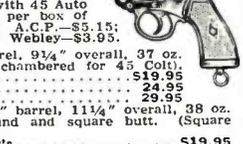
Klein's Complete Price..... $10.95

RUGER 22 AUTO PISTOL

3 models—BRAND NEW—All shoot 22 L.R. ctg. STANDARD RUGER, 10 shot 4¾" barrel, 36 oz. of perfect balance, amazing accuracy..... $37.50
TARGET RUGER, MARK 1, 6⅞" Barrel.... $57.50
TARGET RUGER, MARK 1, 5½" Barrel.... 57.50

SALE! 45 CAL. BRITISH WEBLEY ENGLAND'S FINEST REVOLVER! $19.95 up

Genuine British WEBLEY 4" or 6" barrel Revolvers made in England by world-famed Webley & Scott. Author W.H.B. Smith says of the Webley 45: "One of the finest heavy duty military weapons ever made. This is one of the official revolvers of the British forces. Safe for heaviest loads." 6 shot, double hinged frame break-open action. State choice of calibers: 45 Colt, 45 Auto Colt, 45 Auto Rim or 455 Webley. Half moon clips free with 45 Auto Colt caliber. Ammunition per box of 50: 45 Colt—$4.55; 45 A.C.P.—$5.15; 45 Auto Rim—$4.75; 455 Webley—$3.95.



MARK IV Webley's 4" Barrel, 9¼" overall, 37 oz. weight. (4" Webley not chambered for 45 Colt).
Very Good 4" Webley's..... $19.95
Very Good to Excellent..... 24.95
Excellent Condition..... 29.95
MARK V & VI Webley's—6" barrel, 11¼" overall, 38 oz. weight. Available in round and square butt. (Square butt shown.)
Good Condition 6" Webley's..... $19.95
Very Good 6" Webley's..... 24.95
Very Good to Excellent 6" Webley's..... 29.95
Add $5.95 for finest hand carved holster.

COLT 45 REVOLVERS

Top quality Genuine Colt "New Service" Revolvers. State choice of 45 Colt or 45 Auto caliber. The finest service revolver made. Jointless, solid frame. simultaneous ejection, swing out cylinder. positive lock, center fire double action. Square butt. 5½" barrel. Blued.

At Klein's in Good Condition, Only..... $24.95
Very Good Condition..... $29.95
Very Good to Ex. Condition..... 34.95
Finest Hand Carved Holster to fit..... 5.95

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The Encyclopedia for Shooters!

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Guarantee: I understand my money will be refunded in full if I am not 100% satisfied.
Firearms Purchasers Sign: "I am not an alien and I have never been convicted of a crime of violence, nor am I under indictment, a fugitive from justice or a drug addict."
Signed .....Occupation.....Age.....
Hanegun shipments outside U.S.A. and its possessions not permitted. Send State Permit if Needed.

CREDIT CUSTOMERS—Please Read and Sign Following Simple Credit Agreement: Also Send Coupon Above.
I want Credit. Enclosed is $..... 20% Down Payment. I agree to pay the balance in six equal monthly payments, starting 30 days after I receive the merchandise I ordered. I understand there will be no carrying charge if I pay the balance in full within 90 days. If payment in full is not made in 90 days, I understand a Carrying Charge will be added. The Carrying Charge will be 10% of the difference between the selling price and my down payment.

Signed .....
Be sure to state your age, marital status, own home or rent, employers name and address, length of present employment, two business credit references with complete addresses and one personal reference. Use separate paper for this information.

freely, and are resistant to alkali, acids, and oils.

The ink can be used to mark places on the tapes, interruptions, beginnings, ends, and identifications of tapes.

MOBILE TEST GEAR

A new portable frequency and deviation meter for checking radiated carrier frequency, undulation deviation, and other performance data of mobile two-way radio systems has been developed by the *RCA Victor Division* of *Radio Corporation of America,* Camden, N. J.

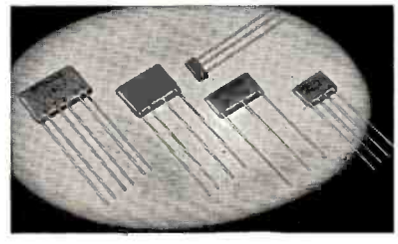
The Type CX-8A is a self-contained, direct-reading instrument which provides facilities for checking radiated

carrier frequency of mobile and stationary radio transmitters to comply with FCC regulations. It can also be used as a field strength meter and as a precise signal source for aligning radio receivers.

It is designed to operate at one or two specified frequencies in the 25-50 or 152-174 mc. range or at other frequencies on special request.

PRINTED CIRCUITS

Five new printed circuits for TV and radio sets have been added to the replacement line by *Sprague Products Co.,* 51 Marshall St., North Adams,



Mass. All of the new items are resistor-condenser networks screen-printed on high dielectric constant ceramic bodies.

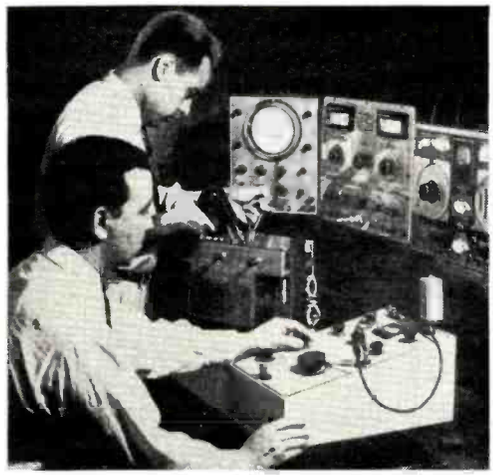
Circuit diagrams of these new units are available from the Technical Service Section of the company.

HI-FI SOUND SYSTEM

A new, matched high-fidelity radio-FM-phono system has been introduced by *Meissner* of Mt. Carmel, Ill. The entire system is matched both electronically and in physical appearance.

The system comes complete with

(*Continued on page* 144)



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GIANT 3-SPEED RECORD CHANGER SALE!

IMPERIAL DELUXE MODEL
STOCK NO. RA-69

Equipped with single needle, with precious metal long-lasting tip. Plays all speed records, 33⅓, 45 and 78 RPM. Regular retail price $47.50. Shpg. wt. 15 lbs.

Single, each $19.99. In lots of 3, each, only.. **$18.99**

HI-FI DELUXE MODEL
STOCK NO. RA-113

Equipped with "Turnover" cartridge and dual needle. One side for 33⅓ and 45 RPM discs and other side for 78 RPM discs. Both sides equipped with precious metal long-lasting tips. Regular retail price $52.50. Shpg. wt. 15 lbs.

Single, each $22.99. In lots of 3, each, only.. **$21.99**

3-SPEED GENERAL INSTRUMENT AUTOMATIC RECORD CHANGER

Automatically Changes All Sizes—7", 10" and 12"

All Speeds—33⅓, 45 and 78 RPM

All the finest features are incorporated in these General Instrument Record Changers. Records Slide Gently down the center spindle. There is no wobble, no scrape, no slap. No chance of damaging your records. The newly-designed controls are so simple, they explain themselves. No instructions needed. All moving parts in every General Instrument Changer are factory adjusted thus insuring years of trouble-free performance.

These Changers are precision-built by craftsmen who have had years of experience. Every Changer is brand new — in original factory-sealed cartons — and guaranteed 100% by Olson and the manufacturer. Here is one of Olson's most sensational bargains. Believe us—you can't go wrong.

Changer can be connected to any radio or amplifier. Equipped with clever "touch-plate"—a slight press and you can reject or skip a disc and go on to the next one. Has perfect cast parts. Here's a Changer you'll be proud to demonstrate to your friends. You can sell plenty of them too. Operates on 115 Volts AC, 60 cycle. Base size 12"x12½". 5⅛" above plate and 3½" below. Take your choice of either model.

COMPLETE 3-SPEED RECORD CHANGER AMPLIFIER KIT

Easily Assemble Your Own Automatic Record Player

Stock No. AS-71 FOR ONLY **$29.99**

SEE WHAT YOU SAVE Complete Kit	Regular List Price
3-Speed Changer	$47.50
Amplifier (Wired)	7.50
Set of 3 Tubes	4.55
5" Heavy Duty Speaker	4.00
Output Transformer	1.75
Mounting Base (Pre-Drilled)	8.50
Mounting Hardware	.55
Total List Price	$74.35

Here's an outfit that normally retails at $74.35. Save yourself a pile of money and have fun assembling your own 3-Speed Automatic Record Player. It's easy—can be assembled by anyone in just 30 minutes. All holes are drilled and all mounting hardware is provided. The Amplifier is completely wired. All you have to do is attach the Changer and Speaker wires. Shpg. wt. 20 lbs.

You Get Everything You Need to Easily Assemble Your Own 3-Speed Automatic Record Player. Kit includes:

- GENERAL INSTRUMENT IMPERIAL DELUXE CHANGER (Model RA-69 — as described to left).
- 5" PM HEAVY-DUTY SPEAKER AND OUTPUT TRANSFORMER.
- 3-TUBE AMPLIFIER COMPLETE WITH TUBES
- MOUNTING BASE—WITH HARDWARE & INSTRUCTIONS

HIGH GAIN STANDARD COIL TV BOOSTER

★ Latest Model ★ Brand New
★ Reg. List Price $30.00
★ While they last. Model No. B-51. **$10.95 Ea.**

Just connect one of these Standard TV Boosters to your receiver and get brighter, snappier pictures and less "snow" and interference. Easy to attach. Works on all TV sets. An amazing deal—you can cash in—save money — Order Today. Tunes all 12 channels. Uses a 6AK5 tube and a selenium rectifier. Complete. Operates on 115 V. AC. Shpg. wt. 6 lbs.

12" Magnavox Speaker and Baffle Close-Out

Stock No. AS-66
Get both for only...
$7.95
In lots of 4 sets.
One set for $8.95.

You get Magnavox's fine 12" PM speaker with Alnico 5 magnet. (Same as you'll find in those expensive Magnavox Super-Radio-Phono Combinations.) Power output 8 watts. Voice coil fully dustproofed. Impedance 6-8 ohms. In addition you get a walnut Speaker Baffle to bring out the full rich, rounded tones of the Magnavox Speaker. Baffle may be mounted on a wall or it will stand on a table. Here's the ideal combination for extension speakers for porches or other rooms. Can be connected to any radio or amplifier. Order 4 or more sets and install them in restaurants, auditoriums, halls. Shpg. wt. 12 lbs.

DELUXE COUNTER

We're letting these go at a fifth of Actual Cost—$8.50. Keep an accurate count up 100,000 on transactions, traffic, production, etc. Just touch a lever and it counts. Shpg. wt. 1 lb.

$1.69 Stock No. X-298

BIG INSULATED RESISTOR KIT

OLSON SPECIAL PRICE

Contains a carefully selected assortment of 100 insulated resistors. Standard RMA color code. Included are 70—½ watt, 20—1 watt and 10—2 watt resistors. Handsomely packed in a durable piloflm bag. Regular List Price $15.80. Shpg. wt. 2 lbs.

$2.99 Stock No. AS-32

COMPLETE TV ANTENNA

A complete stacked array. Made by a famous manufacturer whose name and brand is on every factory sealed carton. Look what you get: 2 Six-element conical baya, 1 pair "Q" bars, 2 Five-foot mast sections, 60 ft. 300 ohm twin line, 5 Standoff insulators, 1 mounting base, 1 guy ring, 1 clamp, hardware. Elements are highest quality aluminum. Reg. list price is $31.95. Shpg. wt. 15 lbs. Express only.

Stock No. AU-24
$11.99 Complete Set

GIANT AKRAD "LOADMASTER" CONDENSER KIT

STOCK NO. AS-20
$16.95
4-DRAWER STEEL CABINET ***FREE!***

69 PIECES List **$52.00**

Here's your chance to get 69 By-Pass and Electrolytic Olson Akrad "LOADMASTER" Condensers all packed in a Big 4-Drawer Chest (10" x 11⅛" x 10") which we give you absolutely FREE. Treat yourself to a supply of these high-quality Condensers and see for yourself why 150,000 Radio Repairmen insist upon Akrad.

27 Akrad "LOADMASTER" Electrolytic Condensers

Qty.	Cap.	Volts	List, ea.	Total
2	10	25	$1.00	$2.00
2	25	25	1.00	2.00
5	20	150	1.20	6.00
5	40	150	1.35	6.75
4	20-20	150	1.65	6.60
5	8	450	1.25	6.25
4	16	450	1.40	5.60

42 "LOADMASTER" By-Pass Condensers

Qty.	Cap.	Volts	List, ea.	Total
2	.001	600	$ .25	$ .50
2	.002	600	.25	.50
2	.005	600	.25	.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	.1	600	.45	4.50
2	.005	1600	$ .60	$1.20
2	.008	1600	.65	1.30
2	.01	1600	.65	1.30

SLOTTED SUPER SPACE LINE

LOWER LOSS 300 OHM
STOCK NO. W-115
500 Ft. Spool Single, Ea. $7.95
Lots of 2 Spools ..... **$7.75 EACH**

This slotted 300 ohm TV line is made to standard specifications in such a manner as to provide maximum air spacing while maintaining the desirable strength and durability of the usual 300 ohm twin line. Color: Brown, with ±22 stranded copper, pure polyethylene 55 mil web. Never offered before at such a low price. ORDER EARLY—while supply lasts. Shpg. wt. 7 lbs.

DON'T THROW AWAY OLD PICTURE TUBES

BOOST BRILLIANCE WITH THIS TV TUBE BOOSTER

Completely automatic. Easy to install — no tools needed. Just plug into old picture tube that is starting to dim and watch the big change. Works on any Tube—10" to 30" in all AC parallel circuits. Adds months and months of service to those old tubes. Reg. $5.95. Shpg. wt. 1 lb.

$2.95 Stock No. T-100

OLSON ELECTRIFYING BARGAIN!

THE NEW WONDER OF ELECTRONIC CONTROL CAN BE YOURS FOR PRACTICALLY NOTHING

THYRATRON REMOTE CONTROL

SERVICEMEN—HOBBYISTS—HAMS EXPERIMENTERS—RADIO SCHOOLS

Here's the chance of a lifetime to own a genuine Thyratron Electronic Remote Control of your own at a fraction of its regular price! This mighty handful (only 5¾"x5"x3¼") of miracle control can be made to perform hundreds of practical, fascinating feats of remote control. A complete schematic showing the circuit is included with each unit. It's a steal! Buy it just for the parts alone. Take it apart! Look what you get: Valuable parts and tubes galore that you can so easily use in any other radio, amplifier, etc.—or for experimenting.

You get the complete outfit, including cabinet, 3 tubes (6SL7, 6SN7 and GL-5662) and wiring diagram.

STOCK NO. RA-111
Single, each, $5.99
Lots of 3, each **$4.99**

LOOK AT ALL THE PARTS YOU GET

- 6SL7 and 6SN7
- GL-5662 Tube
- 16 Mfd. @ 150 Volts
- .1 Mfd. @ 200 Volts
- .02 Mfd. @ 200 Volts
- .1 Mfd. @ 200 Volts
- .1 Mfd. @ 200 Volts
- Control Relay
- Switch—SPST
- Pilot Lamp, Type 44
- Dial Assembly
- Control Housing
- Bottom Plate
- 5 Prong Plug
- Filament Transformer
- 175 Ohm Var. Control
- 600 Ohm Calibration Control
- 1 Megohm—½ Watt Carbon
- 2600 Ohm—½ Watt Wirewound
- 1000 Ohm—½ Watt Wirewound
- 8000 Ohm—10 Watt Wirewound
- 3000 Ohm—½ Watt Wirewound
- 1 Megohm—½ Watt Carbon
- 240,000 Ohm—½ Watt Carbon
- 2 Ohm—½ Watt Wirewound
- 1 Megohm—½ Watt Carbon
- .24 Ohm—2 Watt Wirewound
- 33 Ohm—½ Watt Wirewound
- 15,000 Ohm—½ Watt Carbon
- 500 Ohm—½ Watt Carbon

How can you lose? These parts are certainly worth THREE TIMES this amazing low cost. The General Electric Thyratron Type GL-5662 tube alone costs $3.30 wholesale. Besides, consider the plate sensitive relay, filament transformer, tubes, condensers, resistors (many of them 1% precisions). No matter how you use it, here's a great, great Olson Bargain. Operates on 115 V. AC. Shpg. wt. 5 lbs.

POWER CORD makes it easy to connect to 115 V AC line. Consists of 12 ft. heavy rubber covered wire with rubber molded plugs. STOCK NO. W-116, ea., 49c.

Can easily and quickly be modified for Electronic Remote Control of: Transmitters; Turn Radio and TV on and off; Open and Close Garage Doors from your car; etc. Schematic Diagram included at No Extra Cost.

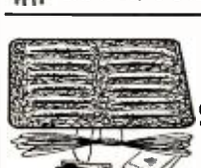
6J6

Reg. List $2.50
Single, ea., 99c
Lots of 10, **69¢** ea.

MOST POPULAR TV TUBES—Discount Over 72%
INDIVIDUALLY BOXED • BRAND NEW MADE BY LARGEST MFG.

Here's the inside story on how Olson bought these fine brand-new tubes. America's largest tube manufacturer made them and was ready to ship to a big company when they suddenly got a cancellation. Olson stepped in and made a deal and bought a terrific quantity. Then we had our "Akrad" brand put on every tube. They're individually boxed and carry the usual 100% Olson Money-Back Guarantee. Order Plenty at This Price.

REAR DECK AUTO SPEAKER KIT FOR ALL CARS



STOCK NO. AS-81

$2.95 EACH

Install a rear seat speaker in any car, any radio. Complete Kit of parts furnished with easy instructions. Includes beautiful grille and 3-way dashboard switch for operation of front and rear speakers separately or together. Supplied less speaker. Requires popular 6" x 9" size speaker. Shpg. wt. 3 lbs.

SPEAKER FOR AS-81 KIT

Heavy duty—high volume PM 6"x9" speaker with 3.2 ohm voice coil for AS-81 installation. Shpg. wt. 6 lbs.

STOCK NO. S-114 **$3.39 EACH**

USE HANDY ORDER BLANK ON NEXT PAGE ▶

OLSON AKRAD RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

MAIL YOUR ORDER TODAY—OLSON WILL RUSH IT RIGHT AWAY!

NO MORE WHEN THESE ARE GONE!

SPECIAL SALE!

WILCOX-GAY RECORDIO TAPE RECORDER

2 Full Hours of Recording or Playback—Automatic—Foolproof Push-Button Controls • 2-Speeds • Records • Plays Back • Erases

STOCK NO. AMP-10
BRAND NEW
REGULAR $149.95
ONLY... $99.50

Order your Wilcox-Gay Tape Recorder for less than Dealer's Cost! This is the finest Recorder Olson has ever offered—at a price that is really give-a-way. We made a real deal and you get the benefit.

Five "Prest-o-matic" Push-button Controls allow instant choice of all operating functions—fast forward and reverse, record, stop, and playback. The easiest of all recorders to operate. Handles up to 7" reels. Full range of recording times—7" reel records for a full hour at 3.75" per second, plus another hour on other half tape; and at 7.5" per second you get a full recording hour on both halves of tape. Rewinds in less than 3 minutes.

Automatically records from FM or AM radio, phonograph, TV or mike. Plays back through powerful built-in amplifier and 5"x7" elliptical speaker. Frequency response—70-8500 cps at 7.5" per second, and 90-6000 cps at 3.75" per second. Output—2 Watts. Maximum Fidelity gained by Automatic Speed Selector.

Complete with Controlled Reluctance Mike, Record Lock Button, External Speaker Jack, Full Range Variable Tone and Volume Controls, 4 Tubes—6SJ7, 6AQ5, 12AX7, 6X4 Rectifier, 7 ft. Cord, Neon Recording Indicator, Handsome Removable Cover.

Ideal for Office, School, Church, Club, Home, etc. Lightweight, only 23 lbs. complete. Portable size 12"x14"x9". 110-120 Volt 60 cycle AC. U.L. Approved.

RECORDING TAPE—FAMOUS

PLASTIC BASE
600 FT. REEL
STOCK NO. X-275
Single, ea. $1.49
Lots of 10 $1.29 each

1200 FT. REEL
STOCK NO. X-249
Single, ea. $2.19
Lots of 10 $1.99 each

MFR.'S CLOSEOUT

Get the buy of your life. Save up to 64% on high quality RECORDING TAPE. A large manufacturer had to sell his inventory and he unloaded the whole deal. Olson now offers you this high grade recording tape at prices which defy competition. Standard ¼" wide, 1200 ft. long. Frequency response 50 to 8,000 cy. Plastic Reel included with each. Shpg. wt. 1 lb.

ROLA 12" PM SPEAKER

STOCK NO. S-174
Single, each, $5.95
Lots of 3 $4.95 EA.

With Matching Output Transformer for 6V6

Rola—a great name in Hi-Fidelity—has built these fine 12" Alnico 5 PM Speakers. Olson clinched a deal whereby you can get yours at ½ the usual wholesale price. Every Speaker is brand new and guaranteed. Features include a unique voice coil construction which maintains constant air gap and sustained high volume. New design cone delivers all frequencies between 40 and 16,000 faithfully and clearly. Voice coil impedance 8 ohms. Matching transformer for 6V6 tube included. Look at Olson's Low-Low Price! Shpg. wt. 10 lbs.

A MIRACLE in RESISTORS

KIT OF 130 NATIONAL RESISTORS
½ WATT—10% TOLERANCE
COMPLETE KIT YOU GET 13 SIZES 10 OF EACH SIZE
ONLY $3.66 Stock No. AS-68

Less than 3c each. You get 10 each of the following 13 popular values. OHMS: 10,000. 15,000, 22,000. 27,000, 47,000. 56,000. 100,000, 270,000, 330,000, 470,000. MEGS. 1, 4.7, and 6.8. The degree of precision astounds experts. National Resistors are the product of a New Japan, the product of an electronic industry which already enjoys worldwide recognition for unsurpassed excellence. Olson made a deal whereby we obtained 260,000 units at a special price—so we could convince even the most skeptical. Every Resistor stamped with value. Size ¾"x3/8" with 1" tinned copper leads. Shpg. wt. 2 lbs.

FREE! OLSON'S BIG NEW BARGAIN CATALOG

Get Olson's LOWER-than-wholesale prices from this famous book. STANDARD BRANDS—FRESH STOCK. IMMEDIATE DELIVERY. Catalog is two colors—40 full pages of unbelievable bargains. A new catalog mailed Bi-Monthly—with new low bargains each mailing. Simply note on order blank or write today for your free copy from: OLSON RADIO WAREHOUSE, 275 E. MARKET ST., AKRON 8, OHIO.

WANTED! $500,000.00

WORTH OF Radio and TV Parts, Speakers, Transformers, Tubes, Picture Tubes, Condensers, Resistors, Switches, Wire, Knobs, Coils, Phono Cartridges, etc. ALSO Partially assembled or complete Radio, Amplifier and Television Chassis. ALSO Test Equipment, Record Players, Automatic Changers, Motors, Microphones, Tone Arms, Meters, Cable, Cabinets, Grille Cloth, Wire or Tape Recorders.

MANUFACTURERS and WHOLESALERS

Here's your chance to dispose of your inventory for cash.

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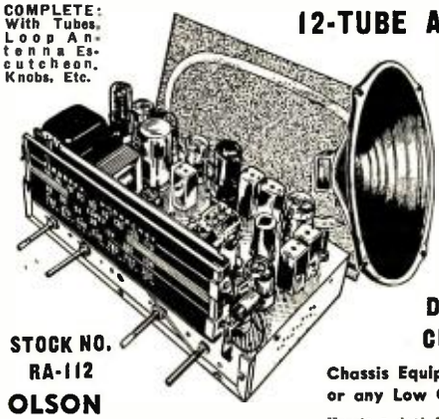
If you live in or near either of these cities visit our Bargain Stores where you'll find these and hundreds of other Olson Buys.

OLSON HAS OVER 150,000 SATISFIED CUSTOMERS

BRAND NEW LATEST 1953 MODEL ESPEY



COMPLETE: With Tubes, Loop Antenna Escutcheon, Knobs, Etc.

12-TUBE AM-FM RADIO CHASSIS COMPLETE WITH 12" MAGNAVOX SPEAKER

LOOK HOW YOU SAVE

12" Magnavox Speaker..$ 20.00
12 Tube AM-FM Chassis. 130.00
Regular List Price.....$150.00

STOCK NO. RA-112
OLSON SUPER BARGAIN!
BOTH FOR ONLY. $66.66

DESIGNED FOR QUALITY CUSTOM INSTALLATIONS

Chassis Equipped with Built-In Pre-Amp for GE or any Low Output Variable Reluctance Pickup

Here's a deal for you! Don't pass it up. We got a terrific bargain by paying cash on the barrel-head. Olson passes it on to you. If we went out to duplicate this offer WE COULD NOT DO SO TODAY. Order Your Outfit Now!

LOOK AT THESE FEATURES: You get a full size AM-FM Chassis including 12 tubes (4 are dual purpose, thus giving you the equivalent of 16-tube performance). Push-Pull Output Audio Stage delivers 10 Full Undistorted Watts. Improved FM Circuit, drift compensated. Built-in Automatic Volume Control, Inverse Feed-back, High-Fidelity assured on both AM and FM channels. Full Range Combination Bass-Treble Tone Control. Slide Rule Dial is indirectly illuminated. Equipped with Loop-Antenna for AM and Folded Dipole Antenna for FM reception. Has provisions for external antennas too. Has Input Jack for both Crystal Cartridge Tone Arm or any Magnetic Low Voltage Cartridge. Also has Microphone Input for Public Address use. Fully licensed under both RCA and Hazeltine Patents.

Receives standard AM broadcast 550 to 1700 KC and FM 88 to 108 MC. The FM Circuit includes an aperiodic RF Amplifier Stage, 2 Stages of High-Gain Intermediate Frequency Amplification and an advanced design Ratio Detector Circuit which provides Low Noise Level between stations, freedom from AM interference, ease of tuning and ample gain.

High-Fidelity Reproduction is assured through well-engineered Circuits and the use of High Quality Parts throughout.

TUBE COMPLEMENT: 1—6BE6, 2—6BA6, 2—12AT7, 1—6SH7, 1—6AL5, 2—6SQ7, 2—6V6GT and 1—5Y3GT. Wide Frequency Response is assured by the Push-Pull Output Stage. Chassis size 13½" wide x 9" high x 9" deep. Complete with Tubes, Knobs, Front Escutcheon, Mounting Hardware and Full Size Layout Template. Operates on 115V AC 60 Cycle.

The 12" Magnavox PM Speaker is of the Highest Quality and is found in the most expensive Console Radios. You can depend upon it to render life-like tone when connected to the chassis. All metal parts are heavily cadmium plated. Full Size Heavy Alnico 5 Magnet is permanently centered. Cone is Full Frequency Construction and the Voice Coil is Fully Dustproofed both inside and out. A Rare Combination such as this AM-FM Chassis and Magnavox 12" PM Speaker is hard to find. Here is truly a generous offer. ORDER YOUR OUTFIT TODAY! Be the envy of everyone who hears the magnificent performance of Radio at Its Best. Original Factory-Sealed Cartons. Shpg. wt. 25 lbs.

OLSON'S 10-PIECE MENNEN • GEM SHAVE KIT

FREE!

Here's an amazing gift that is impossible to buy anywhere. Olson worked hand in hand with Mennen and Gem, the 2 greatest names in shaving aids, to develop a gift that would be unique and yet appeal to all men—and it's yours ABSOLUTELY FREE OF CHARGE. Shave Kit contains: World Famous Gem Featherweight Razor • 5 Super Sharp Gem Blades • Tube of Popular Mennen Brushless Lather • Bottles of Mennen Cream Hair Oil and Skin Bracer • Attractive, Specially Designed, Carrying Case.

HOW TO GET OLSON'S SHAVE KIT FREE! Just make an order totalling $20 or more from these Olson Ads using Handy Order Blank below. We'll ship your order instantly and include the Olson Shave Kit FREE OF CHARGE. One Kit to a customer. THIS OFFER EXPIRES APRIL 15, 1953.

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE:
Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.

MAIL TO: OLSON RADIO WAREHOUSE
275 E. MARKET ST., AKRON 8, OHIO
WE SHIP SAME DAY WE GET YOUR ORDER

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL

ADDRESS _____ ADD POSTAGE

CITY _____ ZONE ____ STATE ____ TOTAL AMOUNT

RN-353

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

Binaural Reproduction

(*Continued from page 73*)

about one one-hundredth of a second, which in live listening would be similar to the delay produced by one sound source being ten feet further away. For recordings using the artificial head technique the spacing between the two heads must be kept to a much closer tolerance as fairly exact phase relationships between the two channels must be maintained to above 1000 cycles. As a result, the spacing between heads should be held to within a few thousands of an inch tolerance, a much more difficult procedure.

Operation of binaural equipment makes it necessary to monitor two channels simultaneously. Conventional vu meters may be used on each of the channels for level indication, while a split pair of headphones, with one ear piece being fed by each channel, is of value in judging the audio quality and balance obtained. Although riding gain on two separate channels may at first seem somewhat complicated, in several respects it is simpler than obtaining correct adjustment in conventional equipment in which multiple microphones feed a common output, due to the fact that both headphones and meter readings give indications of the sound pressure at a particular microphone location. However, if convenient, a master gain control for the two channels may be installed through the use of two identical, ganged volume controls.

In playback the best results, musically, usually are found when the two sound sources are somewhat diffused, as this tends to give a better illusion of spatial dispersion. Use may be made of corner radiation to achieve this effect or multiple speaker installations may be used. Likewise a third speaker may be bridged across both outputs and placed in a central location.

Although playback equipment is, of necessity, usually fairly bulky, the low power audio requirements of tape recording mean that a relatively light, compact, and inexpensive two-channel recorder can be constructed for use in the field. A voltage amplifier triode, such as the 6J5, is sufficient to drive a high impedance recording head, while two preceding stages are usually enough for full output from most types of high impedance microphones. A type 6E5 electron eye tube may be used as a volume indicator as it draws negligible audio power and is capable of giving accurate indication of complex waveforms. However, the high frequency response of the eye must usually be attenuated to prevent the bias frequency from presenting an indication, and some difficulty may be experienced in reading the eye under strong light levels.

A number of different types of microphone placement may be made in recording and the best results in musical reproduction are achieved through

an understanding of the nature of an individual composition as well as proper grouping of the instruments in order to emphasize the spatial characteristics of counterpoint as well as soloists with the group. Use of two channels tends to produce less intermodulation and other distortions due to the somewhat greater simplicity of the waveforms handled and therefore permits the achievement of effects not readily obtainable with single channel equipment. It also might be noted that human hearing is capable of depth perception as well as localization in the horizontal plane. This effect is apparently brought about by the ability of the ear to detect modifications of the original sound brought about through reflections of sound from walls or adjacent objects. As a result, the two-channel system may be used for experiments in distance perspective by placing both microphones and playback speakers in a straight line with the listener.

In conclusion, the use of multiple sound channels offers unique advantages in high quality music and sound reproduction, as well as providing extra reliability and versatility for the recording engineer or public address operator. Present day inexpensive dual-track tape machines may be adapted to simultaneous two-channel operation at relatively low additional expense, while recently developed tape copying techniques, as well as the advent of long playing discs, indicate that commercially produced binaural recordings are well within the realm of possibility.

-30-

Electronic Organ

(*Continued from page* 61)

maximum volume, you are playing a melody. There are no popular songs where a seven second rest is written in the melody and if there were, you could release the volume. There is a way to eliminate this click but it involves the use of another set of contacts on all twenty-three keys and I did not consider it worth the effort. If you will keep a finger on the next key to be played, there will be a continuous melody and no keying will be heard.

"How do I find those exact frequencies for the melody attachment?" A very good question. First, tune the main organ by locating the 440 cycle "A". Then use the chart method to tune the rest of the notes. You will notice that all of the keys in the melody attachment are duplicated in the main organ. Just match the highest key in the melody attachment to the identical key in the main organ. It is a "G" and should be 393 cycles. The potentiometers are all in series so you must begin with the highest note. With that as a basis, tune the remainder of the melody attachment by the chart method.

-30-

DEALERS-SERVICEMEN-MAKE MORE MONEY-GET ACQUAINTED with McGEE

28 WATT $150.00 LIST PORTABLE P. A. ON SALE $69.95

3-SPEED PHONO TOP—TWO 12-INCH SPEAKERS
7-TUBES PUSH PULL 6L6'S HEAVY LEATHERETTE COVERED PLYWOOD PORTABLE CASES
CRYSTAL MIKE $8.95 EXTRA

STOCK No. AP-28X. Portable 28 watt public address system. You get a 7-tube heavy duty push-pull 6L6 amplifier with inputs for 2 mikes either crystal or dynamic with separate mixing volume controls. One phono input. Fully variable tone control high fidelity, wide range frequency response. The heavy duty output transformer has taps for 4, 8, 16, 125, 250 and 500 ohm speaker connections. Two heavy duty 12 inch alnico V P.M. speakers, each with 25 feet of speaker cable. Each speaker is mounted in separate carrying cases. Each case has a snap on back and is large enough to give good speaker baffling. Each case is 21 x 16 x 13 inches. One is used to carry the amplifier. A 3-speed phono motor and pick-up is mounted in the top of the amplifier to play 33⅓, 45 and 78 RPM records.
This portable PA system will put out 20 watts all day long and 28 to 30 watts peak audio.
McGee offers you this $150.00 list portable PA system at a terrific saving.
STOCK No. AP-28X complete portable PA system with 3-speed phono and speakers as pictured (less mike) ship. wt. 71 lbs. $69.95.
Electro Voice model 910 $28.50 list crystal mike with 20 feet of cable and desk stand $8.95 extra.
Floor type mike stand instead of desk stand $4.95 extra.
(SEE OFFERING TO THE RIGHT FOR WALL SPEAKERS INSTEAD OF THE PORTABLE SPEAKERS.)
The AP-28X P.A. system is offered with two of the 25 watt weatherproof trumpet and drivers No. MA-33 shown below; in place of the two portable speakers with baffles. Specify that you want MA-33 trumpets with your amplifier and add $35.00 to the cost. Stock No. MA-28XX. Net price $104.95.

28-WATT AMPLIFIER WITH 12-INCH WALL SPEAKERS

The 28 watt amplifier shown to the left is also offered without the portable speakers. In their place we will ship two Seeburg walnut wall baffles with two heavy duty 12 inch alnico V magnet PM Speakers and 500 ohm line matching trans. Stock No. SS-28R 28 watt amplifier with 3 speed phono top with two 12 inch wall speakers. $69.95. Extra 12 inch wall speakers $11.95. Model 910 Electro Voice mike $8.95 extra. Floor stand $4.95 extra.

50-WATT PORTABLE P.A. ON SALE $99.95
3-SPEED PHONO TOP—TWO 12" SPEAKERS

10-tube portable 50-watt public address system. 4—6L6G (push-pull parallel) output tubes. Inputs for 2 microphones, either crystal or dynamic, with separate mixing volume controls. Twin bass and treble tone controls. High fidelity wide range output transformer with taps at 4, 8, 16, 125, 250 and 500 ohms. Complete with 2 super heavy duty 12" PM speakers and 25 ft. cables mounted in separate leatherette-covered carrying cases, 21"x21"x13". The amplifier fits in one of the cases for carrying. This amplifier will put out 40 watts all day long and 50 to 60 watts peak with ease. 3-speed turntable and pickup arm to play all records 33⅓, 45 and 78 RPM is mounted in the top of the amplifier. Stock No. AP-60X, 50 watt portable P.A. system similar to the 28-watt model pictured above, less microphone. Sale price, $99.95. Shipping weight, 100 lbs. Shipped via Express or Truck only.
Regular $45.00 list Electro-Voice 610 dynamic microphone with 20 ft. cable and desk stand, $11.95 extra. For floor stand instead of desk stand, add $4.95.

10-WATT PORTABLE P.A. ON SALE $42.95
3-SPEED PHONO TOP—10" ALNICO PM SPEAKER

5-tube portable 10-watt (14-watt peak) public address system. (Push-pull 7C5) U. L. approved amplifier with wide range response. Inputs for microphone and phono, with separate mixing type volume controls. Tone control. 10" Alnico V PM speaker is housed in a leatherette case 21"x16"x13" which holds the amplifier for carrying. 3-speed turntable and pickup arm to play all records 33⅓, 45 and 78 RPM is mounted in the top of the amplifier. List value, $90.00. Stock No. AP-10X, 10-watt portable P.A. system similar to the 28-watt pictured above, except it has only one case and one 10" speaker, less microphone. Sale price, $42.95. Shipping weight, 41 lbs. Shipped via Express or Truck only.
Crystal microphone with non-removable desk stand, $3.95 extra when ordered with the AP-10X portable P.A. system.

BRUSH CRYSTAL EAR PHONE With Control $5.49

Simply clip on to the speaker voice coil of any radio or TV set or to an audio amplifier. No soldering necessary. Listen in privately to your favorite programs. The tiny Brush crystal ear phone fits your ear just like a regular hearing aid ear piece. A small remote control box enables using 20 ft. from the radio or TV set. Has its own separate volume control and small matching transformer built-in to operate the crystal from any speaker voice coil. Ideal for hospitals, homes, hundreds of other uses. 10 times more comfortable to wear than conventional earphones. Stock No. BH-500 includes Brush crystal ear piece, remote control box, 20 ft. of cable and instructions. Sale price, $5.49 complete. Brush crystal earphone with 36" cord. Stock No. BR-51. $2.95. (You connect it like any crystal earphone. diagram furnished.) Accessory kit includes volume control with switch plus coupling capacity and instructions, 99c extra.

INDIVIDUALLY CARTONED ELECTRONIC RADIO & TV TUBES

McGee offers you a wide selection of good quality TV and Radio tube types. Individually cartoned. Our private brand. These are not set mfg's. culls, but a carefully inspected private line of tubes with a full 6 months' guarantee. Types listed are in stock in good quantity at this time. Thousands sold. Order 50 tubes and take 10% off the listed prices.

0Z4	$0.59	6AT6	.49	6H6GT	.59	7H7	.79	12SJ7M	.59
1A7GT	.59	6AU6	.49	6K7GT	.59	7Y4	.69	12SJ7GT	.59
1B3GT	.79	6AV6	.49	6L6G	1.09	12AL5	.59	12SN7GT	.69
1H5GT	.59	6AX4GT	.69	6S4	.59	12AQ5GT	.69	12SL7GT	.79
1L4	.59	6BA6	.49	6SA7GT	.59	12AT6	.49	19BG6G	1.79
1R5	.59	6BA7	.69	6SH7GT	.59	12AT7	.69	25BQ6GT	.99
1S5	.59	6BC5	.59	6SF5GT	.59	12AU6	.59	25L6GT	.59
1T4	.59	6BD6	.49	6SK7GT	.39	12AU7	.69	32L7GT	.79
1U4	.59	6BF5	.59	6SL7GT	.69	12AV6	.59	35B5	.59
1U5	.59	6BF6	.59	6SN7GT	.69	12AV7	.89	35C5	.59
3Q4	.59	6BG6G	1.29	6SU7GT	.69	12AX4GT	.59	35W4	.39
3Q5GT	.69	6BH6	.59	6T8	.79	12AX7	.69	35L6GT	.59
3S4	.59	6BJ6	.59	6U8	.79	12BA6	.59	43	.79
3V4	.59	6BK7	.99	6V6GT	.59	12BE6	.59	47	.89
5U4G	.49	6BL7GT	.99	6W4GT	.59	12BD6	.59	50B5	.59
6AB4	.69	6BQ6GT	.99	6X4	.39	12BF6	.79	50C5	.59
6AK5	.89	6CA4	.39	6X5GT	.49	12K8GT	.59	50L6GT	.59
6AL5	.49	6CB6	.59	7A7	.69	12Q7GT	.59	70L7GT	.99
6AQ5	.49	6CD6G	1.49	7B6	.69	12SF5GT	.69	117Z3	.39

OUTDOOR SPEAKERS — WALL BAFFLES — 50-WATT BOOSTER AMPLIFIER

25-Watt Horn $28.95

25-Watt Weather-Proof Out-Door Speaker $28.95

8" PM AND LEATHERETTE BAFFLE, $4.95 LOTS OF 10, $4.75

The finest Leatherette Baffle we have ever offered. New self-supporting plastic grill material, baffle is covered tan with matching grill. Offered with a good heavy duty 8" Alnico V PM speaker with 3.2 ohm voice coil. Stock No. 818. Speaker and Baffle, $4.95 ea.; lots of 10, $4.75.
8" Baffle only. Stock No. NV-8. $2.29 ea.; 10 for $19.95.

ORDER FOR USE WITH ANY P.A. SYSTEM OFFERED ON McGEE'S 2 PAGES OF ADVERTISING

25-WATT HORN 25-Watt Driver and 3½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price $28.95.

50-WATT BOOSTER AMP. $39.95

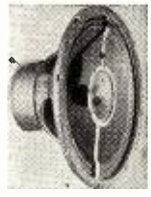
2-Mike Pre-Amp $12.95 Extra, Not a Kit, but a Manufactured Amp.

50-WATT BOOSTER A sensational value, 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6 lb. potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 mill power supply with 5U4 rectifier. Price includes tubes: 4 6L6, 7N7 and 5U4. The two variable controls are for master volume control and bass boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55N. Shipping weight 26 lbs. Sale price $39.95 ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55N Booster amplifier. It enables use of 2. Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control of the 55 watt Booster Amplifier. Small chassis size 5 x 3¼ x 4". Stock No. PR-2X. with tubes 7F7 and 7N7. Net price $12.95 ea.

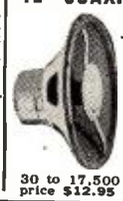
IT'S McGEE FOR COAXIAL SPEAKERS—3-SPEED CHANGERS—FM-AM CHASSIS

McGEE'S $62.50 LIST 15" COAXIAL SPEAKER, $21.95
21 OZ. ALNICO V MAGNET—5" TWEETER



This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 production, of a famous manufacturer of fine speakers. The 15" speaker has a 21½ oz. Alnico V magnet; equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover. leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P15-CR. shipping weight 13 lbs. Net price $21.95.

12" COAXIAL SPEAKER, $12.95



McGee offers the new 1952 model 12" coaxial PM speaker. Quality you would put in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y. Sale price $12.95 each; 2 for $25.00.

12" JENSEN PM, $15.95

Another McGee Scoop! Jensen Concert 12", 14½ oz. Alnico V magnet PM speaker, 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12F. Sale price $15.95; 2 for $30.00.

ESPEY 12-TUBE FM-AM CHASSIS, $59.95

- ★ BUILT-IN PRE-AMP FOR G.E. VARIABLE RELUCTANCE PICK-UP
- ★ WIDE RANGE AUDIO
- ★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING

McGee's new 1953 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1700 kc and FM 88 to 108 mc. Wide range audio response (push-pull 6V6 output) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13½" x 9" high and 9" deep. Complete with tubes: 6BE6, 6BA6, 6BA6, 12AT7, 6SH7, 6AL5, 6SQ7, 6SQ7, 12AT7, 2—6V6GT and 5Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X Espey 12-tube FM-AM chassis. Sale price, $59.95, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.

G.I. 3-SPEED CHANGER WITH G.E. VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE $22.95

Another tremendous McGee Scoop! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically: 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12"x12⅛". Shipping weight 14 lbs. Stock No. 700-GE. Scoop price. $22.95.
GI 3-speed changer same as above, but with Webster flip-over twin needle cartridge. Stock No. GI-700, Sale price, $21.95 each.

ESPEY DEAL (1), $99.95

Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and VM-950 G.E. 3-speed changer equipped with a G.E. turnabout variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1, Sale price $99.95. With 15" coaxial PM speaker P15-CR instead of CU-14Y, $10.00 extra.

ESPEY DEAL (2), $118.95

Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and the English Garrard 3-speed changer equipped with a G.E. variable reluctance turnabout cartridge. Our best home music system, Espey Deal #2, Sale price $118.95. With 15" coaxial PM speaker P15-CR instead of CU-14Y, $10.00 extra.

ESPEY DEAL (3) $138.95

Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge, Espey Deal #3, Sale price $138.95.

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

LOOK TO McGEE FOR ALL RADIO AND TELEVISION MATERIAL

GENUINE STANDARD COIL T.V. BOOSTER $11.95

Not Surplus, But Right From the Factory

Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the saving on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for $35.00, is offered to you for only $11.95 each. Brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes printed high frequency circuits, for improved performance on all channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distorting of picture or sound. Has extremely low noise factor. Continuous one-knob tuning and channel selector control switch for off-on and by-passing 300 ohm lead-in to set. Modern design, dark brown plastic cabinet, 8"x4¼"x4½". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51, Sale price, $11.95 each, or buy 2 for only $22.00.

FRINGE AREA TV RECEPTION IS BETTER WITH OUR McMURDO SILVER TV BOOSTER $10.95—TWO FOR $20.00

Read the article on pages 52 and 53 of the December "Radio & TV News." You will see how a booster like the McMurdo Silver Super Sonic was used for fringe area TV reception. We can't guarantee this unusual reception, but we will guarantee this booster to be a sensational value. Continuously variable inductance type tuner from channel 2 including the FM band through channel 13. Self-powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to TV set. Single knob tuning. Attractive plastic case. McMurdo Silver Super Sonic TV-FM booster. Stock No. GB-6B, shipping weight 5 lbs. Sale price, $10.95 each or two for $20.00.

20 INCH CONVERSION KIT $29.95

YOU GET—

20HP4—20" PICTURE TUBE
20-INCH PLASTIC MASK
14 K.V. FLYBACK AND 70° YOKE

Our 20" conversion kit includes a 6-month guaranteed 20HP4, 20" rectangular blackface picture tube, plus a 14,000 volt G.E. built high voltage flyback transformer, plus a matched 70° cosine yoke, plus a 20" rectangular gold trimmed plexiglas mask and suggested diagram. The picture tube is the latest electro-static focus type that requires no focus coil. Shipped via express or truck only. Ship. weight, 40 lbs. Stock No. 20-TP, net price, $29.95.

17-INCH CONVERSION KIT $25.95

YOU GET—17BP4A 17" PICTURE TUBE
17-INCH PLASTIC MASK
14 K.V. FLYBACK AND 70° YOKE

17-inch conversion kit with a 17BP4A, 17" rectangular blackface electro-magnetic focus picture tube with 6 months' guarantee, plus a matched 70° cosine yoke, a G.E. built 14,000 volt flyback and a 17" rectangular gold trimmed plexiglas mask and safety shield. Suggested diagram furnished. Shipping weight, 30 lbs. via Express or Truck only. Stock No. 17-4XL, 17" conversion kit, Sale price, $25.95.

CAPEHART CABINET, $79.95

BLANK OR CUT TO FIT ESPEY CHASSIS

Buy this cabinet with Espey chassis and the VM changer at the left and have a fine radio-phono combination for less than the value of the cabinet alone. This beautiful cabinet was intended for a Capehart $800.00 combination. It is the finest possible furniture quality cabinet workmanship. 37" high, 40" wide and 21" front to back. Hinged top lifts in two sections. 25½" lid covers the changer compartment and 14½" is the width of the radio compartment. Changer mounting panel is furnished blank. Radio panel is shipped ready cut to fit the 7-C Espey chassis. Baffle is cut to hold 2—12" speakers. Made of top quality walnut veneer. ⅞" material used throughout. Shipped via truck, rail or express only. Shipping wt., 160 lbs. Stock No. C-175, with panel cut to fit Espey 7-C, $79.95. Stock No. B-175B, with blank changer and radio panel, $79.95. Buy 2—12" 32 oz. Alnico PM speakers for use in this cabinet for only $15.00 ($7.50 each).

RCA 201E1 T.V. TUNER $7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was $44.00. Now only $7.95 each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P, TV front end tuner. Convertor coil type for separate sound as used in the famous 630 chassis. Complete with 3—6J6 tubes, $7.95. Specify shaft length desired, either 2" or 4".

RCA 201E-1 T.V. TUNER

Same as pictured above only new—with 2⅞" shaft. Stock No. 2Z01. Sale Price, $11.95.

3-TUBE SARKES-TARZIAN T.V. TUNER $9.95

This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Has built-on convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, with 3 tubes. Net price. $9.95 each. Specify shaft length, either 2⅞" or 4¾".

RCA PRINTED CIRCUIT T.V. TUNER $14.95

RCA Printed Circuit T.V. Tuner with 6J6 and 6CB6 tubes. Similar mechanically to the standard coil (same knobs fit). Snap-in channel segments. Has 6½" shaft. Used on late Hallicrafters T.V. sets. Stock No. RC-A12. 12 Channel Tuner with Tubes. New, $14.95. Knobs, 59c.

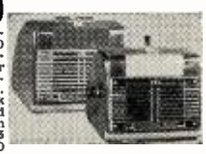
T.V. TUNER FOR EMERSON $12.95

STOCK NO. SC-947E

For Emerson 650D ETC. Has 2¼" insulated shaft and tubes 6BC5—filaments in series—shunted to .6 amps. Stock No. SC-947E. Sale Price, $12.95. Knobs, 59c.

3 STATION INTERCOM MASTER $16.95

SUB STATION $3.95



3-station intercom master housed in chrome plated metal cabinet 7½"x6"x5" sloping front. Full 3-tube amplifier for 110 volt AC-DC operation. Press-to-talk switch is on top of the cabinet and volume control with off-on switch and station selector switch are on either side. May be used with from one to 3 substations. (See matching cabinet chrome plated sub-station No. PM-A5). Master is quiet at all times except when press-to-talk switch is pressed at the master or call-back switch is pressed at the sub. Uses 3-wire intercom cable. 3-station intercom master MPM-A3, shipping weight 10 lbs. Sale price, $16.95 each, sub-stations extra. 3-wire plastic intercom cable, 100 ft. for $1.95, 500 ft. for $8.95.

INTERCOM SUB STATIONS $3.95

Chrome plated, with call back switch for a 3-wire intercom master. Size 7½"x6"x5" sloping front. 5" Alnico V PM spkr. Intercom dealers buy at less than present production costs. Limited quantity. Stock No. PM-A5, ship. weight 8 lbs. Sale price, $3.95 each or 3 for $10.00. Special 3-wire plastic intercom cable, 100 ft. $1.95, 500 ft. for $8.95.

Brown leatherette covered intercom sub-station with call back switch for use with 3-wire intercom masters. 5" square and 2½" deep. Has new plastic grill cloth, Alnico V PM speaker. A true McGee value. Stock No. NE-5, ship. weight, 1½ lbs. Sale price $3.95 each or 3 for $10.00. 3-wire plastic intercom cable, 100 ft. for $1.95, 500 ft. for $8.95.

CAPEHART CABINET FOR 1000 SET—ONLY $99.95

BEAUTIFUL WALNUT

99.95

Beautiful, finest quality walnut combination radio-phono cabinet, 42" high, 42" wide and 22" deep. Made for Capehart's finest combination, selling for $900 and up. Cabinet cost manufacturer over $200.00. Has highly polished matched walnut panels. Made of ¾" material. Top 1⅛" solid stock. This cabinet weighs approximately 175 lbs. The changer and speaker grill all have hinged doors. Radio compartment on right hand side is 14" high and 11½" wide. Made to mount chassis vertically. Changer compartment is 14" high by 26½" wide. Large enough to hold any record changer or recorder mechanism. Front 10" of top over the changer compartment is hinged to fold back for easy access to the changer. Both radio and changer compartments come with uncut blank panels. Speaker baffle is cut for a 12" speaker and the speaker compartment is completely enclosed. Shipping weight, 275 lbs. Stock No. K-275W Capehart combination cabinet. Net price, $99.95. Walnut.

COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT McGEE

3-WAY PORTABLE KIT $15.95

A NEW '52 MODEL

New 1952 Model 3-way personal portable radio kit. Operates on 110 Volts AC-DC or 67½ B plus 1½ volt self-contained batteries. Leatherette covered case size, 5½x5¾x8". Receives broadcast 550 to 1650 KC. A conventional 2-gang superhet circuit with 456 KC iron core IF's. Incorporates the new super gain stick loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PN-4T, shipping weight 7 lbs. The complete kit, less batteries, $15.95. 67½ V. B, $1.59; 1½ V. A, 39c extra.

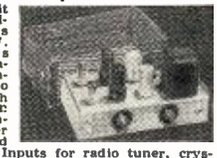
Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, $7.95. DE-6RWT, wired and tested. Net price, $9.95. Crystal mike and desk stand, $4.95 extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net, $3.95 extra.

8-Tube HI-FI Amplifier Kit $29.95

A complete kit, including tubes: 3-7E5, 2-12AX7, 2-triode plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model 7X5. Net $29.95.

10-Watt HI-Fi Amplifier Kit $14.95



A complete kit of parts including tubes 12AX7, 12AU7, 2-5Q1.6, plus rectifier, diagram and instructions to build a high fidelity tweet tone control audio amplifier with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output matches 8 ohms. Response from 50 to 15,000 cps. Chassis ready punched. Ventilated cover. Straight forward circuit with twin triode grain stages and 2-50L6 tubes in push-pull. Size, 5¼" x 10" x 5⅝" high. Model AP-10R, ship. wt. 8 lbs. Sale price $14.95.

10-TUBE RADIO KIT $29.95

10 tube broadcast radio chassis kit, complete with tubes: 2-6SK7, 6SA7, 3-6SN7, 1-6SL7, 2-6V6 plus 5Y3 rectifier, diagram and instructions. 3 gang superhet with 8" slide rule dial. Chassis size, 12½"x10"x6½" high. Features push-pull 6V6 high fidelity audio. Output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model BK-R10 kit less speaker, shipping weight 18 lbs. Net $29.95.

17, 20" T.V. Kit $59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for use with a 16", 17" or 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video IF strip. Circuit is of the conventional design. Do not buy this unless you understand Television. It is difficult to wire. We furnish schematic. Kit model WH-20. Ship. wt. 40 lbs. less all tubes. Net $59.95.
Kit of 22 tubes, less picture tube $16.95. 17" 17BP4A, $19.95. 20HP4, $25.00.

6-TUBE 2-BAND KIT $14.95

Popular with schools and colleges for training. 6 tube AC-DC, 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12K8, 12SK7, 12SQ7, 50L6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x8¼". Shipping weight 12 lbs. Model ME6-2. Net $14.95.

5-TUBE AC-DC KIT $12.95

Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as ME6-2 above. Complete with tubes. Shipping weight 10 lbs.. Net $12.95.

AC POWERED BROADCAST TUNER KIT $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes. 6BA6 R.F., 6BE6 oscillator R.F., 6BA6 I.F. detector, 6AL5 diode. AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020 or 7x5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, $12.95.

CRT TESTER-SPARKER

By

D. GNESSIN & H. D. SUESHOLTZ

Transvision, Inc.

Operational data on a new piece of test equipment including the proper TV servicing procedures.

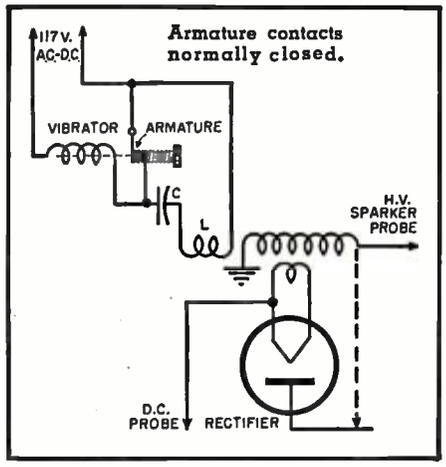
Over-all view of the new Transvision "Tester-Sparker" video test instrument.

THE busy TV technician will welcome the combination service instrument to be described here. The full schematic is shown in Fig. 1. Briefly, the unit consists of a high-frequency oscillator and its related d.c. rectifier. Thus either a.c. for sparking or d.c. for auxiliary high voltage supply is available in the lightweight instrument with its own power supply.

Study Fig. 1. Note the a.c. (or d.c.) from the power line actuates the vibrator. The adjustment screw on the armature contacts can be set with a knob from the front panel for optimum vibration, effectively acting as a voltage potentiometer. The damped oscillations set up in the oscillatory circuit, *LC*, operate at the natural resonant frequency determined by the component parameters, falling within the low radio-frequency range. The turns ratio of the high voltage "Sparker" winding, inductively coupled to *L*, is so great that the high-frequency field at the "hot" end of the probe is on the order of 10 kv. or higher.

When the "H.V. Sparker Probe" is applied to any metallic substance, like the pins of a vacuum tube, a spark jumps from the probe to the pins, carrying the high-frequency energy throughout all the metallic parts. The presence of gas within the tube is immediately exposed by a colored fluorescence. Thus the "Sparker" is an indicator for showing up *soft* tubes. The amount of fluorescence shows the amount of gas present, varying from the slightest blue tinge in acceptable cases to bright pink and purple in obviously gassy types.

Fig. 1. Circuit diagram of the test unit. See text for explanation of operation.



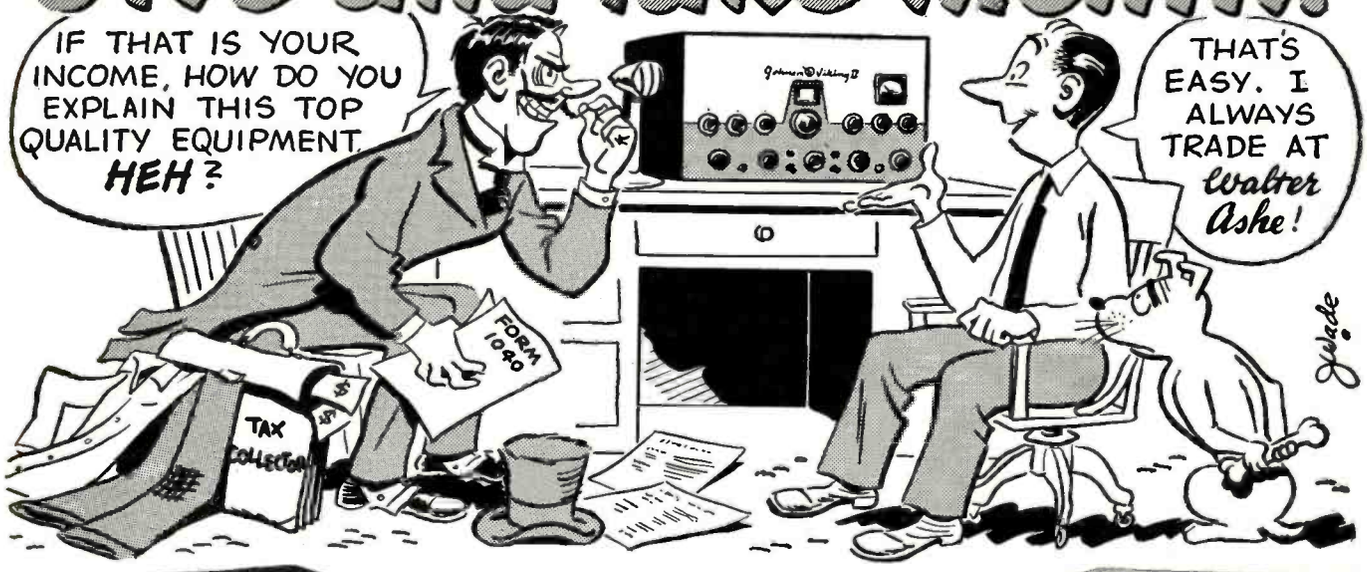
It would be nice to set down a comparator chart so the color of the fluorescence would automatically indicate gas content. This is impossible since so many different types of tubes, made by different techniques of manufacture, create different interpretation of the color results. It is analogous to a physician reading an X-ray. A shadow in one case may be acceptable when all the conditions are known, where in another case it would spell trouble. So, too, with a little experience will the operator of the "Tester-Sparker" soon be able to differentiate between the subtle changes in color and thus determine which is acceptable and which is not.

Sparking a picture tube (or any other vacuum tube for that matter) permits exposure of any foreign substance within the tube, *such as high-resistance shorts, dag material shorting the CRT gun,* etc., to the high-frequency sparking. The energy heats the foreign material, *vaporizing* it, thus relieving the short.

For television set analysis the "Tester" portion of the instrument is used. Refer again to Fig. 1. The dotted portion shows the connection for d.c. output. Rather ingeniously the "H. V. Sparker Probe" is pushed into a cavity in the instrument case, permitting the probe tip to engage a spring contact connected to the 1B3 plate. At the same time inductive coupling between the probe winding and a pick-up coil in the case develops a little over one volt which is applied to the 1B3 filament. The rectifier now acts exactly like the high-voltage rectifier in the television chassis, making high-voltage d.c. available at the d.c. probe. This device provides an auxiliary second anode supply which opens a new field of TV analysis.

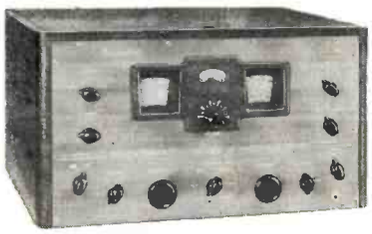
In the television receiver, failure of

'Give and Take' Month!



HALLICRAFTERS S-76
Less spkr. Shpg. wt. 46 lbs.
Only $179.50

HALLICRAFTERS SX-71
Less spkr. Shpg. wt. 51 lbs.
Only $224.50



HAMMARLUND HQ-129X
Less spkr. Shpg. wt. 74 lbs.
Only $239.50

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any portion of the horizontal oscillator, discharge, amplifier, damper, flyback, or rectifier circuits or their related power supplies, filament circuits or interconnected components causes failure of the high-voltage supply at the picture tube. Without high-voltage there is no raster. Loss of raster deprives the technician of the most elementary tool in TV analysis—the screen image.

Here we have a vicious cycle: We need the image on the screen to show the distortion or failure of circuit parameters, yet we cannot get the screen image because the failure of one of the involved circuits prevents getting *any picture at all!*

There is precedent for this new circuit substitution technique. In radio circuits when nothing can be received through the receiver a signal generator *squirts* an artificial signal through the set so that *something* gets through to allow service procedures to be applied. So, too, does the "Tester-Sparker" provide an alternate high-voltage supply to permit a raster to show something to start test procedures.

The instrument provides variable high-voltage output at its clip lead. This is attached in place of the anode cap regularly used. The set's original anode cap is carefully dressed away from the chassis to avoid arcing. The chassis and service instrument are then tied together with common chassis bond to provide ground return. Now, to work:

Remember to keep the "Brightness" control down low to prevent screen burn in case there is no deflection. Turn that control up slowly. If a *perfect picture* results then manifestly it has been shown that the original high-voltage supplied to the picture tube was unsatisfactory, since the substitute high-voltage supply has provided a perfect picture. Trouble may be sought in the h.v. rectifier with its associated circuits.

It may be that *no raster* results. Since we know the high-voltage is okay, a further check using a scrap lead from chassis to anode terminal *while the auxiliary supply is connected to CRT anode* should draw a healthy spark. No spark here is indication the high-voltage is being bled off—probably grounded within the CRT. The next step is to check the CRT and its associated socket supply.

An *undeflected spot* shows the set has no apparent sweep (either horizontal or vertical) with no high-voltage. This trouble involves both sweep circuits—look for a common supply there.

A *vertical line* shows at least the vertical sweep is okay. Lack of horizontal sweep has caused the loss of high voltage and the horizontal oscillator and/or amplifier is indicated.

Pronounced *foldover* at the left is an indication of damper problems and its associated circuit. An open in these circuits would open the h.v. pulse.

Limited horizontal width may be evidence that horizontal excitation is low or is insufficiently amplified to

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provide large enough flyback pulse or h.v. Trouble may be between the horizontal oscillator and flyback.

Limited picture size all over indicates presence of both sweeps but insufficient amplitude for either, with insufficient flyback action for high-voltage. The supply common to both sweeps should be investigated.

Raster but no video shows that in addition to lack of high-voltage the set has video trouble. This brings out a very pertinent point: Look for the possibility of *more than a single* element failure.

None of these failures could have been seen on the screen without the use of an auxiliary high-voltage supply like that of the "Tester-Sparker."

Finally, the d.c. high-voltage supply can be used as an insulation tester.

Applying a spark through the test material to ground indicates the ability of the material to resist breakdown under the influence of high voltage. The purple glow that is apparent on the surface of the material does not represent breakdown, but rather ionization of the air.

True insulation breakdown is indicated by a deeper blue spark of a thicker, more substantial nature. It is possible to determine the manner in which an insulator will break down by repetitive sparking at a broken-down point. Inspection will then show whether the material will *carbonize* or merely break down.

Prolonged d.c. sparking to chassis or physical ground should be avoided, since excessive current may be drawn in this manner, burning out a rectifier tube.

Reference to the over-all view of the instrument shows the knob used for varying the high-voltage output (armature control). Also shown is the top of the 1B3 rectifier projecting through the front panel with the spring contact connected to it. The sparker probe engages this contact through a cavity in the rear of the instrument.

Certain basic safety precautions should be observed in handling this instrument. Since it is high-voltage equipment, *safety first!* —30—

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Mobile Equipment
(*Continued from page* 63)

ner as the spring whip except that a metal tube is used to support the antenna and its skirt, through which the coaxial transmission line is passed. This tube extends through the surface of the automobile with a suitable bushing and is clamped to a substantial point inside the luggage compartment.

The roof-top antenna is mounted near the center of the vehicle roof and the transmission line is passed through to the luggage compartment between the roof and the cloth headliner.

To install a roof-top antenna, the following procedure should be employed. Locate the proper position for the antenna. Choose a location well to the rear of the vehicle. There is very little electrical advantage to be gained by mounting the antenna forward and by shortening the distance between the antenna and the transmitter, line losses are minimized. This shorter distance also makes it easier to install the transmission line. Most manufacturers of roof-top antennas include instructions for loosening the headliner over one of the rear windows and fishing the antenna lead through to the trunk of the vehicle in this fashion. Headliners are usually installed oversize at the automobile factory and then trimmed to size after being firmly anchored into position. It is nearly impossible to loosen a headliner and replace it in such a way as to be unnoticeable. Wrinkles or gaps in the replaced headliner tend to make the completed installation look messy and non-professional. The required hole for the antenna may be best accomplished by drilling a small pilot hole and then reaming to the required size. If a large drill is used initially, the tendency of such a drill to "grab" as it passes through, may tear a hole in the headliner of the vehicle. Drilling a small pilot hole and using a broad taper reamer to enlarge the hole to size eliminates this danger. Thoroughly scrape the paint away from both the top and underside of the opening. This insures a proper ground point for the antenna. A good ground at this point allows the roof of the automobile to act as a ground plane reflector for the antenna providing directivity in the vertical plane of antenna radiation.

The transmission line is installed by using a length of electrician's "fish tape." The fish tape should be long enough to reach from the antenna hole to the luggage compartment with a reasonable amount for handling on each end. In most automobiles, the fish tape can be pushed into the antenna hole in a direction so as to pass directly behind the rear side window, into the luggage compartment. This same path is utilized for electrical system wires in most cars. The transmission line is then fastened to the

fish tape and pulled back through to the antenna opening. This eliminates the necessity for loosening the headliner entirely. The transmission lines should then be attached to the antenna, carefully soldering all connections. In some cases the transmission line is attached to the antenna at the factory and must be pulled in the other direction. The free end of the transmission line should be attached to the end of the fish tape protruding through the antenna opening and then pulled into the trunk of the vehicle. The proper connector may then be attached to the end of the transmission line to allow for connection to the mobile unit.

Installations made in trucks and types of vehicles other than passenger automobiles often require individual consideration as to the problems encountered and the methods to be employed. Generally, certain rules should be followed regardless of the type of equipment. Always remember that the equipment will require service and should be mounted accordingly. Equipment mounted at a point between the front and rear wheels of a vehicle will receive less road shock than when mounted in other locations. Battery leads supplied with the radio equipment are usually sixteen to eighteen feet in length and of heavy copper wire. If the installation is permanent, it may be desirable to shorten this lead as much as possible. This is highly recommended in the higher power types of equipment. Such shorter battery leads will mean higher operating voltage at the unit and consequently fewer eventual service calls. Be certain that the equipment is well grounded to the frame of the vehicle and that all ground and battery cables are tightly connected to prevent voltage drop due to high resistance connections. Try connecting the "hot" battery lead to the starter relay or starter rather than the battery to prevent corrosion of the connection.

When the installation is complete and checked, pause a moment and consider the different conditions of operation that might affect the performance of the mobile radio unit. Driving at night means additional load for the vehicle's electrical system. Headlights, heaters, and many other power consuming devices are operated from the electrical system. All of these may consume power that will then be deducted from the amount reaching the radio. To be certain that the radio is to perform under these conditions of extra load, turn on the lights, heater, or other devices and then check the radio for normal operation. If the equipment operates normally under these conditions, it can be considered ready for the user.

If, after all possible precautions have been taken, the user encounters radio difficulty, remember in his mind, you—the technician—the radioman—are solely to blame. Bear it with a smile and once in a while—the customer may be right! —30—

CURING A FOCUS PROBLEM

By
JESSE JACOBSON

Details on a simple circuit change which can be made to correct TV receiver de-focusing trouble.

A RATHER interesting focusing problem came to my attention recently. Although it may be described as interesting to the technician, it proved to be quite annoying to the TV set owner. Perhaps the word "de-focusing" would be more suitable for describing the situation.

The owner of about 100 TV receivers, who rented these sets to tenants in a midtown hotel, was kept busy making trips to the hotel rooms in order to readjust the focus control. These sets were all of the same make and model and many presented the same symptoms. The picture would slowly go out of focus after playing awhile but could be brought back to normal focus by adjustment of the focus pot. However, after the set was turned off and allowed to cool, the picture would be out of focus when the receiver was turned on again.

An examination of the set showed that replacing the 25L6 tube in the sound section cleared up the trouble but did not guarantee that the trouble would not repeat if and when the tube characteristics changed. The owner of these sets desired a circuit change that would prove to be a permanent cure.

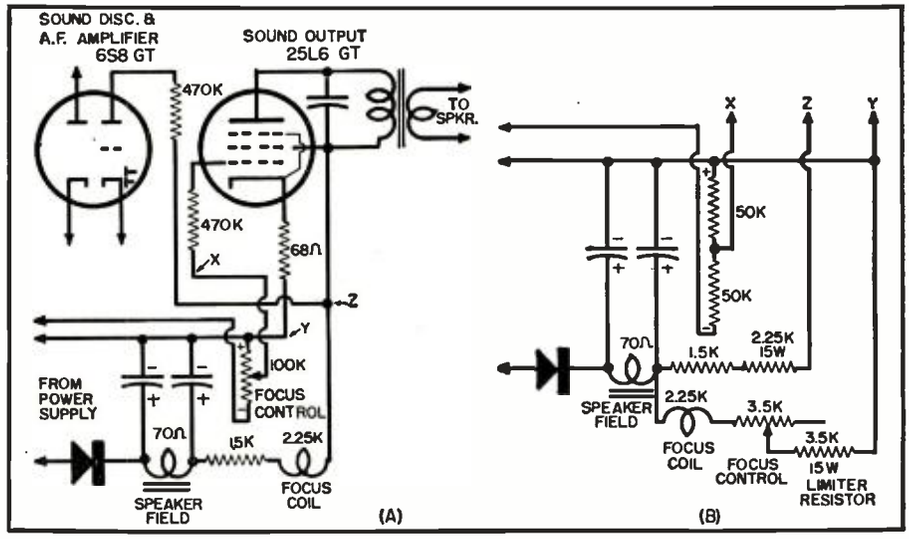
Cause of the Trouble

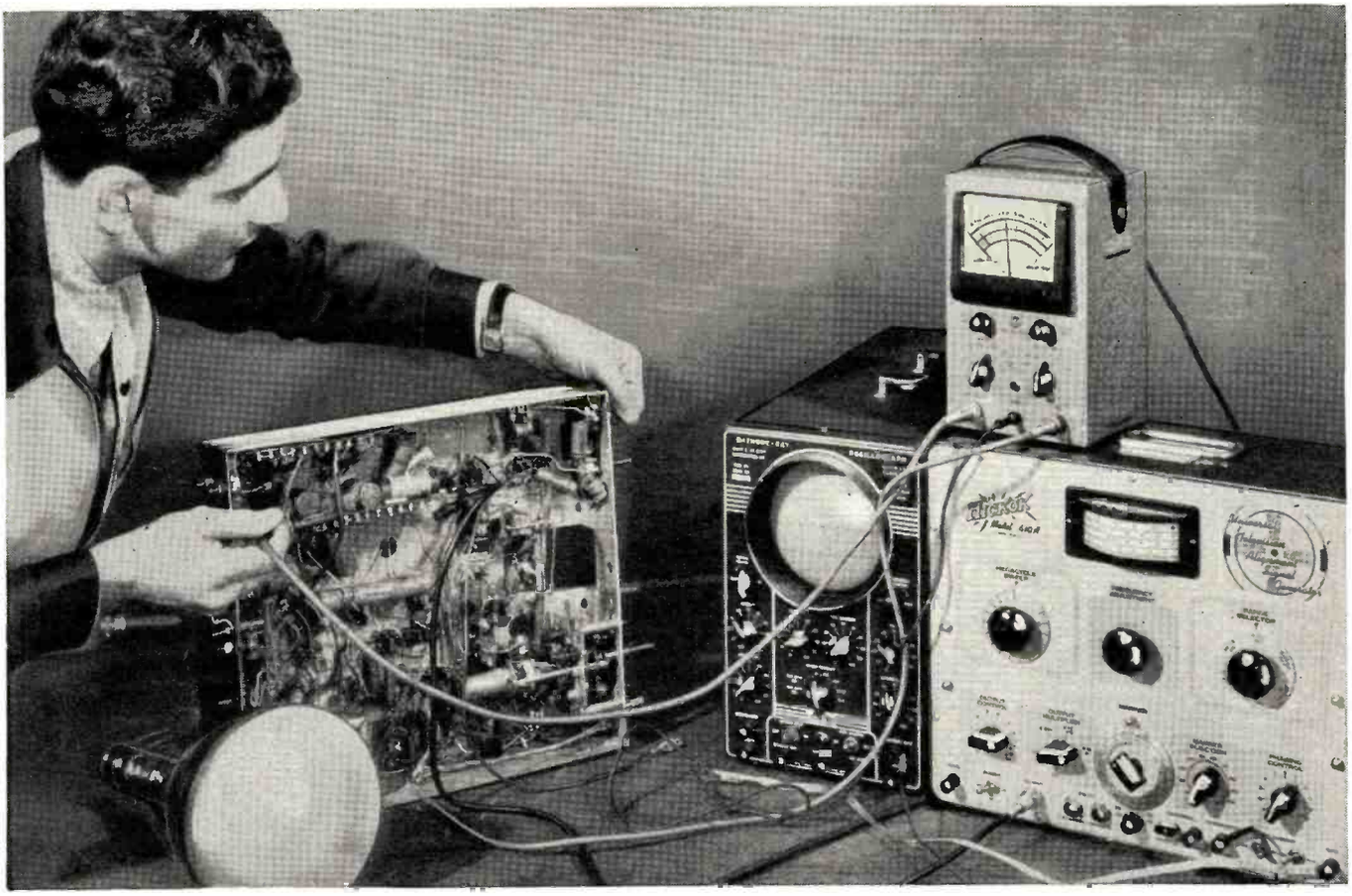
Fig. 1A shows the focus circuit as used in this model receiver. It may be seen that the current through the focus coil depends on the current flow through the 25L6 sound power tube plus the current flow through the 6S8 sound discriminator and a.f. amplifier tube. However, the 6S8 tube may be disregarded as the amount of current flow through it is small compared to the 25L6 tube. Thus it may be seen that any change in characteristic of the 25L6 tube would vary the amount of current flow through the cathode-to-plate and cathode-to-screen path, thus causing de-focusing. In other words, loss of emission in the tube or gassing of the 25L6 would cause a loss or increase of current through the focus coil.

The Focus Control

An examination of Fig. 1A shows that a potentiometer is used for the focus control. The pot. acts as a voltage divider to the control grid of the 25L6 tube. Variation of the pot. causes the negative bias, as measured between the control grid and cathode, to become more or less negative. This action controls the plate current through the 25L6 and focus coil. Thus a larger negative bias causes less focus current through the focus coil and *vice versa*. The ohmic value of the focus coil is 2250 and the combined current flow of both tubes is equal to approximately 55 ma. In order to provide stability of the focus circuit, it was found necessary to remove the 25L6 tube from the path of current flow through the focus coil. However, in doing so, the aim was to make as few circuit

Fig. 1. (A) Original focus circuit. (B) Changes made in that part of the circuit below points X, Y, and Z in original circuit to correct the de-focusing trouble.





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changes as possible and keep the necessary changes simple.

New Focus Circuit

Fig. 1B shows the new focus circuit that was used to solve this particular problem. The first step was to substitute a 2250 ohm resistor for the focus coil. This simply allowed the original sound power circuit to operate in the normally designed manner. As there was no further need to vary the bias on the 25L6 tube, the original focus pot. was removed and two carbon resistors, each having a value of 50,000 ohms, were substituted in its place. The resistors were placed in series, the center point taking the place of the center lug on the pot. This arrangement placed a normally operating bias on the 25L6 tube, allowing it to draw its normal rated plate current.

The next problem was to obtain d.c. focus current through the focus coil. The amount of current had to be the same as before and also had to be adjustable. Most important, the current must remain steady or else all of this effort would be in vain. It was decided to exclude all tubes from this path of focus coil current and place it in its own independent branch.

Hunting for 45 ma.

Hunting through the circuit for a "spare 45 ma." was the next step. A 2250 ohm focus coil has one advantage and one disadvantage.

Advantage: Low current requirements to obtain focusing due to large number of turns. Therefore it may be placed *across* a voltage source due its high resistance.

Disadvantage: Cannot be placed in series with the entire "B plus" current source due to excessive voltage drop across coil.

Placing it in series with the entire "B plus" line would, of course, be an ideal condition if the coil resistance was lower. If a tube changed its characteristic and its current flow, it would not be noticeable as it would be "swamped out" by the current flow through the 20 other tubes in the set. However the excessive voltage drop due to the resistance of 2250 ohms, would not allow this type of circuit to be used with this particular coil. It was decided therefore to place it across the output of one of the selenium rectifiers. Before actually placing the focus coil in its new circuit, it was decided to set up an experimental equivalent circuit across the selenium rectifier to see whether the additional 45 ma. would place an excessive load on the rectifier. The circuit consisted of an adjustable wirewound resistor in series with a d.c. milliammeter, adjusted to draw 45 ma. The point of connection was chosen so that the additional current flow would not "rob" any other circuit of its normal current. Note on Fig. 1B that this point is well "in back" of any large resistor values to avoid *IR* drop. It also precludes the use of tubes and is entirely independent. The trial circuit was left on for an hour and then

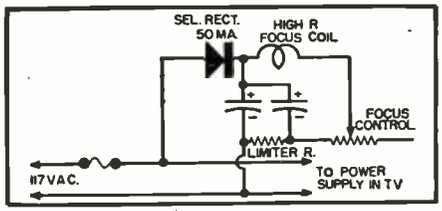


Fig. 2. A separate rectifier focus circuit.

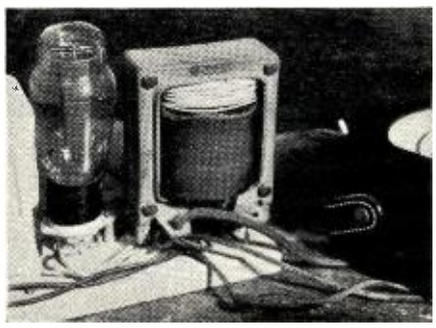
checked for excessive heating of the rectifier. The rectifier, although slightly warmer than normal, did not show any other abnormal signs. Measurement of the voltage at the point of connection before and after connecting the trial circuit showed no appreciable change. It was decided to use this point of connection for the focus coil. It may be seen that this same selenium rectifier supplied the original focus current.

Referring again to Fig. 1B shows that in order to prevent excessive current flow through the focus coil, should the new focus pot. be turned to its minimum resistance position, a limiting resistance is used. The value of resistance, as shown, provided a variation of about 20% from normal focus current when the focus pot. was turned to either extreme.

Applying to Other Sets

The same general idea may be applied to other TV receivers using high resistance focus coils. It is possible to install a small selenium rectifier that will supply focus current independently to the focus coil. However, this is only necessary when it is felt that the additional drain through the focus coil cannot be handled by the original rectifier. Fig. 2 shows this arrangement, using the separate selenium circuit. The selenium rectifier may be of the 50 ma. variety. The focus pot. and limiting resistor may be chosen so as to put the correct focus current in the range, plus or minus 20%, with the focus pot. in either extreme position. The limiting resistor and pot. should both be wirewound and have a sufficiently large wattage rating to prevent overheating and burnout. —30—

Fred J. Lingel, W2ZGY, suggests this method for winding additional turns in the space at the end of a transformer to give an extra filament winding for 12 volt heaters or heater voltage for tubes with the cathode at a considerable voltage above ground. The smooth plastic insulated wire, available in most dime stores, slides through the winding space easily and is tough enough not to ground on the transformer core.



THE BROOMSTICK BOOMSTICK

By **ROB WAGNER, W6WGD**
R.F. Lab., Dalmo-Victor Co.

Three dollars for curtain rods and broomsticks can buy a high-gain, six-element beam with "expensive" performance.

JOHN X. Amateur and Joe Q. Ham operate identical two-meter stations from similar locations. While John exchanges "Q-5" reports with the DX station at Far Acres, Joe fumes and frets, for the Far Acres signal reads "S-zero" at his location.

A wide-spaced, "*Q*"-matched twin yagi array accounts for DX signal reverberations from John's speaker. The same signal presents a big fat cipher at the bottom of Joe's dipole!

Joe, realizing he should also have a beam, surveys its initial cost, and large neon-lighted dollar signs seem to hang from every element. John saves the day by replacing dollars with sense, showing that a good beam need subtract but 30 thin dimes from the piggy-bank while adding about 10 db to the signal gain.

John X. Amateur has discovered that ¼" aluminum tubing proves hard to find and harder to pay for. The hardware store no longer stocks solid #6 aluminum clothesline, and metal-foil-wrapped wooden dowels lack staying power when employed as beam antenna elements.

John (a *Woolworth* customer) bought sixteen curtain rods at a nickel apiece; 80 cents' worth resulted in enough material to provide all elements and "*Q*"-bars. The rods are thin-walled rolled-metal tubing, ¼" o.d., measuring 20" in length. Another 20" section of ⅜" o.d. telescopes within. *Voilà!* a forty-inch element for the former price of a good cigar!

To support his antenna elements, John bought four 35-cent mop handles (same as broomsticks) at the hardware store. This type of wood was chosen for its light weight, cross-sectional strength, and ready availability. Most broom and mop handles appear to be standardized at an o.d. of ⅞", thus a raid on the wife's broom-closet could result in a saving of $1.40 plus tax (*this maneuver is not recommended!*).

Thus far, cash investment amounts to $2.20, plus tax. If the junk box can't yield six standard ¼" i.d. solid shaft couplings, add about 80 cents to the total. We now possess all main components and have spent only two-thirds of a single sawbuck.

Construction

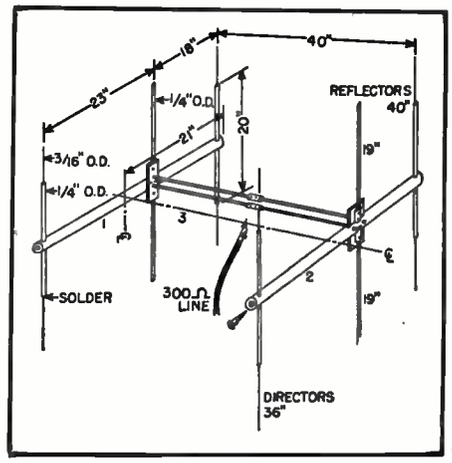
Remove the little spheres from the ends of the curtain rods. Two reflectors and two directors are made from the one outer and two telescoping sections. Using the ¼" o.d. portion of the rod as an element center section, slide a ⅜" tube into each end, arriving at a total length of 40". Solder the junction of the sections, and the two reflectors are almost ready for installation! After making two more elements in similar fashion (directors, 36" long) fill each open end of the tubing to a half-inch depth with solder. We now have four parasitic elements with ¼" o.d. center sections and ⅜" diameter end pieces.

The antenna's driven elements utilize four additional ¼" diameter sections, each rod being sawed to a length of 19". Fill each end with solder as before.

To make the "*Q*"-bars, use the remaining ¼" curtain rod sections. Two each join at their centers, held together with a pair of shaft couplings. Inasmuch as all open ends have been solder-filled, set-screw pressure serves to make a rigid mechanical joint. A #6-32 machine screw run through each coupling's center provides good electrical connection to the 300-ohm line. Over-all length of each "*Q*"-bar measures 40". All metallic elements of the beam are now complete—and you have enough ⅜" tubing over to construct that new 220 mc. array!

Fig. 2 illustrates the method of joining the four driven elements and two "*Q*"-bars to a piece of plastic, such as polystyrene, which both insulates and supports the assembly. Cut two pieces of plastic ⅛" thick, 1" wide, and 3" long and scribe a centerline down the middle of each. The two shaft couplings used in this assembly have a nominal o.d. of ½"; file a 1/16th flat

Fig. 1. Dimensions of the broomstick beam. The cross-member #3 is not yet mounted.



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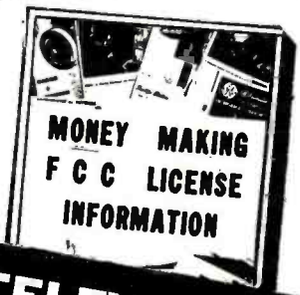

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Albert Schoell 110 West 11th St., Escondido, Calif.	2nd Phone	23

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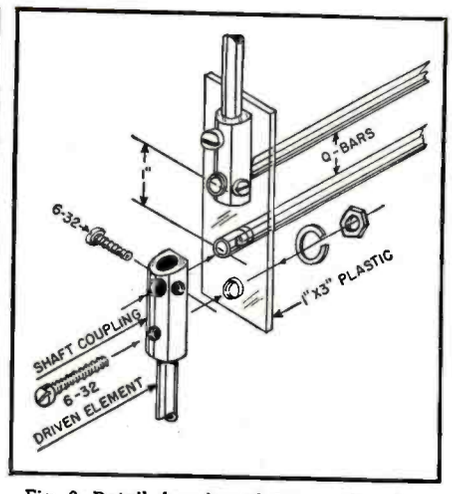


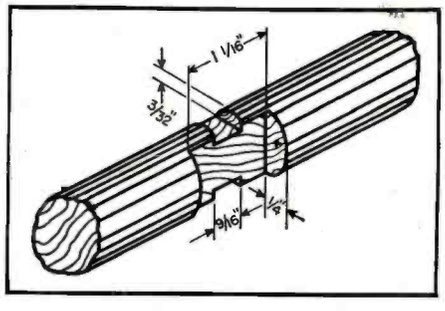
Fig. 2. Detail drawing of the coupling between the driven elements and "Q"-bars.

along one side of each coupling. Place the flat side along the plastic's centerline so that a ¼" hole may be drilled at right angles to the coupling's vertical plane. Insert the end of one *"Q"*-bar and tighten the set screw. Repeat the procedure with the second shaft coupling, observing the 1" center-to-center dimensions of the ¼" holes as shown in Fig. 2. When the second *"Q"*-bar is secured, repeat the operation for the opposite side of the array.

Place each of the four 19" lengths of driven element upright within the shaft couplings. Drill a #27 clearance hole directly through coupling, element, and plastic, then secure the three pieces with a #6-32 machine screw. Fig. 2 shows that construction is mechanically rigid and electrically sound. The driven element-*"Q"*-bar assembly is now complete and ready for installation upon the two antenna support booms. These are referred to as "Broomsticks" #1 and #2.

Begin "Operation Broomstick" by cutting two lengths of stock to 42" each. To ensure that all elements will mount in the same vertical planes, place a straightedge along the top of each broomstick's length and scribe a pencil line. Center-punch the line ½" in from the end of the stick. Another mark is located 18" down from the first point, and a second center-punch is made at 23" from the 18" mark. "Broomsticks" #1 and #2 are now ready for drilling and notching according to Figs. 1 and 3.

Fig. 3. Dimensions of the notches in the sticks #1 and #2. The assembly of Fig. 2 mounts within the notches, secured by two 6-32 machine screws (see text). Centerlines of the notches are 18" from the mounting holes for the reflector elements.



The ¼" element holes and mounting slot for the *"Q"*-bar assembly must be made at a right angle with respect to the pencil line's axis to ensure "in-line" placement of the elements.

Centered at the 18" mark, the *"Q"*-bar mounting slot is made with careful application of hack saw and file. Its flat surface supports the plastic insulator at a right angle to the broomstick's lateral axis, placing the vertical antenna rods upon the elements' centerline. Two smaller notches within the slot provide clearance for the bottom ends of the shaft couplings.

When the woodwork has been completed, apply shellac or plastic spray to insulate it against "r.f. termites" and wet-weather deterioration.

Assemble all elements to "Broomsticks" #1 and #2. The complete *"Q"*-bar section, seated against the flat center of each slot at ends, is drilled through at this assembly, at two convenient points, through both plastic and wood. Two #6-32 machine screws tighten these junctions.

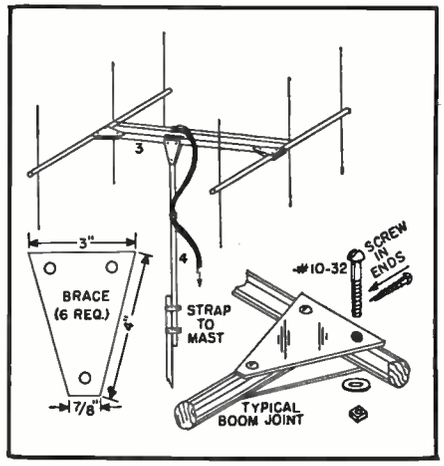
After placing the parasitic elements within their mounting holes, run a small pilot hole into the ends of the broomsticks and through the centers of the elements. Small wood screws then hold the rods tightly in place.

Reduce "Broomstick" #3 to a length which fits snugly between numbers 1 and 2; this dimension is determined experimentally. As the two sides of the array are now separated and spaced by the *"Q"*-bars, the length of #3 should be approximately 39¼" in order to avoid "springing" the *"Q"*-section.

Fig. 4 shows the over-all boom assembly, and the details illustrate the trick of making a solid joint between right-angle junctions of circular members. Both ends of "Broomstick" #3 should butt solidly against the sides of 1 and 2; no flattening at these points is required, as braces are used.

The local sheet-metal shop should be able to provide enough scraps of thin-gauge galvanized metal to fabricate three pairs of braces, dimensioned

Fig. 4. The final assembly. As all holes are drilled upon assembly, no dimensions are given. Taping the transmission line to vertical member #4 keeps rotation from affecting the electrical connections.



in Fig. 4. The same shop may let you use their heavy shear to make them.

Reference to Fig. 4 makes construction self-explanatory. #10-32 machine screws secure the boom junctions, resulting in a surprisingly strong construction. Additional cross-bracing between cross member #3 and the vertical support ("Broomstick #4") will not ordinarily be required.

Note that long slender wood screws run through the sides of #1 and 2 into the ends of #3. Another screw passes through the top-center of #3 into the top end of #4. The wood screws are added after the metal braces have been assembled with the broomsticks. Make certain that all assembly angles are 90°.

The completed array should receive a coat of aluminum paint, except that the area comprising the driven-element-*"Q"-bar* junction should be left uncovered. Metallic paint across these connections would amount to an r.f. short-circuit. It would be a good idea, however, to apply a final weather-proofing layer of plastic spray to the assembly, including all elements.

The 300-ohm transmission line now connects to the 20" center of the *"Q"*-section, and the array is ready to be secured atop the antenna mast. Fig 4 shows use of two "plumber's tape" pipe clamps which securely strap the lower end of "Broomstick #4" to the top of the antenna mast.

No beam rotator is needed. The entire mast turns by applying hand-power to vise-grip pliers clamped to the bottom of the pole.

As the antenna schematic is shown in most radio handbooks, precise treatment of its gain and pattern need not be made here. Experiment shows the apparent gain over a dipole to be 10 db or greater, and front-to-back ratio to be about 3:1. Minor lobes seem farther down than a well-digger's instep.

What about Joe Q. Ham these days? He built the "Boomstick" and now enjoys equal status with John X. Amateur in the DX derby! Matter of fact, it might be said that the "Broomstick Boomstick" makes a clean sweep of the entire operation. —30—

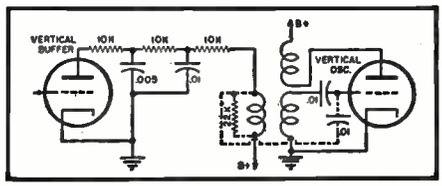
TV SERVICE TIP

By JEROME LEINER

HERE is a kink I use for servicing Du Mont sets when the primary winding of the vertical buffer opens. I shunt the primary with a 22,000 ohm resistor and connect the plate side of the primary through a .01 μfd. condenser to the grid of the vertical saw-tooth generator, as shown in Fig. 1.

I have used this idea many times and find that it gives excellent results. —30—

Fig. 1. Servicing Du Mont vertical buffer.



Antenna Maintenance

(*Continued from page 39*)

After the connectors have been removed, clean the points on the driven elements which make contact with the connectors. For this use fine grain sandpaper. Also, give the elements a general cleaning to remove surface corrosion. Replace the signal take-off hardware with nickel-plated nuts and bolts (or their equivalent) and reassemble the antenna.

When mounting the antenna be sure to use mast stand-offs and inspect the antenna mount itself for loose bolts or cracks. Inspect the ninety-degree bends on chimney straps for cracks and signs of breaking.

In order to properly insure an antenna's life on the rooftop, where it is exposed to weather, the service technician must start his protection at the very beginning. Purchase of a properly designed and manufactured antenna is the first essential protective measure. To eliminate the temptation towards false economy, it is wise to remember that there are no low cost antennas. There are only antennas made from low cost and, consequently, inferior grade material. A poorer quality antenna cannot, even under ideal conditions, stand up as long as an antenna made of better quality components. Softer aluminum, imperfectly plated hardware, inferior plastic for insulators, and low grade metal for crossarms all contribute to the eventual failure of the antenna.

However, even after installing a good quality antenna, the service technician isn't free from his obligation to protect the antenna so that the customer gets the maximum reception out of the installation. In an antenna installation, the picture is no better than the antenna.

Our tests show that a properly protected antenna will have a life of approximately one year. By proper protection we mean that all critical points, such as signal take-off points, nuts and U-bolts, and places where the elements clamp to the insulator, should be sprayed with an acrylic spray, there being many excellent grades on the market.

Once the installation has been correctly protected you can count on about one year of reception equal to that the customer received when the antenna was first installed. The customer should be told, at the time of installation, that after a period of time the elements and hardware will start to corrode. As the hardware corrodes the impedance goes up until ultimately, such a mismatch exists that a very great portion of the signal is lost. Ghosts suddenly appear where there were none before. This is caused by standing waves which have developed because of the mismatch.

After he protects the antenna upon initial installation, the service technician can make a follow-up call, ten

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1A5GT 59c	3Q4 .69	6AV6 .59	6F7 1.59	6SK7GT 59c	7C7 79	12BA6 .59	14W7 1.19
1A7 .69	3Q5GT .89	6AX4 .69	6F8G 1.59	6SL7GT .69	7E5 79	12BA7 1.19	14X7 1.19
1B3GT .95	3S4 .69	6AX5 .79	6G6G .95	6SN7GT .69	7E6 79	12BE6 59c	19BG6G 1.49
1B5 .29	3V4 .95	6AX6 .69	6H6GT .89	6SQ7 59c	7E7 79	12BF6 59c	19T8 .89
1H5GT .59	5T4 1.40	6AY5GT .89	6J5GT .59	6SQ7GT 59c	7F7 .89	12BH7 .69	20 1.40
1J6GT 69c	5U4G .59	6B4G 1.44	6J6 .79	6SR7GT 59c	7F8 1.47	12F5GT .65	24A .69
1L4 .87	5V4G .87	6B8GT 1.15	6J7G .69	6SS7 .99	7G7 1.19	12H6 .89	25AC5GT 1.04
1LA4 1.19	5W4 59c	6BA6 .59	6J8G 1.15	6T7G 1.15	7H7 1.05	12J5GT .75	25BQ6GT 1.15
1LA6 1.19	5W4GT 59c	6BA7 69c	6K5GT .69	6T8 .89	7J7 1.19	12K7GT .69	25L6GT .59
1LC5 .69	5Y3GT .45	6BC5 69c	6K6GT .59	6U5 69c	7K7 1.19	12Q7GT .89	25W4GT .69
1LC6 1.19	5Y4G .54	6BC7 1.05	6K7GT .69	6U6GT 69c	7L7 .79	12SA7GT .69	25Z5 1.04
1LD5 1.19	5X4G 81c	6BD5GT .89	6K8GT 1.19	6U7G 69c	7N7 .69	12SC7 1.05	25Z6GT .69
1LE3 1.19	5Z3 1.68	6BE6 .59	6L5G .95	6U8 .89	7Q7 .79	12SF5GT .69	32L7GT 1.15
1LH4 1.19	6A3 1.68	6BF5 69c	6L6G 95c	6V3 1.29	7R7 1.19	12SF7 .99	26 59c
1LN5 1.19	6A7 1.21	6BF6 69c	6L6GA 95c	6V6GT .69	7S7 1.19	12SG7 .89	27 .99
1N5GT	6A8GT 69c	6BG6G 1.69	6L7 1.19	6W4GT .59	7V7 .79	12SH7GT	35A5 .99
1P5GT	6AB4 69c	6BH6 69c	6N6G 1.40	6W6 .69	7W7 1.19	12SJ7GT 69c	35B5
1Q5GT 69c	6AB7 1.15	6BJ6 69c	6N7GT 1.19	6X4 59c	7X6 1.05	12SK7GT 69c	35C5 69c
1R5	6AC5GT .89	6BK7 .98	6P5GT .69	6X5GT 59c	7X7 79c	12SL7GT	35L6 69c
1S4 .99	6AC7 1.45	6BL7 .79	6Q7GT .59	6Y6G .69	7Y4 .89	12SN7GT .99	35W4 .45
1S5	6AG5 1.05	6BN6 .89	6R7GT .69	6Z4/84 .72	7Z4 .89	12SQ7	35Y4 99c
1T4 69c	6AG7 1.49	6BQ6GT .85	6S4 .59	7A4 .95	12A7 1.59	12SQ7GT 69c	35Z3
1U4	6AH6 1.89	6BQ7 1.19	6S7GT 1.15	7A5 1.19	12A8 .69	12SR7GT	35Z4 .75
1U5 .59	6AK5 .89	6BZ7 .85	6S8GT 1.25	7A6 .89	12AH7 1.38	12Z3 .95	35Z5 .55
1V .88	6AK6 1.08	6C4 .59	6SA7GT 69c	7A7 79c	12AL5 .54	14A7 1.05	35/51 .79
1X2A .89	6AL5 69c	6C5GT	6SC7 1.19	7A8	12AT6 .59	14AF7 .93	36 1.06
2A6	6AQ5 .89	6C6 69c	6SD7GT .99	7B4 .89	12AT7 .89	14B6	37 .93
2A7 89c	6AQ6 .81	6CB6 1.69	6SF5 .59	7B5 .89	12AU6 .69	14B8 89c	38 88c
2B3 .89	6AR5 .79	6CD6G 1.69	6SF5GT .59	7B6 .89	12AU7 .79	14C5 1.25	39/44
2B7 .89	6AT6 .59	6D6/78 1.10	6SG7	7B7	12AV6 .59	14C7 1.12	41 .72
2C34 .60	6AS5 .90	6D8G 1.15	6SH7 .89	7B8 89c	12AV7 .89	14F7 1.05	42 .69
2E5 .89	6AU5GT 1.29	6E5 .69	6SH7GT 69c	7C4 1.30	12AW6 1.19	14F8 1.45	43
							45 72c
							45Z5 .69
							46 89c
							47 1.05
							50A5
							50B5 69c
							50C5 1.39
							50C6G .69
							50L6 .69
							50X6 .99
							50Y6
							70L7 89c
							70L7GT
							71A .87
							75 .79
							77 .69
							78/6D6 1.10
							80 .69
							83 1.45
							84/6Z4 .72
							85 .79
							117L7 1.40
							117N7 1.95
							117P7 1.95
							117Z3 .59
							117Z6 1.19
							715B 7.75
							807 1.55
							813 10.95
							866A 1.49
							1294
							1299
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							2051 1.15
							7193 .87
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Model	Watts	
WS-100	150	$8.77
Single heat		
WS-200	275	
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Dual Heat		$10.73
WD-250	275-350	
Dual heat		$11.71

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Maximum results in fringe areas. Clear pictures up to 125 miles. High gain, directivity and high front-to-back ratio on all channels. Outperforms two bay Yagi on low band and four bay Yagi on high channels. Ruggedly constructed, corrosion proof. Furnished completely preassembled. Easy installation. Full instructions included. NET $32.34
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PILOT LIGHTS, Type No. 47 10 for 39c . . . 100 for $2.95
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OUTPUT TRANSFORMER—for 50L6 29c for 6V6 39c
UNIVERSAL OUTPUT TRANSFORMER, 12 watt . . . 99c
CHIMNEY MOUNT for TV ant. . . . 98c
3 SPEED G. I. CHANGER . . . $24.95
6 foot LINE CORD UL . . . 10 for $1.95
TV INTERLOCK CORDS . . . ea. 49c

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We will send the correct Photofact Folder Set—each $1.50
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- All the exclusive features of most expensive sets

- Meet all Standard RTMA requirements
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17" Table Model now only . . . $169.50
21" Table Model now only . . . 189.50
Console Sets $20.00 additional.
Limed Oak Finish . . . $12.50 extra

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8" COAXIAL PM SPEAKERS High Fidelity with high pass filter attached. 20 watt; 40-17500 cps. response; 8 ohm Voice-Coil. $9.95 ea.

12" COAXIAL PM SPEAKERS . . . ea. $12.95
Very best quality—NATIONAL BRANDS. Individually Packed.

3"	ea. $1.39	8"	ea. $3.23
4"	ea. 1.59	10"	ea. 5.10
5"	ea. 1.59	12"	ea. 5.95
6" SPECIAL PRICE			ea. $1.79

21" TV CONVERSION KIT

Consisting of rectangular tube, 70 DEGREE YOKE, Beautiful Mask and FLYBACK TRANSFORMER complete . . . $31.95

20" TV CONVERSION KIT, as above, complete . . . $28.95
17" TV Conversion Kit, as above, complete . . . $23.95

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months to a year later, to advise the customer that the protection originally applied is starting to wear off. For a nominal fee, he can take the antenna down, clean it, put in new hardware, and re-spray it, insuring at least another year of satisfactory use out of it.

It is the authors' opinion that a fantastically high percentage of TV ills lie on the roof. Unless the technician is looking for a "quick buck," with no regard to his future or reputation, he must make every possible effort to protect his customer by protecting the antenna.

-30-

International Short-Wave

(*Continued from page 74*)

pensates for all the headaches of a young radio station, the *Kol Zion* officials believe.

The *Kol Zion Lagolah* broadcasts—relayed from Jerusalem—are aired over a 7.5 kw. transmitter at Tel Aviv, operating currently 1100-1700 on 9.010A (listed 9.000). The *English Service* is on the air at 1615-1700 closedown; French is heard at 1530. The Israeli Post Office is now constructing a *new* 50 kw. transmitter which, when in operation, will greatly extend the carrying power of *"The Voice of Zion"* to a world-wide audience.

Our best wishes go to *Kol Zion Lagolah* and its personnel for continued and further success in the years ahead!

* * *

Radio Club Notes

Sweden—Arne Skoog, DX Editor, *Radio Sweden* writes that Teknikens Varld's Radio Club, Sveavagen 53, Stockholm 6, Sweden, has now enrolled 10,500 members. Circulation of the fortnightly magazine, *Teknikens Varld,* is 70,000 copies.

USA—Although the National Radio Club is strictly a BCB organization, due to several requests, here's the QRA supplied by Harris, Mass.—National Radio Club, Box 38, Kensington Station, Buffalo 15, New York.

Anson Boice, Conn., editor for "United 49'er's Radio Society," sent along these results of the club's recent DX Contest—top scorer was Gary Tipton, LeRoy, N. Y., with 300 U. S. and Canadian stations heard over the week-end of the competition, 241 DX stations, 98 countries and U. S. and Canadian districts, 28 zones, and a grand score of 296,890.8 points. Runners-up were Jehoiakim Arnold, Bermuda; Charles Green, LeRoy, N. Y.; Bette Pearl Elder, Bremerton, Wash.; Chas. McCormick, Jr., Baltimore, Md.; Jim Alfrey, London, England; Jack Hathaway, W9LMC, Rantoul, Ill. The contest was judged by Walter Mulvey, Jr., W1TSZ, New Haven, Conn.

* * *

This Month's Schedules

Afghanistan—Kabul Radio, 9.975, appears to be on the air most days 1030-1045A, but runs longer some days (to 1100 or later); uses *English.* (Pearce, England; Ridgeway, South Africa, others)

Algeria—Radio Algerie, 9.57, noted with news in French 1515; bad QRM. (Scheiner, N. J.)

Al Kuwait—A station heard on 5.000 at 1230 with vocal Arabic music by a man is believed to be Kuwait in the Persian Gulf. (Pearce, Catch, England) Closedown should be around 1430.

Anglo-Egyptian Sudan—Radio Omdurman has added an *English* newscast aired 1115 on *Wed., Sun.* (Pearce, England)

Angola—Radio Diamang, Dundo, noted moved from 6.870 to 9.340 where is heard parallel with 7.070 at 1300-1430. (Engberg, Sweden, others) CR6RJ, *Radio Clube de Huila,* 10.040A, Sa da Bandeira, noted closing 1603 with "A Portuguesa." (Pearce, England) Also noted by Niblack, Ind.

Radio Club de Benguela has been heard on a *new* channel of 9.502 at 1415-1500; is CR6RF, 350 w. (Radio Sweden) CR6RB, 9.165, Benguela, is heard in Sweden 1330-1400. (*GDX-aren,* Sweden) *Radio Club de Angola,* Luanda, noted parallel on 11.862 and 9.470A around 1510 and closing down 1527 with "A Portuguesa." (Bellington, N. Y.) Ridgeway, South Africa, lists current schedule as 1330-1600 (Sat. to 1730, Sun. to 1600). Mocamedes, CR6RM, 7.232, noted from 1300 with Portuguese session, closes weekdays 1500. CR6RD, 9.705, Nova Lisboa, has a session 0600-0800 and afternoons (*EST*) is parallel with 7.105 (formerly 7.096). (Ridgeway)

Argentina—LRA, 9.69, noted opening Spanish session 2000, excellent level in Mass. (Golden) Good in *English* to North America on 17.720 around 1700-1930. (Hoffman, N. Y.) *Radio Splendid,* 9.316A, heard as early as 1800, closing 2300; usually has CWQRM. (Gay, Calif.)

Australia—VLX4, 4.897, Perth, noted 1000 with ABC news; closed 1030 with "God Save the Queen." (Pearce, England) VL16, 6.090, Sydney, noted 0345. (Cox, Dela.)

Austria—Blue Danube Network,

Representatives of the Swiss Broadcasting Corp. in the studios of the Swiss Short-Wave Service in Berne interviewing members of the Mt. Everest Expedition 1952 on their arrival in New Dehli on December 29th. This two-way transmission was arranged in cooperation with All India Radio in New Delhi. From left to right: Russell Henderson of the Swiss Short-Wave Service (English language interview); Jo Excoffier from Studio Geneva (French language); Rene Dittert who took part in the Everest climb earlier this year; and Arthur Welti from studio Zurich (German language broadcast).

9.617, Salzburg, noted with call 1100; news 1105; heard 0215 with recordings. (Pearce, England) Noted on 5.080 at 1800 when gave weekday schedule as 0200-2000, Sun. 0100-1800. (ISWC, London)

Belgium—ORU, Brussels, was noted recently on 6.000A from 1447 tune-in to 1515 with French session; started *English* for Britain 1515. (Bellington, N. Y.) When this was compiled, ORU had announced use of 9.150 instead of 9.745 to Leopoldville, Belgian Congo, in the beam around 1200-1830A. Was using 9.745 to Africa 2000-2015, with OTC, Leopoldville, relaying on 9.655 to North America; 2015-2100, ORU, 9.745 to Africa, and 6.085 (moved from 6.065) to North America, with OTC 9.655, relaying to North America; 2100-2200, ORU, 9.745, to Africa, 6.085 to North America, and OTC, 9.655, relaying to North America; 2200-2400 sign-off, same set-up in *English only.* (Levy, N. Y., others)

Belgian Congo—Officials of *Radio Congo Belge* sent schedule of OTM1, 6.295, 0000-0130, 1130-1600; OTM2, 9.380, 0000-0130, 1130-1600; OTM4, 11.720, 0515-0730; OTH, 9.210, 0530-0700, 1130-1330; OTH, 11.670, Sun. *only,* 0500-0700. (Boice, Conn.)

Brazil—ZYK3, 15.145, Recife, noted in *English* at S7 level 1300 recently saying "This is Pernambuco speaking to the world"; woman announcer; is *Radio Jornal do Commercio.* (Niblack, Ind.) ZYK2, 11.825, noted 1518-1528 with *English* identification, directed to Europe, Africa. (Patterson, Ga.) *Radio Cultura,* ZY457, 9.745, Sao Paulo, noted from 0345 to *after* 0500 and always from around 1530; bad QRM 1530 from Belgium. ZYR61, 4.805, Taubate, is good level in South Africa 1700; gives call every 15 minutes. (Ridgeway) PRK5, 6.000A, Belo Horizonte, noted 1900 with QRM from HJKD, Colombia. (URDXC)

British Honduras—When this was compiled, ZLK2, 4.950, Belize, was being heard with fair signal in Eastern USA around 1830-2030 (*may not be complete schedule*), mostly in *English,* some Spanish. (Bellington, N. Y.; Saylor, Va., others) May also have a transmitter on 6.100A soon.

Bulgaria—Radio Sofia, 9.700A, noted with *English* 2000-2030. (Lund, Iowa)

Burma—Rangoon announces *English* for 2015-2030 on 9.543, 6.035; 0115-0145, 9.543, 6.035; 0915-1015, 9.543, 4.775. (Ridgeway, South Africa)

Canada—CHNX, 6.130, Halifax, N. S., is like a "local" from 0700 onwards; CFRX, 6.070, Toronto, Ont., is good level around 1100. (Morrison, R. I.)

Canary Islands—EA8AB, 7.305A, noted closing 1800. (Pearce, England)

Cape Verde Islands—Praia noted parallel on 5.885A and 7.130A around 1645. (Bellington, N. Y.) Noted closing on 7.130A at 1700. (Niblack, Ind.)

Ceylon—Radio Ceylon's 4.900 channel is seldom reported, but recently was noted at fair level in New Zealand 0915 in Chinese session; is fair level on 17.820 with modern recordings 0430. (Cushen) Noted on 15.120

with native program 2205-2230; *no English.* (Sutton, Ohio) Heard on 11.975 and 7.190 with *English* programs 0830-1145 (some days to 1215) to India-Pakistan. (Ridgeway, South Africa)

Chile—CE920, 9.200A, noted 1926 with Latin American music, good level but with slight heterodyne and CWQRM. (Bellington, N. Y.) *La Voz de Chile para todas Americas* has moved from 11.90 to 11.937A; is CE1190 and is heard well in South Africa 0630-2300. (Ridgeway) CE1515, 15.150, Santiago, signs off 2300.

China—Radio Peking noted on 6.050A

(*Continued on page* 148)

PROGRAM SET

THE Seventh Annual Spring Technical Conference, sponsored by the Cincinnati Section of the IRE, will be devoted exclusively to television.

Held in Cincinnati on April 18th, the program will include papers on "TV and the Bell System," "High-Powered U.H.F. Broadcast System," "Design of TV Receivers Utilizing Non-Synchronous Power," "Selection and Amplification of U.H.F. Signals," "Transient Considerations in the NTSC Color System," "Four-Gun Tube for Color TV Receivers," "Latest NTSC Color Systems," etc.

Advance registration is being handled by Anthony C. Wahl, c/o A. C. Wahl Co., P.O. Box 8, Green Hills 18, Ohio.

-30-

VIDEO DETECTOR FAULT

By GEORGE R. ANGLADO

MOST TV sets manufactured today make use of a germanium crystal as the video detector instead of a vacuum tube.

It does its job well in this particular circuit but usually goes bad in about three to five months' time. The crystal, being mounted under the chassis, develops a high resistance which is caused by heat from the set. This, in turn, makes the picture on the screen appear to be washed out.

To test the crystal, use an ohmmeter and measure the forward and back resistances. The forward resistance should be lower than 400 ohms and the back 10,000 ohms or higher. Any crystal providing a less than 25:1 front-to-back ratio indicates a defective unit.

Using an "Eico" 20,000 ohms-per-volt meter on one of the crystals removed for measurement, the reading was 525 ohms in one direction and 8700 ohms in the other direction, showing the crystal to be below standard.

When a new 1N34 was measured, the reading was 120 ohms in one direction and 1.2 megohms in the other direction—indicating a "hot" crystal. When the new crystal was installed, the washed out trouble disappeared and the set returned to normal operation.

When replacing a crystal, be careful not to hold the soldering iron too close as it may be ruined. Do a quick job by heating the terminal in the set first, then shove the lead of the unit in the terminal hole and apply one drop of solder to the connection, letting it drop from the iron. Do not heat the leads of the crystal.

In addition, be sure that the correct crystal polarity is observed when making the replacement. -30-

Transistor Amplifiers

(*Continued from page 41*)

coupling as indicated in Fig. 4A. Of course, the d.c. resistance should not be too high or the voltage drop will reduce the collector operating voltage to too low a value. Low impedance phones are fully as satisfactory if there is no objection to using a matching transformer as in Fig. 4B. The approximate load impedance to match the output transistor is found with sufficient accuracy for experimental use by dividing the d.c. voltage at the collector by the d.c. collector current.

A word about transformers. There are many types of transformers with a variety of impedance combinations suitable for use in the circuits discussed. However a small tapped transformer such as *UTC* types R-27, R-28, R-33, R-38A, R-59, *Thordarson* types S62, S86, S87, S88, and similar universal types are relatively inexpensive, small, and provide impedance ratios from a few hundred to several thousand times so that optimum coupling can usually be obtained for interstage use as well as for input and output requirements. A mismatch of two to one in the lower level stages may be used without appreciable loss of gain.

The next item in designing this amplifier is that of battery voltage. Three volts is a desirable supply voltage although 1.5 will suffice in many cases. Even higher voltage may be used when larger output power is required. The maximum collector current rating for type CK722 is 5 ma. so with 3 volts supply less the drop in the output transformer or earphone, we can still put 8 or 10 milliwatts in and easily obtain several milliwatts of audio output power. The input resistor in the final stage should be adjusted to give the lowest collector current which will result in sufficient output power to drive the phone for there is no need for using more battery current than necessary. The CK722 transistor has a maximum collector dissipation rating at room temperature of 30 milliwatts which means that with obtainable efficiencies you can if you desire more power output (up to about 20 or 25 milliwatts), operate the final stage at its maximum collector current rating of 5 ma. and a collector voltage of about 10 volts. If this is done, it will save battery power if the stages preceding the output stage are operated from a separate 1.5 or 3 volt battery rather than through a dropping resistor connected to the total available supply voltage.

Although some amplifiers may be usable without a volume control, it is usually necessary that means be provided to adjust the volume to accommodate variations in signal input, changes resulting from battery aging, etc. The volume control problem is not quite as simple as with tubes but one good method for resistance-

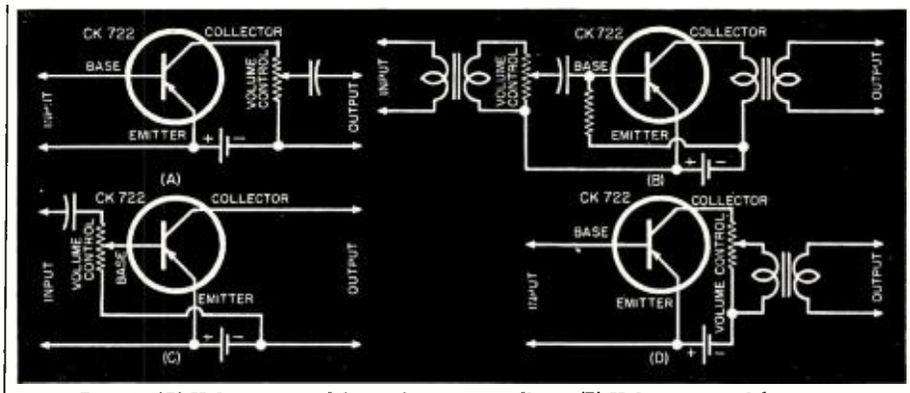

Fig. 5. (A) Volume control for resistance coupling. (B) Volume control for transformer coupling. (C and D) Unsatisfactory volume control circuits. See text.

coupled circuits is illustrated in Fig. 5 where the resistance portion of the control becomes the load for the transistor and the arm of the control supplies the signal to the following stage. The control may be used in any convenient amplifier stage but ordinarily it is well to put it at the "front" of the circuit to aid in preventing overloading of following stages on strong signals. Fig. 5B shows a volume control circuit suitable for use with transformer coupling. In this circuit, the resistance of the control should be at least 10 times (more if possible) the impedance of the transformer secondary.

The volume control cannot be connected in a manner which would vary the base bias, and thus the collector current, so Fig. 5C is a volume control circuit which is *not* satisfactory. Fig. 5D shows another method which is *not* satisfactory because it would vary both collector current and load impedance. Even the insertion of a condenser between volume control arm and transformer primary would not make the circuit desirable because the load impedance would vary with changes in the volume control setting.

Although we assumed that we were designing a transistor amplifier for a particular purpose the reader should understand that this was to give some indication of how to proceed with the design of an amplifier for a typical application. There are infinite combinations of components which may be used and after one has gained some experience in building transistor amplifiers he can readily work out variations such as the use of loudspeakers for both pickup and reproduction as in intercoms, combinations of different transistor circuits such as a first stage using a crystal mike directly coupled to the high input impedance grounded-collector circuit, followed by grounded-emitter stages for maximum gain, and other combinations designed to meet particular ideas and requirements. Also transistors may be used in push-pull class A, class B, and other conventional circuits for greater output so there is no end to the possibilities which may be investigated and employed by those interested in the advantages in small size, lightweight, and low battery drain obtained by using transistors. Negative feedback in a grounded-emitter circuit may be obtained by an unbypassed resistor in the emitter lead and offers another line of investigation for the experimenter. Negative feedback over more than one stage is possible, as with tubes, but not always as easily accomplished. For example, tertiary windings on transformers appear most promising in transformer-coupled amplifiers for which negative feedback is desired. It is very desirable that the investigator have available an audio signal generator and oscilloscope for use in observing the effect of changes in transistor circuits and operating conditions.

REFERENCES

1. ———; *General Radio Experimenter, March 1952, page 3.*
2. *Dixon, Robert K.; "Build This Transistor Receiver,"* RADIO & TELEVISION NEWS, *February 1953.*

—30—

NEW SUN STORE

SUN Radio & Electronics Co. of New York has recently moved into new and modern headquarters at Sixth Ave. and 20th St. in Manhattan.

The 20,000 sq. ft. of floor space (on a single level) will be used for "supermarket" merchandising of parts and equipment. Three sound studios and a TV bar are other unique features of the store.

—30—

INCREASING BOOSTER GAIN

By GEORGE R. ANGLADO

INCREASED booster gain and range in the "Regency" and other boosters using the popular 6J6 tube can be obtained by substituting the new 12AT7 for the 6J6.

The 12AT7 has more gain than the 6J6 and will pull in the stations more clearly.

To make the change, the socket must be changed to the noval 9-pin type, the tube connections rewired, and the cathode resistor increased to 200 ohms. Be sure to connect the 12AT7 cathodes (pins 3 and 8) together. Greater sensitivity may be obtained by decreasing the value of this resistor to 100 ohms but care must be taken to see that the plate current does not exceed its maximum value.

The heater transformer is connected so that one side goes to pin 9 and the other side to pins 4 and 5 on the 12AT7.

—30—

GREAT NEWS!

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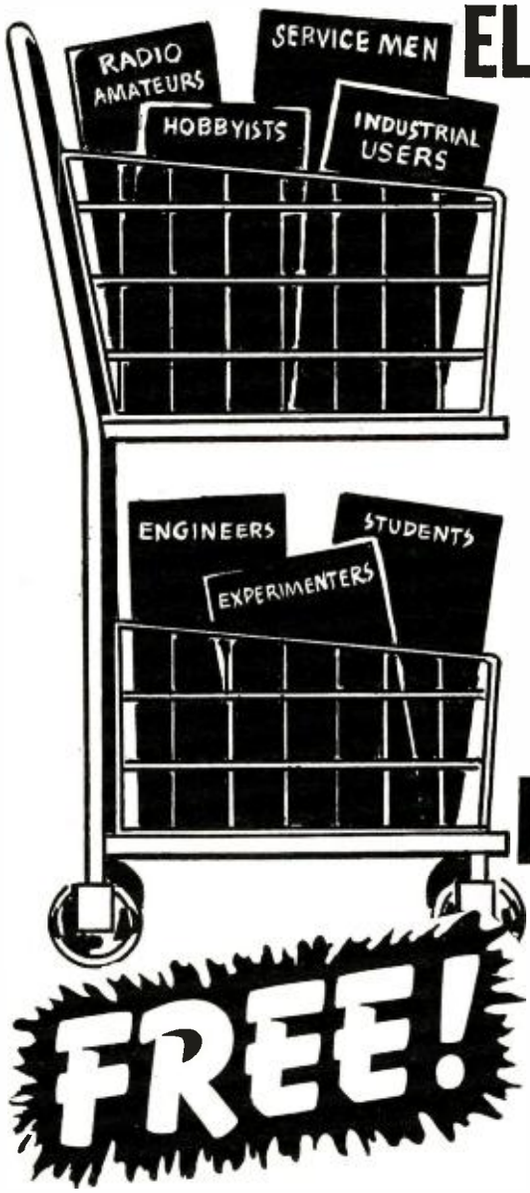

In order to keep up with modern buying trends, Sun Radio has moved to a bigger and more easily accessible location to bring you the first electronic shoppers' world. A paradise of everything electronic in over 20,000 sq. ft. of ground floor space.

CHECK THESE INNOVATIONS:

- *Over 150 ft. of counter space.*
- *Complete displays of all test equipment, transmitters, receivers, etc.*
- *Complete stock of radio and TV replacement parts.*
- *Complete stock of amateur radio equipment.*
- *Self-service TV antenna bar.*
- *3 complete sound studios.*
- *Complete staff of qualified sales personnel.*
- *Easily accessible to Metropolitan New York, New Jersey and Long Island.*

Stop in today. You can't afford to miss our tremendous values during our mammoth opening sale. Come in and browse or buy at your leisure. Every item in our tremendous stock has been specially priced for this event.

FREE!

over $1,000.00 in Prizes

Stop in to see our new home, and please don't fail to register so that you may qualify for one of these valuable prizes. Drawing date will be on April 11th, 1953 and all winners will be notified if they are not present. Don't miss out on these great prizes. Stop in today and see the NEW . . . BIGGER . . . BETTER Sun Radio!

FIRST PRIZE
RCA Master Voltomyst WV87A

SECOND PRIZE
Precision 612P Cathode Conductance Tube Tester

THIRD PRIZE
Simpson Model 303 V.T.V.M.

Plus

2 RCA WV77 Junior Voltohmyst
5 Eico 221K V.T.V.M. Kits
3 Eico 320 K Signal Generator Kit
5 Superior 770 Volt-ohm-milliameters
10 American Beauty #3138 Soldering Guns
10 Weller WD 135 Solder Guns
50 $5.00 Gift Certificates

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Open Daily & Saturday 8:30 - 6:00

You and U.H.F.

(*Continued from page 49*)

allowed its use. The antenna available commercially is sturdy and economical. It will also save the customer money since it can also be used for v.h.f. when the v.h.f. station opens up later on.

This antenna allows you to select the angle required for optimum reception. Our checks showed that when the angle of the V elements was adjusted to approximately 90° the antenna gave best results on v.h.f. A 60° angle seemed best for u.h.f.-v.h.f. use, while narrowing the angle down to 45° provided best reception for u.h.f. only.

Where multi-path and gain were factors to be considered, the best u.h.f. antenna we tested was the stacked bow tie with reflector.

An interesting development in the u.h.f. antenna field is the increased feasibility of the u.h.f. built-in antenna. In the first place, the very nature of the u.h.f. allows built-in antennas to approach one-half wavelength. And in the second place, transmission line losses may be sufficiently great when long lines are run to cancel any gain achieved through the installation of a roof-top antenna.

In contrast with v.h.f., we were surprised to see the number of indoor or built-in antennas that were giving satisfactory reception. For this reason, don't discount the possibility of using the built-in antenna when the u.h.f. receiver is located in a strong signal area.

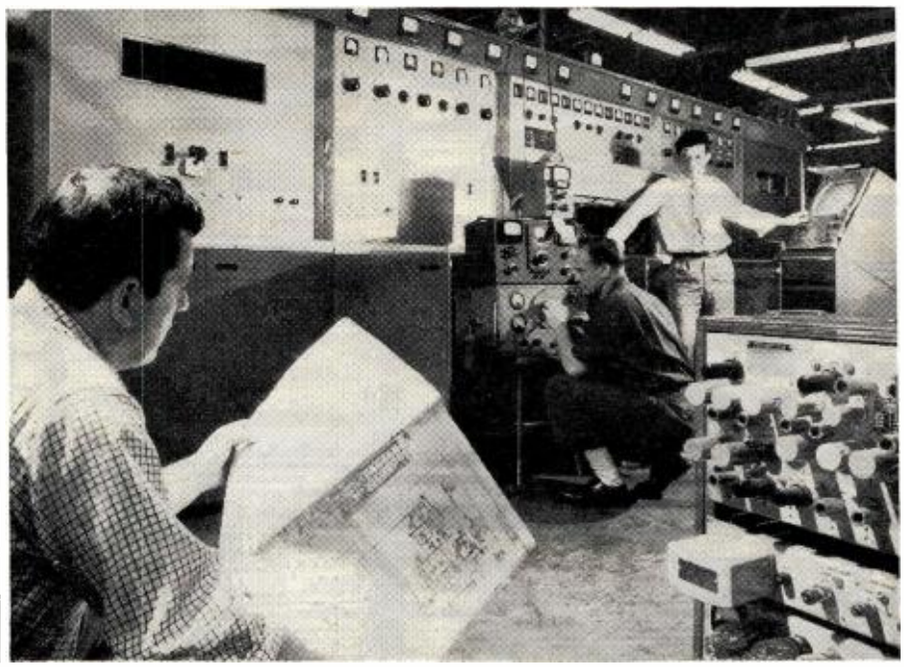
After selecting the antenna to be used in an installation, you next have to decide on the location of the antenna. Don't be afraid to spend a little time in covering the entire roof area looking for the best spot. The location and height of the antenna are extremely important for optimum results —much more so than in v.h.f. installations. Nor is it taken for granted that the higher you go the better. When probing a location move your antenna up and down as well as moving it about.

After you have located the antenna site, you still have to transfer the u.h.f. signal to the input circuit. Don't lose what signal you have by using lines with heavy moisture attenuation. Don't run your line down close to the building, roof, or metal objects such as drains or gutters. You will lose too much signal by absorption. Figs. 2 and 4 show you graphically the effects due to moisture and proximity to a roof.

Relative losses due to moisture in transmission lines in db-per-100-feet are shown in Table 2. In practice it was seen that 300-ohm tubular lead became almost standard in Portland. When using this lead-in be sure to seal the top end of the line, and make a rain loop at the bottom before allowing it to enter the home. Also, cut a hole in the bottom of the polyethylene before it enters the house to allow any accumulated moisture or condensation to run out. You wouldn't want this to drip into the customer's home.

When studying Figs. 2 and 4 bear in mind that in each case signal conditions and receiver settings were the same. Fig. 4 illustrates the differences

The nation's first high-power, u.h.f. television transmitter undergoes final tests at General Electric Company's Syracuse, New York plant before being shipped to station WHUM-TV in Reading, Pa. This 12,000 watt unit is expected to be in operation in the near future. As the Federal Communications Commission continues to grant new TV station permits, this scene is being repeated throughout the country as transmitter makers go into high gear to help get stations on the air as quickly as possible. Reading's WHUM-TV has been assigned Channel 61. It will have an erp of 260 kw. by using a low-loss waveguide to carry power to a twenty-five gain antenna.



in received picture when the 300-ohm flat ribbon line is compared with the 300-ohm tubular line. The conclusion is obvious: whenever you suspect rainy or damp weather, you'd better stay away from 300-ohm flat line.

The conclusions to be drawn from Fig. 2 show unmistakably that when it is necessary to run your transmission lines close to roofs or other absorbing surfaces, you should use only coaxial cable.

Not included in Table 2 is the open-wire *Gonset* line. While this transmission line has the lowest losses of all tested by our group, we found that the spacings of the line are somewhat critical. When using this line, make sure that during the twists and turns necessary in running a transmission line down to the set, that the spacings are not varied. This would, of course, vary the characteristic impedance.

Unless exceptionally long runs of line are required, it is doubtful that this open wire line will be necessary in many installations.

Significance of U.H.F.

The increased coverage made possible by the new FCC allocations will bring television to many communities not now enjoying this modern miracle. It is hard to realize that until April there were only 108 stations in 65 communities, 43 of which were single channel cities. Fifteen states had no stations at all.

In April the FCC made 2053 channel allocations, about two-thirds of which will be in the u.h.f. band. So you can see that u.h.f. is really making it possible for all America to enjoy television.

The opening of new markets presents unlimited growth possibilities to ambitious service technicians. Good technicians with a knowledge of business principles can strike out on their own in the new station areas where there is a crying need for their expert services.

Industry predictions call for 50,000,000 sets to be in operation in the next five years. This will call for a service force more than double what we have now.

Men now in the industry can serve as a framework for the expansion and training program that must develop.

Now as never before, every conscientious service technician must strive to keep up with industry progress and improve his knowledge and methods. This includes the fields of business practice and customer relations, as well as technical "know-how."

In new areas such as Portland, service technicians will have the benefit of manufacturers' service clinics and a good supply of valuable service literature. But this isn't enough. The service technician should enroll in refresher courses in local trade schools if available.

In areas that have had fringe reception and are now awaiting the advent of local u.h.f. telecasting, the problem

will be somewhat different. Here there will be a hard core of experienced technicians who have mastered the intricacies of squeezing the last bit of signal out of a fringe installation. They know what low loss lines are, and the need for proper antennas and replacements.

There is something that service people can do, though, to lighten their load when the new station does go on. In the first place, they can expect a marked increase in telephone inquiries —most of which will be time consuming and nonproductive. Since it is assumed you will be busy enough with your normal work, tying up your phones with inquiries about u.h.f. will hamper your operations. It is therefore suggested, that you prepare yourself for this period by having a little question and answer leaflet made up which will anticipate your customer questions. Will you have converters? How much will they cost? How can I find out what antenna I need? Will my set receive the new station? etc., etc.

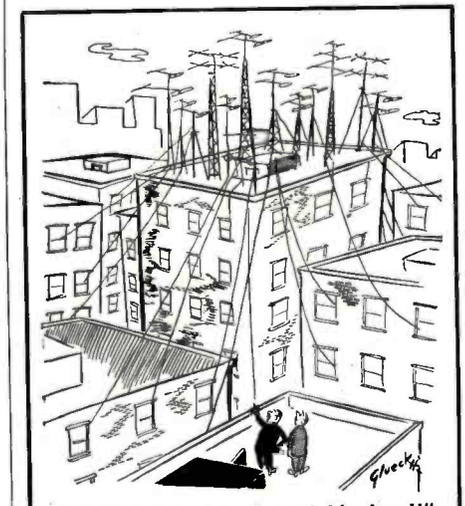
By preparing answers to these general questions in advance and mailing them to your customers you can forestall many inquiries and, at the same time, line up some future business.

Extra leaflets should be available, so that when new customers call you, you can cut down the length of your phone conversations by promising to mail a leaflet "that will give you all the answers."

A return work order card should be included in your mailing. This will facilitate bringing in some new business.

Summing up, we see that u.h.f. is here to stay. It works with moderate power. It provides good pictures. It covers the territory well. It can be received with present receivers. It can be installed with reasonable care using techniques with which we are familiar. And finally, it presages an era of industry expansion the likes of which we have never seen before. Stay with it, and you'll get your share of the fun and profit.

—30—



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Mac's Service Shop

(*Continued from page 70*)

days, and it is hard to imagine then the tugging, yanking strain that will be placed on those guys by a gusty windstorm. Spike nails are certainly not adequate guy-wire anchors, and ordinary lag-screws through the sheeting is little better, for water seeps down around the threads and rots the wood, allowing the screw to pull out. Unless you can drive creosote-covered lag-screws several inches into dry, seasoned wood, it is best to use long eye-bolts that pass through both the edge of the roof and the protective sheeting beneath the rafters—or if the rafter-ends are not boxed in, you can use a board nailed across a couple of them.

"Don't fasten all the guys from one corner of the tower to a single anchor of this sort. That piles up the strain on it, and if it does go, the whole tower is left unsupported and is certain to fall. Use a separate anchor for each guy. A stake—either iron or wood—driven into the ground is a poor anchor. When the ground is softened by rains or thawing, a surprisingly long rod can be pulled out easily. Either a pipe set in concrete should be used, or a 'dead man' with a large surface area and considerable weight should be buried in a deep hole and a chain, rod, or heavy cable led from it to the surface for fastening to the guys."

"You ought to keep the guys real tight, I suppose."

"Not too tight. While there should not be enough slack to let the tower lunge back and forth, if they are made too tight, especially in warm weather, the shortening with cold weather will put unnecessary strain on them and their insulators. Incidentally, of course, you should *never* use anything but strain insulators of the type that can break without destroying the support of the guy wire. A few owner-erected towers came down because of this obvious mistake. A few cents expended on cable-clamps for fastening the ends of the guy-wires is also very cheap insurance.

"Another storm-taught lesson is that the required height should be secured with the tower alone, and the mast should be just long enough to mount the antennas and support them a short distance above the top of the tower. Antenna masts that were too long, that were too thin or made of material with insufficient strength, and that had too much high-wind-resistance antenna stacked on them never had a chance. If a fellow wants to use a half-dozen different antennas, he had better put them on two or more separate masts instead of trying to stack them all on the same one."

"How do the insurance companies feel about the situation?"

"Naturally, they are not too happy. Most damaged antennas were covered

by the 'extended coverage' clauses on either the property or the household goods policies; but there were exceptions to this. For example, all antennas erected on mercantile buildings and many on apartment buildings were not covered in this manner but required separate policies. The only safe thing to do is to check with your insurance agent just as soon as the antenna is erected. One installer I know never leaves a new antenna installation without first impressing on the owner that he should get in touch with his agent at once and find out if the structure is insured.

"If there is a single weak spot in an antenna installation," Mac reflected, "a high wind will certainly find it out; so the only thing to do is try to make the job like the fabled One Hoss Shay: without any weaknesses. The tower should be strong enough to support easily the antenna used, and it should be adequately and intelligently guyed. The guy wire used should be of the best, and it should be fastened to anchors that will take more than a breaking pull on the wire. Compression type insulators and cable clamps at all guy wire ends are a *must*. If a motor is used, it should be mounted on a pipe with a two-inch outside diameter; and this pipe—or the bottom of the mast if a motor is not used—should be fastened in the tower so that it cannot turn. The clamping action of the tower hooks is not enough but should be aided by a strong bolt passing through the pipe and clamped to one of the hooks.

"The mast should not be any longer than necessary, and antennas with large wind areas or considerable weight should be mounted as near the bottom of the mast as feasible. Wind-resistance of particular antennas should be considered when choosing a mast."

"Sounds to me like the ideal antenna installer ought to be the kind of guy who wears both a belt and suspenders: one who takes absolutely no chances!" was Barney's grinning comment. —30—

Mobile radio hams in Virginia have the benefit of the State's first departure from its regular licensing system: special call-letter license plates. Amateurs with fixed stations only were not accorded the privilege so there is incentive for more W4's to "get rolling."

Receiver Changes

(*Continued from page 44*)

stages should be replaced one at a time, and results noted. It may be possible in some cases to boost the sound signal by using a sound i.f. tube (or tubes) with a higher gain than the one present. Checking the transconductance of the tubes present in these circuits (in a tube manual) against those of similar characteristics and applications, will indicate whether such a procedure is possible.

Decoupling resistors in plate or screen circuits may be shorted (not to ground! of course!) in one or more sound i.f. stages, and improvements noted. (If oscillation or regeneration breaks out—an unlikely contingency—remove the short.) Screen and plate voltages may be raised by connecting the "B+" feed of the sound i.f. stages to a higher-potential point in the rectifier output circuit. Suitable increases in the wattage of resistors in the plate and screen circuits should be made in such cases.

Plate and screen voltage-dropping resistors in the sound i.f. stages may be lowered to boost plate and screen voltages. (Limiter voltages should not be tampered with.) Corresponding bias changes may have to be made in some cases to minimize or remove slight distortions. A slight peaking of the sound i.f. tuned circuits may be made —by ear—to note whether an increase in volume may be obtained without excessive distortion. (If the r.f. oscillator has a tendency to drift, this procedure is not recommended.) In all of the cases cited, the disadvantage of any distortion introduced must be weighed against the improvement in gain.

If a relatively low-gain 1st audio amplifier tube is being employed, it may be replaced by a tube capable of providing a much higher gain (suitable bias changes being made, of course).

When an a.v.c. system is used, the a.v.c. feed to the sound i.f. stages may be removed, and the grid returns of the a.v.c.-controlled tubes grounded.

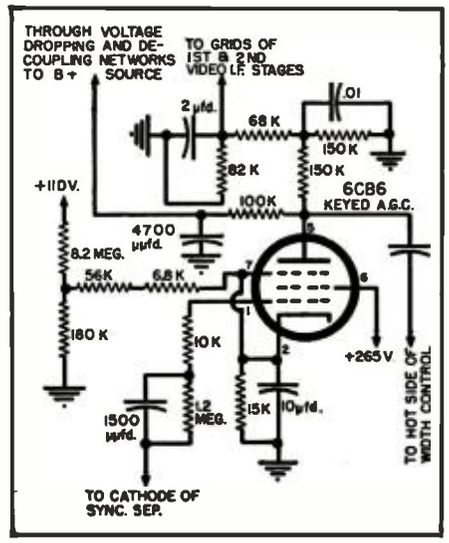


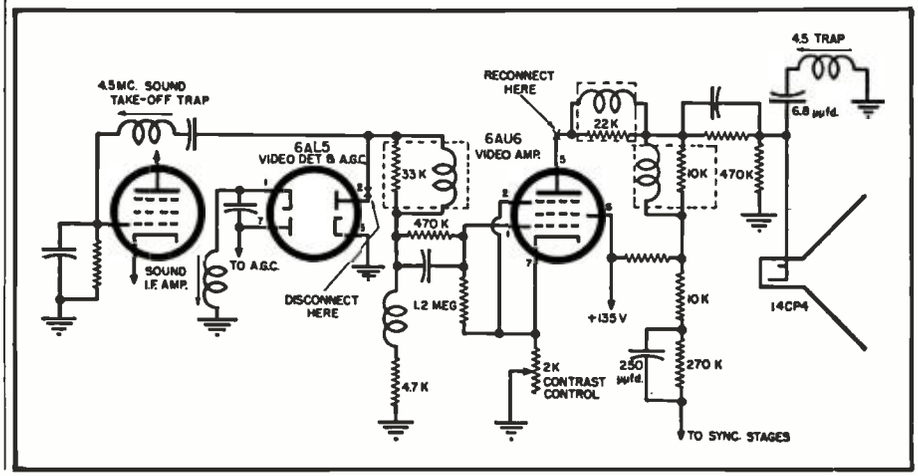
Fig. 9. Keyed a.g.c. voltage reduction. The voltage may be reduced by lowering value of the 82K ohm resistor or increasing the value of the 68K ohm resistor in series with the latter. A conservative procedure would be to increase the value of one resistor by the same amount the other is reduced, thus keeping plate circuit resistance constant and minimizing circuit changes. Alignment of these circuits may be upset and should be checked. Circuit is from an RCA Victor Model 17T53.

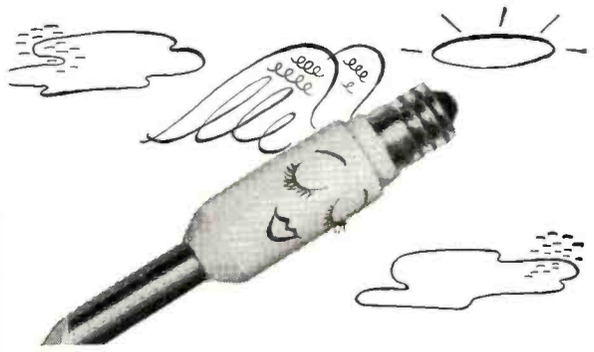
A check of the alignment of the sound section should be made after circuit changes in the sound i.f. or detector stages.

In the case of intercarrier receivers, if the sound signal is taken off at the video detector, the take-off point may be changed to the plate circuit of the video amplifier (see Fig. 10) to boost the sound. If a vertical sync buzz becomes audible as a result, the take-off point should be restored to its original point, unless the technician wants to try removing the buzz by careful realignment of the ratio detector or discriminator, and possibly other tuned circuits as well. The sound take-off coil should be retuned if its take-off point is changed.

(To be continued)

Fig. 10. A boost in sound volume may be obtained in intercarrier sets by disconnecting the sound take-off lead from the plate of video detector (pin 2) and reconnecting it to plate of video amplifier (pin 5). Circuit is from an Admiral 14R12.





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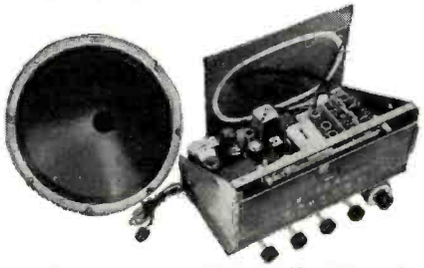

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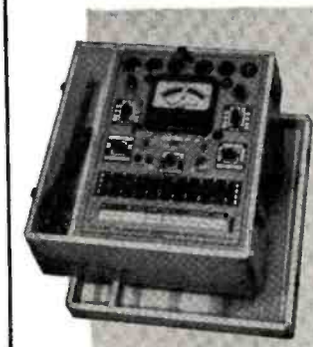

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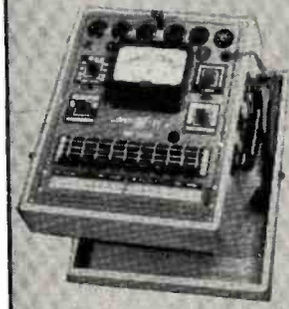

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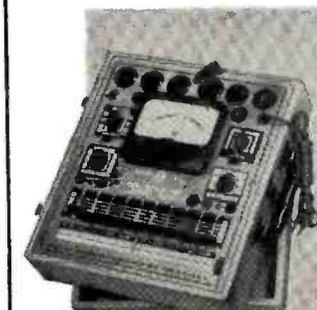

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Frequency Standard
(*Continued from page* 57)

though the multivibrator is synchronized and will stay locked in with the 100 kc. oscillator over a wide range of plate voltage, the note out seems to suffer by getting rough and raspy. Voltage regulation is simply good insurance and adds little to the cost.

It will be noted from the schematic that neither side of the a.c. line is connected directly to the metal case or chassis. All the usual ground or chassis connections are made to insulated tie points. However both sides of the line are connected to the chassis through two .005 μfd. condensers, thus serving to ground the chassis and case for r.f.

After the frequency standard has been constructed, there are three adjustments which must be performed before the job can be considered complete. The 1000 kc. oscillator must have its plate circuit tuned by adjusting C_7 (actually this is the screen grid of the 12AU6). Adjust this trimmer for maximum amplitude of oscillation and then back off a bit. This can be easily found by placing a v.t.v.m. on the grid of the oscillator or if one is not available, simply by observing the S-meter of a receiver tuned to 1000 kc. or one of its harmonics. If no carrier can be found and assuming no wiring errors, back off on C_7. As with any tuned-plate oscillator the amplitude of oscillation will increase as the capacity is increased up to a point where the oscillation will suddenly cease, *i.e.*, the plate circuit becomes capacitive.

The 100 kc. oscillator is adjusted to zero beat with WWV. Tune in WWV on the frequency that is the strongest in your particular locality. Loosely couple the frequency standard to the receiver, wait for the unmodulated portion of the WWV transmission, and adjust C_1 for zero beat. If greater precision is desired in this adjustment, connect an oscilloscope directly to the output of the second detector in the receiver and adjust for a straight-line pattern.

Next the multivibrator must be synchronized at the tenth subharmonic of the 100 kc. oscillator. This is done by adjusting the potentiometer R_{10} in the grid circuit of the 12AU7 multivibrator. First accurately establish on your receiver two adjacent 100 kc. points. This might best be done on the low end of the broadcast band (600 to 700 kc.) where 100 kc. occupies a considerable space. Now switch the frequency standard to 10 kc. operation and count the number of harmonics heard between and including those at the 100 kc. points. Adjust R_{10} so that ten are heard. The multivibrator is then operating at one-tenth of 100 kc. Considerable leeway will be noted in this adjustment, that is, the multivibrator will stay synchronized with the 100 kc. oscillator

over a large variation of R_{10}. However the correct adjustment will be when the correct number of harmonics are noted and these signals sound the cleanest.

For most applications a piece of wire 10 inches long will serve to provide adequate signal pickup when the frequency standard is placed on the operating table along with the receiver.

The construction of this frequency standard has proved to be one of the most worthwhile additions to our ham shack. It has completely changed our operating procedure. In effect, it has given us about 25% more frequencies since now we can sidle up to within a few kilocycles of the band edge—and know for sure that we're not inviting a little pink billet-doux from the FCC. —30—

CARBON COPY

C. H. BOWERS of Portland, Oregon has sent us a carbon copy of a letter he wrote to "Radio Melbourne" and has kindly granted us permission to share his correspondence with our readers.

Mr. Bowers writes: "For some time I have been going to give myself the pleasure of writing 'Radio Melbourne' and expressing my thanks and appreciation for the many hours of entertainment I have enjoyed from 'down under.'

"I am likewise interested in Sydney as it is just 37 years since my first acquaintance with that great city. In 1915 I was Chief Radio Operator aboard the Yankee Mail Boat 'Sonoma' between San Francisco and Sydney via Honolulu and Samoa. At that time one of your stations was at Pennant Hills, just outside of Sydney. The Navy personnel was laboring with crystal detector receivers and, with effort, could copy code from Honolulu at night. My running mate aboard the liner 'Ventura,' Kenneth Ormiston, as well as myself was pioneering with vacuum tubes and, on one trip, Ormiston brought a number of Armstrong detector tubes to the boys at Pennant Hills, along with an improvised receiver for using same. Much to the amazement of your Navy operators, they were able to read Honolulu any time during the day and many other long range stations unheard before.

"You can understand my interest in listening to your stations in Australia—the GPO clock chime in Sydney, the sound of the Kookaburra, and all the other things that go to make up Australia. In one second, I can ride the ether waves back to Coogee and Bondi Beaches and summer weather when it's bleak and cold here!

"In this location we receive your beamed signals on an 8-foot 'buggy whip antenna' 20 feet off the ground.

"As soon as one development in radio becomes commonplace another advances. We are now concerned with television and the time may soon be at hand when TV waves may be channeled from Australia direct to our shores and vice versa. It is really unfortunate that the present generation has not experienced the same thrill as we who followed radio in 1915.

"All good luck to 'Radio Melbourne' and may you long continue to radiate cheer and good will from under the Southern Cross." —30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

ONE of the least publicized but most effective programs of "self-help" for the service industry is that being carried out by the Television Service Association of Michigan. Since an important phase of this program has succeeded because of the cooperation of a Joint Committee on Service which includes executives of Detroit set and parts distributing organizations, the plan merits serious study by parts and set distributors and service businessmen in every marketing area across the country.

The Television Service Association of Michigan is an organization of businessmen engaged in electronics servicing. Parenthetically, we would like to point out that "electronics" servicing covers the entire field of electronic vacuum-tube circuitry but especially television, radio, sound, and industrial electronics equipment.

The TSA program revolves around regular monthly business meetings of the association members which are always attended by executive personnel from set and parts distributing organizations. At each of these meetings a talk on some important facet of business management is given by a competent speaker. Potentially harmful business practices or developments that crop up in the Detroit area are openly discussed and committee reports on investigations are thorough, complete, and factual.

One of the most interesting phases of the TSA-Joint Committee program is the manner in which they handle meetings devoted to technical developments and progress. In order to provide technicians and technical supervisory personnel a maximum amount of important technical information in a minimum of time they hold an annual "new receiver clinic." Competent lecturers are brought in to discuss, in detail, circuit trends in new models and to explain practical techniques in using servicing equipment. Set distributors display representative models of their latest chassis units and have technical personnel in attendance at their booths to cover the questions on circuitry in their receivers.

Recently arrangements were made with the TTLB to have Edward M. Noll present his lecture on u.h.f. to technicians in the greater Detroit area. The meeting was sponsored by TSA and the Joint Industry Committee on Service. More than 650 people attended this lecture which was given in the main auditorium of the *Detroit Edison Company.*

The most significant proof of TSA progress shows up in the rapid growth of their monthly house organ—*"TSA News."* This interesting and informative publication has grown from a four-page bulletin into a 12-page magazine which includes a 4-page "consumer section". While distribution of the *"TSA News"* is restricted to service businessmen and associated businesses in the greater Detroit area, thousands of copies of the consumer section are printed for mailing and personal hand-outs to set owners by TSA member organizations.

(*Editor's Note: Service businessmen who would like to see a copy of "TSA News" with its consumer supplement should write to Harold Chase, President, TSA of Michigan, 16311 Grand River, Detroit 27, Mich. However, in requesting a copy we would suggest that you send ten cents for a single copy or one dollar for a year's subscription to pay the handling cost of mailing to you.*)

The controlling factors in the splendid success of the TSA program can be crystallized in three elements:

1. TSA is an organization of service businessmen. Their basic motive is to establish the business of electronics service as a stable, profitable, and respected business activity in the greater Detroit area.

2. All phases of their program—both technical and business—are managed by TSA officials and counselled by members of the Joint Industry Committee on Service.

3. The program is actively supported by all leading parts and set distributors in Detroit.

The success of the TSA program, which parallels that of the Associated Radio-Television Service Dealers of Columbus, Ohio, clearly demonstrates one very important fact—that the most pressing problems of the electronics servicing industry can and

must be handled on a local or regional basis. It also shows that such programs can be successful if they have the whole-hearted support (including financial) of local parts and set distributors *provided the planning and management of the program are left in the hands of service business executives.*

National Lecture Programs

Competently prepared and ably presented lectures have proven to be the most effective training medium for technicians actually employed in shop or field service work. Service people have little idea of the high cost of preparing and touring the kind of lectures that service technicians will attend—and learn from.

A good service lecture is one that will "hold" its audience through to its conclusion. It is normal practice to call a mid-lecture "break" in a technical presentation. When a lecturer loses half or more of his audience at the break it is because either his material or his method of presentation was not getting across to service technicians. Usually it is the fault of the material.

It is always a surprise to non-technical people to observe how technicians stay "glued" to their chairs for perhaps two hours listening to a technical presentation and making notes on important points. Yet that always happens when a speaker "knows his stuff" and has prepared his lecture to give a smooth presentation of the material.

What does it cost to prepare a good technical lecture?

Depending upon the subject and the amount of equipment that must be covered, it costs from three to five thousand dollars to prepare the kind of practical, factual lecture that is required to hold the attention of service technicians. The material must be carefully researched; equipment must be used under normal servicing conditions; its preparation must be based upon a complete understanding of actual service problems. There is a wide difference between the theoretical concept of how service should be handled and the actual practices that must be employed to handle service work at a profit. Successful service lecturers understand that difference from personal experience.

Under normal scheduling conditions the average service lecturer can complete only about fifty lectures per year. Considering all of the costs involved which would include the lecturer's salary, traveling expenses, scheduling costs and, of course, the amortization of the lecture preparation cost, the most efficiently planned lecture tour will cost at least $300-per-lecture to present. This does not include the cost of the hall nor of the announcements and other promotional material necessary to publicize it properly.

Equipment and parts manufacturers have become discouraged with lecture programs because of the small at-

tendance these lectures have drawn in recent years. When only a handful of technicians attend a manufacturer's lecture it means that he has spent from thirty to fifty dollars-per-man in attendance to give the lecture in that city.

Attention was sharply focussed on this situation in the Philadelphia area by Paul V. Forte, Executive Secretary of TCA, in an article in the *"Almo Broadcaster"*:

"Last year, in Philadelphia, the attendance of technicians at lectures designed to keep them abreast of progress in the industry was discouragingly low. In only two instances, to this writer's knowledge, were there full turnouts to lectures. One of these was early in the season and the other late in the season, and both sponsored by the Joint Electronics and Radio Committee on Service under the direction of its Technical Advisory Panel. Both of these lectures were presented by the Television Technicians Lecture Bureau.

"In one instance that we know of, one major manufacturer sent a lecture crew and equipment to Philadelphia at an estimated cost of $1500.00 only to find 27 *bona fide* technicians in attendance. In another instance, one of the country's most widely known TV personalities found himself addressing 85 people, with only 54 of them known to be technicians. Such things have the result of manufacturers trimming their educational budgets even though they know the considerable need for their programs."

One of the growing problems of the service industry is that an increasing number of service technicians is interested in their work only to the extent that it is a job at which they must work a certain number of hours per day for their weekly paychecks. This is not unusual, of course, because most employed people feel that way about their work. But it poses a serious problem for the service businessman in his need to keep his personnel abreast of the industry's fast-moving developments. It is one of the main reasons why well-planned, comprehensive lectures covering a wide range of products and circuitry are important to him for they help his technicians to acquire a lot of useful, practical information in a minimum of time. They are the kind of lectures that he is glad to pay his service people for the time they spend in attending.

A Preview of Growth

At the year end, Dr. W. R. G. Baker, vice-president and general manager of the Electronics Division of the *General Electric Company* set down an interesting outline of developments anticipated in the course of the present year. Dr. Baker said that he looks for this to be a record year for the electronics industry with the accomplishment of the following tangible results:

1. More than 200 television stations in operation by the end of the year.

2. Upwards of 6,500,000 home television receivers produced and approximately 7,500,000 home and portable radio receivers.

3. Continuation of the trend toward larger size picture tubes and advancement in the development of color picture tubes.

4. A continuing high level of production of military electronics equipment, and an increase in total dollar volume of the entire electronics industry over the presently estimated $4,000,000,000 a year rate.

5. A marked increase in new technological developments both in pure research and applied research areas.

6. A large scale increase in the development and production of germanium devices, including transistors, rectifiers, and diodes.

Discussing television and radio in detail, Dr. Baker had this to say:

"Construction and operation of new television broadcasting stations will create new markets for the sale of television receivers in 1953. These new markets, together with the strong demand for larger size sets in older markets, should result in a substantial increase in 1953 television production over that realized in 1952 or 1951. Total industry production and sale of television sets in 1953 should exceed 6,500,000 units and may come close to the record factory sales of 7,355,000 units in the year 1950. The majority of the new television stations will be broadcasting in the ultra-high-frequency range. Therefore a substantial number of television receivers in the year 1953 will be equipped for both v.h.f. and u.h.f. reception.

"The demand for radio receivers continues strong, and it is estimated that approximately 7,500,000 home and portable radio receivers will be produced and sold by the industry during 1953, an increase of approximately 10 per-cent over 1952 production. We believe that over one third of this 1953 volume will consist of clock radio sets.

"On June 30 of this year (1952), the ban that had existed on new television station construction was lifted by the Federal Communications Commission. Since that date the FCC has issued a large number of new station permits and by year-end it is estimated that the FCC will have granted over 150 new station permits; approximately 45 for new v.h.f. stations and 105 for new u.h.f. stations. It is expected that this high rate of construction permit grants will continue through the first quarter of 1953 and that by the end of 1953 an additional 250 CP's will have been granted making a grand total of 400 since the end of the freeze. These CP holders will spend approximately $100 million on just transmitters, antennas, and television studio equipment. The industry will ship a large share of this equipment in 1953, and by the end of 1953 over 200 new stations should be in operation. This will bring television to all but the very remote areas of our population.

"At the present time new u.h.f. television station construction permits are being granted faster than the industry can supply equipment and delivery promises on equipment must, of necessity, extend well into 1953. It is hoped that by the end of 1953 the rate of production will have been raised so that improved delivery promises can be offered to new u.h.f. television construction permit holders. The industry, in addition to supplying this requirement for new stations, must also provide amplifiers for existing as well as new stations. These amplifiers will not only improve television service in existing areas, but will also extend the range of stations thereby bringing television service to additional families."

Effect on Service Industry

The most noticeable effect on service of this industry expansion will be to add to the competition for the services of the available experienced TV technicians. The lifting of the freeze has had no material effect on the volume of service business in the older TV areas. Competition has been stiff and fringe operators featuring low-priced service calls continue to crop up in the major cities. However, established well-managed service businesses continue to operate on a healthy basis despite a continuing barrage of fringe and thoughtless competition.

At the present time it is difficult to predict how well independent service businesses will fare in the new u.h.f. areas. The only station that has been on the air commercially for a long enough period to provide continuing propagation and reception information is on a channel, #27, at the low end of the u.h.f. band. Whether the experience gained on this channel will apply on Channels 45 and 61 has yet to be determined.

At the year-end the industry was producing new television receivers at the rate of approximately six to seven million a year. Undoubtedly a large percentage of these sets will be dually equipped to receive both u.h.f. and v.h.f. Set dealers will be pushing these combination receivers while the service industry will be trying to sell conversions of the present v.h.f. sets. It may develop into quite a competitive battle. -30-

A TIME SAVER

By DOYLE D. HOLCOMB

DURING recent years more and more customers are having their present radios equipped with phono jacks to enable them to use the small, inexpensive record players, especially the 45 rpm units.

The most time-consuming part of these "hook-ups" is the installation of a "radio-phono" switch. If one is not installed, stations and noise mix with the music.

To avoid this problem, simply bend one of the rotor plates on the antenna section of the gang condenser so when the gang is fully meshed it shorts the antenna section. No noise! -30-

What's New in Radio

(*Continued from page* 96)

everything needed to provide a neat, time-saving installation. The package includes an AM-FM tuner, 3-speed phono-changer, a hi-fi amplifier, and a coaxial speaker. A brochure giving all specifications is available on request.

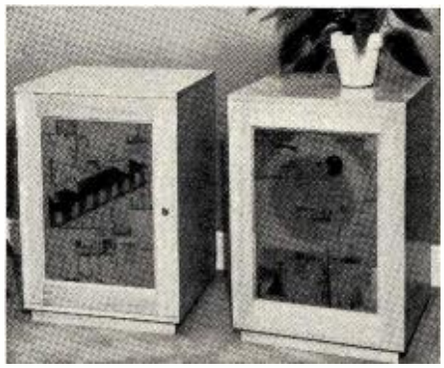
RESONANCE METER

Premier Mfg. Co., 943 N. Russell St., Portland 12, Ore., is marketing a resonance meter and r.f. detector which comes in a carrying case that includes a basic resonance grid dip meter, impedance and inductance measuring units, r.f. detector probe, and self-contained power.

The unit is dry-battery operated and can be used in the field, laboratory, or shop. The meter with accessories fits into an 8" x 10" x 13" carrying case which weighs 14 pounds in all.

MATCHING CABINETS

Orfeo, 19 E. 48th St., New York 17 is offering a pair of matching cabinets,



one for equipment and large enough to hold all conventional tuners, amplifiers, and record players and the other a six-foot speaker cabinet.

Available in any finish desired, the new units are constructed of ¾" mahogany veneer. Covering fabrics for both cabinets are chosen to match the wood finish.

V.H.F.-U.H.F. VARIABLE

A v.h.f.-u.h.f. variable condenser designed for use in tuned circuits that operate at frequencies from 50 to 500 mc. has been developed by *Hammarlund Mfg. Co., Inc.*, 460 W. 34th St., NYC 1.

The "VU" incorporates a unique design which places two condenser sections in series and eliminates the need for contacts to the rotor. The rotor is completely isolated by means of *Pyrex* glass ball bearings.

BASE STATION ANTENNAS

Mark Products Co., 3547-49 Montrose, Chicago 18 has a new line of omnidirectional, vertically-polarized, high-gain base station antennas available.

Designed for the communications services in the 150 and 450 mc. regions, these antennas are based on a new and different colinear stacking and feed design which permits high gain and good bandwidth. Both three- and seven-element units are in production providing 4 db and 7.2 db gain over a half-wave dipole. Special units are available on a custom basis.

I.F. TRANSFORMERS

Radio Industries, Inc., 5225 N. Ravenswood, Chicago 40 has announced a new Series A line of i.f. transformers which have been designed especially for AM and FM.

The Series A is available in two constructions, one designed for use on standard chassis and the other for use with the new printed circuit chassis. Short terminal lugs for pressure fitting into the lug slot openings are featured for this latter application.

A data sheet covering the new Series A is available from the company.

TRANSISTOR HEARING AID

E. A. Myers & Sons, Inc., of Pittsburgh has announced the development of a hearing aid which uses three transistors, thus eliminating vacuum tubes and the "B" battery.

A capsule size "A" battery, that is said to last 2000 hours, is the only replacement part. The company estimates that operating costs will be only 4% of present operating costs.

SMALL-CRAFT RADIO

Radiomarine Corporation of America, 75 Varick St., NYC 13 has introduced a new radiotelephone transmitter-receiver designed especially for small-boat installations.

Two models of the ET-8050-HP have been designed to comply with latest

and pending FCC regulations. One model, for the inland waterways, ranges from 2000 to 9000 kc. and the second, for the high seas, ranges from 1650 to 18,000 kc. The new eleven-channel radiotelephone features a separate power unit for 32, 115, or 230 volt d.c. or 115 volt a.c. operation. Power output is approximately 85 watts.

COMMUNICATIONS TOWERS

Rohn Mfg. Co., 2108 Main St., Peoria, Ill., has several towers available for radio communications applications.

The standard 12" triangular Type 10 tower may be used for non-guyed applications up to 50 ft. and guyed up to 100 ft. The new Type 20 is a 14" triangular tower which is adequate for heights up to 150 ft.

The towers come in 10 ft. sections for easy erection. They may be climbed for maintenance or servicing.

CLIPPER DIODE AND RECTIFIER

Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L.I., N.Y., has announced the Type 6269, a new, high-vacuum clipper diode and rectifier which is only 2" long without leads and ¾" in diameter.

Designed as a miniature, ruggedized version of the 3B29, this new, external diode operates under more stringent conditions than its prototype.

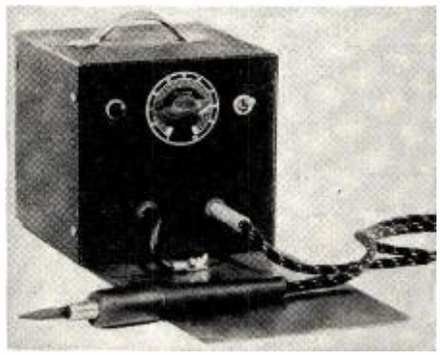
The 6269 is cooled by liquid-immersion in silicone oil. Maximum peak voltage is 16 kv. and peak current is 250 ma.

Although designed primarily for military radar applications, it exhibits interesting possibilities for use in the high voltage electronic field where space requirements are critical.

NEW SOLDERING UNIT

Sunrise Products Co., P. O. Box 173, Hawthorne, N.J., is introducing a new soldering unit, the Model L-72.

This particular unit features a metal ground plate on which jigs can be mounted and adjustable heat control



which allows the electrodes to heat up instantly to 1250 degrees F.

The unit may be used for soldering condensers, condenser cans, lugs, terminal boards, electronic parts, etc.

A pamphlet describing this equipment is available on request.

TRANSISTOR APPLICATION

Sonotone Corp. of New York City has announced the availability of a new hearing aid which uses transistors to achieve more compact construction.

The new "1010" is the thinnest and smallest (3 oz.) unit the company has ever made. This unit employs a single transistor and two of the company's micro-miniature vacuum tubes.

According to the company, the new circuit design is expected to increase the "B" battery life to more than six months and increase the "A" battery life by 50 per-cent.

SAFETY PLUG

Noma Electric Corp., 55 W. 13th, N.Y. 11, N.Y. has available a safety plug which reduces the hazards of overloaded and shorted electrical circuits.

The plug contains two easily-replaceable safety fuses which blow on a short or overload, leaving the rest of the circuit undisturbed. Appliances and TV sets can be wired to the plug by inserting the wire into it and turning a locking spring.

AUTOMATIC PORTABLE

Califone Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif. has introduced its Model 11AJ automatic portable record player.

The instrument has a 4 watt amplifier and employs an 8" speaker. It is equipped with the latest model *Webster*

changer and has a completely automatic shut-off of the changer and amplifier. An output jack for an external loudspeaker or headphones is provided.

The unit is competitively priced and full details are available on request to the company.

MOBILE MIKE

Electro-Voice, Inc., Buchanan, Mich. is on the market with a new hand-held differential-type, noise-cancelling, high-output, single-button carbon microphone, the Model 208.

It is designed for mobile communications and similar applications. Articulation is at least 97% under quiet conditions, 88% under 115 db of ambient noise.

Frequency response to sound of close origin is substantially flat from 100 to 4000 cps. It comes complete with 5 ft. of 3-conductor cable and weighs 3 oz.

LABORATORY MONITOR

Berkeley Scientific, 2200 Wright Ave., Richmond, Calif. is marketing a general-purpose count rate meter with provision for a visual and/or aural indication.

The Model 1800 has a front panel

control which permits selection of five different meter ranges: 300, 1000, 3000, 10,000, and 30,000 counts per minute. Aural volume control is also provided. Accuracy is ± 5%. The unit measures 6½" x 6½" x 10¼" and weighs approximately 8 pounds. –30–

RESCO EXPANDS

RADIO ELECTRIC SUPPLY CO. of Kingsport, Tenn. has moved to 245 E. Market St. in an expansion program which increases the floor space from 680 sq. ft. to more than 6000 sq. ft.

One of the unique features of this new distributor setup is the inclusion of a meeting hall which has been planned for use by technicians and amateurs in the Kingsport area. The hall is 33 ft. x 17 ft. and will accommodate 50 persons. It is equipped with blackboards and will have facilities for showing manufacturers' movies on various subjects.

Service groups requiring such facilities are invited to get in touch with Resco for scheduling such dates.

–30–

International Short-Wave

(*Continued from page* 124)

around 1030. (Engberg, Sweden) Heard parallel on 10.21A and 7.50 with Chinese music and vocals 1915; the 10.21A channel signs off 1929 but by that time 7.500 was covered by QRM. (Bellington, N. Y.) The 10.21A outlet noted 1730 with news in parallel with 11.69A. (Niblack, Ind.) A Chinese station on 15.58A apparently is *Radio Peking,* heard 0930-1000 parallel with 9.43, 9.04. (Ridgeway, South Africa)

Colombia—La Voz del Norte, 4.875, Cucuta, noted with dance music 2200-2230 when signed off with National Anthem; HJKD, 6.002, *Emisora Nuevo Mundo,* Bogota, noted with classical music 2315-2400 when closed with National Anthem; HJDE, 6.145, Medellin, heard 2000 at good level; HJEX, 6.055A, heard with Spanish commentary 2215-2230, closing 2300 with National Anthem. (Casey, Ky.) HJFR, 4.935, Ibague, is a *new* station heard evenings (*EST*), as is HJEQ, 4.915, Popayan. (NNRC) QSL from HJDE, Medellin, listed short-wave channel as 6.145. (Parrish, Ga.)

Costa Rica—TIHH, 11.972, *Radio Athenea,* noted at good strength with popular North American songs 0900-0915; requested reports to Apartado Postal 2208, San Jose, Costa Rica. (Casey, Ky.)

Cyprus—Limassol, 6.79, noted 0030 with Arabic music and vocals. (Bellington, N. Y.) ZJM7, 11.72, heard with strong signal from around 0930 to close 1145 with Arabic program; male and female announcers; has dictation-speed news in Arabic 1115-1145; a station in Arabic on 6.679A from 1145 to 1400 closedown at poor level is believed Limassol. (Ridgeway, South Africa)

Denmark—Copenhagen now radiates to India-Malaya at 0800-0900 on 15.165 on Tue., Thur., Sat. (and to ships in South Asian waters 0900-0920); the Danish Home Service which tested on 6.060 is again on 7.260 at 1240-1615 using the 50 kw. transmitter. (WRH, others) Still good on 9.52 to North America 2030-2130, 2200-2300. (Saylor, Va.)

Dutch New Guinea—Radio Hollan-

NEW TV STATIONS ON THE AIR

(As of January 10, 1953)

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER* (IN KW.)
Alabama					
Mobile	WALA-TV	10	192-198	5.08	316
	WKAB-TV	48	674-680	1.45	22.5
Arizona					
Tucson	KOPO-TV	13	210-216	4.65	316
Colorado					
Colorado Spr.	KKTV	11	198-204	4.93	250
Denver	KFEL-TV	2	54-60	17.8	56
	KBTV	9	186-192	5.25	240
Indiana					
South Bend	WSBT-TV	34	590-596	1.66	170
Mississippi					
Jackson	WJTV	25	536-542	1.83	180
New Jersey					
Atlantic City	WFPG-TV	46	662-668	1.48	18
North Carolina					
Asheville	WISE-TV	62	758-764	1.29	23
Ohio					
Youngstown	WKBN-TV	27	548-554	1.79	200
	WFMJ-TV	73	824-830	1.19	175
Oregon					
Portland	KPTV	27	548-554	1.79	91
Pennsylvania					
Wilkes-Barre	WBRE-TV	28	554-560	1.77	1000
York	WSBA-TV	43	644-650	1.52	170
Texas					
Austin	KTBC-TV	7	174-180	5.61	109.6
El Paso	KROD-TV	4	66-72	14.61	56.3
	KTSM-TV	9	186-192	5.25	64
Lubbock	KDUB-TV	13	210-216	4.65	31
Virginia					
Roanoke	WSLS-TV	10	192-198	5.08	250
Washington					
Spokane	KHQ-TV	6	82-88	11.8	100
Hawaii					
Honolulu	KGMB-TV	9	186-192	5.25	35
	KONA	11	198-204	4.93	117

*From station CP application.

Formula for computing wavelength in feet of video carrier:

$$\text{wavelength in feet} = \frac{984}{\text{frequency in mc.}}$$

Total number of television stations now on the air: 131 (10 of which are u.h.f.)

dia, 7.126, is heard 0400-0730. (Japanese Short-Wave Club) Latest schedule from the station lists closedown 0700. (Kary, Pa.)

Ecuador—The Ecuador outlet on 9.557A appears to be parallel with HC1AC, 7.210, Quito; signs off around 2330. (Bellington, N. Y.) Noted by Stark, Texas, as early as 0800.

HC4AS, 4.200, Bolivar, heard 2000-2100 at good level; HC4FF, 4.580V, Esmeraldas, noted signing off 2304; HC2AJ, 4.651, Guayaquil, heard 2130 with fair signal. (URDXC) HCJB, 11.915, noted in *English* 2100-0030; also on 15.115, 9.745, and from 2300 on 6.050A. (Engen, Minn.)

England—The BBC's 104-m. channel, GRC, 2.880, noted at good strength 2300-2400 during General Overseas Service relay; left air abruptly with no special announcements. (Levy, N. Y.)

Ethiopia—Although the schedule of *Radio Addis Ababa,* ETAA, 15.040A, is rather irregular (around 1030-1420 more recently), an *English* newscast is generally radiated around 1330. (Bellington, N. Y., others) *Radio Sweden* says is now using 9.624 for *English* 1400-1430.

Finland—Helsinki was heard recently on 15.190 with an *English* broadcast to the Western Hemisphere at 1430; should be parallel over 17.800, 9.555. (Bellington, N. Y., Callarman, Oregon) The week-day *English* session is now 0700 instead of 0715 over these channels and is rebroadcast on them at 2200A to North America.

French Equatorial Africa—Brazzaville, 11.970, noted on Thursday 1445 with "The French Have a Word for It." (Casey, Ky.) Noted with news 1745, good level, some CWQRM. (Mullen, Mass.) And with news 1550-1600. (Bishop, Ohio)

French West Africa—Radio Dakar, 9.560, noted around 1415-1500 with variety program, strong level; should have news in French 1700. (Niblack, Ind.) Heard signing on 0200 with march, French announcements, then setting-up exercises in native. (Saylor, Va.) A station on 4.96A which signs on with "La Marseillaise" 0130A is believed to be *Radio Dakar;* at times appears parallel with Dakar's 11.896A outlet; has news in French around 0230. (Saylor, Va., Bellington, N. Y.)

Germany—Stuttgart, 6.03, was noted recently parallel with Frankfurt, 6.19, at 0232 with classical music. (Bellington, N. Y.) Hamburg, 11.795, noted 0735 with music; man identified in German 0740. (Scheiner, N. J.) Heard on 6.270 at 2349 tune-in; news in German 2350; time pips 2400, then continued talking in German; fair level, QSB; when returned 0103 had setting-up exercises by woman with piano accompaniment. (Bellington, N. Y.)

Greece—Athens appears to be using 7.300 instead of 9.607 for *English* 1430 and for the transmission to North America 2000-2100 (*English* news around 2035). (Ferguson, N. C., Bellington, N. Y.)

Greenland—Angmagssalik has been

heard in Sweden some days 0915-0945 on 7.570. (Radio Sweden)

Guadeloupe—Some days, Basse-Terre, 7.447, is heard well in French around 0600-0630 when signs with "La Marsellaise." (Chatfield, N. Y.)

Guatemala—TGJA, 5.990, noted closing 2400 and announcing return for 0600. (Casey, Ky.) TG2, *Radio Morse,* 6.621, Quezaltenango, and *Radio Colonial's* TGCB, Antigua, 6.570, both sign off with anthem 2205. (Stark, Texas) TG2 noted fairly strong 1845-1900. (Tonsi, Wis.) This one was *measured* recently as 6.6189. (Rastorfer, N. Y.)

Haiti—According to West Va., 4VEH, 9.865A, Cap-Haitien, is to be *silent* on Thursdays this year. Bishop, Ohio, notes 4VRW, 10.075V, Port-au-Prince, announcing in both French, *English* 2115. Cox, Del., recently heard 4V2S, 5.591, Port-au-Prince, at fair level in French 1545.

Honduras—Radio Tela is now on 6.035 from 6.177; appears to open 0800 and closes 2300A. (Stark, Texas)

Hungary—Radio Budapest, 9.833, noted closing *English* session 2000 at good level in Ind. (Niblack) Heard on 6.248 at 1930-1945. (French, Mass.)

Iceland—TFJ, 12.175, Reykjavik, was fair level recently on its Sunday *only* schedule, 1115-1130 but had bad code interference. (Levy, N. Y.)

India—The *English* news service from All India Radio, Delhi, is scheduled 1450-1500, 7.275, 4.880; 1930-1940, 11.850, 9.630; 2310-2320, 17.705, 15.130, 11.870; 0300-0310, 17.705, 15.160; 0830-0845, 11.780, 9.565; 1045-1055, 15.290, 11.780.

Indo-China (Vietnam)—Radio France-Asie, 9.754A, Saigon, noted with news in French 1015, closing with "La Marseillaise" 1030. (Pearce, England) Is heard in Australia on 11.925 at 2030-2130 on Sun.-Wed. and again Fri., but also announces is on the air that time Thur. During the 0900 transmission, some days uses 11.925, other days 11.830 so must be seeking best channel to use. (Radio Australia) Sanderson, Australia, notes the 2030-2130 transmission on 11.830 some days.

Iran—EQO, 3.850A, Teheran, has had an outstanding signal in New Zealand with Arabic news items 0830 lately, many *English* recordings. (*N. Z. DX Times*)

Iraq—Radio Baghdad can be heard some days on 6.135 parallel 11.724 with news in Arabic 1400 and with *English* session 1415-1500 closedown. (Bellington, N. Y.) Schedule is 2255-0100, 0400-0600, 0830-1500. (*N. Z. DX Times*)

Ireland (Eire)—Officials of *Radio Eirrean,* Dublin, recently notified Bellington, N. Y., that the station (which had been operating on 15.120 and 9.595) was off the air and that it was not known when it would resume operations.

Italy—Rome is noted with *English* for the East Coast of North America now 1920-2000 over 11.905, 9.575 *only.* (Bellington, N. Y., others) Heard with news 0425 on 15.120, 17.770; in *English* to Pacific 0400-0445 on 21.560, 17.800, 15.400, and signing on *English* for Far

East 0445 on 17.800, 11.905, 15.400. (Pearce, England)

Jamaica—When this was written, *Radio Jamaica* appeared to be using 4.950 from 0600 to 1600 or later, and 3.360 from around 1600 to 2300 close-down. (Bishop, Ohio, others) Noted on 4.950 at good level 0700-0800. (Chatfield, N. Y.)

Japan—JKL, 9.605, was noted recently parallel JKI, 11.825, at 0115. JKL heard at 1700 with news. (Bellington, N. Y.) Kawachi, 11.800, noted at fair level 1718; has CWQRM at times. (Ballou, Calif.) JOA2, 7.180, noted 0700 with news, then music. (Sanderson, Australia)

Kashmir—Radio Kashmir is on a *new* schedule of 2130-2330 and 0700-1200 on 3.277, and 0200-0330 on 6.110. (WRH, others) Location is Srinagar.

Lebanon—Beirut, 8.036A, noted in French with recordings 1430-1500. (Sutton, Ohio)

Liberia—ELBC, 6.025A, Monrovia, 1 kw., has *English* daily 1050-1845. (*Radio Amateur,* London)

Madagascar—FIQA, Tananarive, is noted some days in Sweden on 7.374A at 1100-1130. (Engberg)

Malaya—BFEBS, Singapore, noted signing on 0630 on 9.69 (good) and 7.12 (fair). (Balbi, Calif.) Has replaced 21.72 with 15.31 at 0915-1135. (Ridgeway, South Africa) Kuala Lumpur, 6.025, now has news 0545. (Balbi, Calif., Mast, N. Y.) *Radio Malaya,* 7.200, Singapore, noted with news 0545. (Sanderson, Australia)

Mexico—XEFT, 9.545, Vera Cruz, noted with North American dance music 2200-2215. Usually has bad QRM. (Casey, Ky.) XEBT, 9.625, noted in Spanish 2345 to 0130 sign-off. (Mast, N. Y.) XEKW, 6.030, Morelia, heard signing off 2325 with announcements in both Spanish, *English;* announces sign-on for 0730. (Callarman, Oregon)

Mozambique—CR7IB, 7.258, Beira, noted at high level 1100-1330; probably closes 1530. Lourenco Marques is now using a *new* channel of 11.955 for its Portuguese network programs 0000-0100, 0430-0630, 1300-1515; 15.285 is used now *only* 1200-1300; 4.872 is used 1300-1515; 7.262 is used 0430-0630 in parallel with 11.955. (Ridgeway, South Africa)

New Zealand—Radio New Zealand's latest schedules are 1300-1515, ZL2, 9.540, ZL9, 11.810; 1530-0145, ZL10, 15.220, ZL4, 15.280; 0200-0545, ZL2, 9.540, ZL3, 11.780. (Engberg, Sweden, others) Is good level on 15.280 around 2400. (Rosenauer, Calif.)

North Borneo—According to station officials, *Radio Sabah,* Jesselton, broadcasts on 7.237 at 2300-2345 Mon.-Sat. with 250 w., fed into a folded dipole antenna one-fourth wavelength above the ground. (Scheiner, N. J.)

North Korea—Pyongyang, 6.25A, noted 0528 at fair level, moderate fading. (Ballou, Calif.) Was logged recently in parallel on 6.200A. (Japanese Short-Wave Club)

Northern Rhodesia—Lusaka, 4.826, noted 1250 with dance music; BBC news relay 1300. (Pearce, England)

Uses *all* frequencies—7.22, 4.826, 3.275 straight through 0700-1400 closedown now. (Ridgeway, South Africa)

Norway—Oslo, 11.850, noted closing 1900 with *English* identification. (Niblack, Ind.) LLM, 15.175, heard identifying in *English* 0700; asked for reports. (Mast, N. Y.) On Sundays at 1200 has *English* session ("Norway This Week") on this channel. (Buettner, Germany)

Outer Mongolia—Ulan-Bator is heard in Japan on 6.518 irregularly from around 0500 until 1000 closedown; *native music is different from that of China.* (Japanese Short-Wave Club)

Pakistan—*Radio Pakistan* is at good level on both 7.010, 6.235 in the transmission to Turkey 1430-1515 and to the United Kingdom 1515-1600 closedown. (Engberg, Sweden, others) Noted with news 0730-0740 on 17.835. (Pearce, England) Heard with *English* 2130 on 5.987, high level in South Africa. (Ridgeway) Noted with news and commentary 2015 on 11.914; Dacca, 15.335, heard 2100 with program for local listeners. (Sanderson)

Paraguay—ZPA1, 6.275, good level around 2030 to sign-off 2201A. (Levy, N. Y.)

Peru—*Radio Nacional del Peru,* OAX4Z, 6.082, noted weekdays with news in Spanish 2000. (Casey, Ky., Niblack, Ind.) Heard closing 2400 with powerful signal in Oregon. (Callarman) OAX4J, 9.330, Lima, noted around 2230; all-Spanish; identified as "Radio Colonial de Lima." (Patterson, Ga.)

Philippines—Far East Broadcasting Co., Manila, is noted in Sweden on the *new* 17.805 outlet around 0400-0600, has QRM. (Engberg) DZH7, 9.73, noted with fair signal 1715-1800. (Bellington, N. Y.) With *English* announcements 1800 on DZH9, 11.855, of "The Call of the Orient"; weak. (Niblack, Ind.) DZB2, 3.325, noted 0600 at excellent level. (Sanderson, Australia) *Radio Free Asia* relay, 6.110, heard closing session 1015, good level. (Rosenauer, Calif.) Schedule now seems 0645-1015A.

Poland—Latest schedule for *English* for Europe from *Radio Warsaw* is 0130-0200, 5.955, 7.125, 5.995; 1200-1230, 7.175, 9.555; 1230-1300, 6.025, 9.555, 7.145; 1400-1430, 6.025, 9.555, 7.145; 1430-1455 and 1730-1800, 5.955, 7.125, 5.975. (Pearce, England) And for North America—0600-0630, 9.570, 9.555; 0715-0800, 15.120, 9.555; 1715-1800, 1945-2015, 2315-2345, 0030-0100, 6.025, 9.555.

Portugal—A short-wave station in Coimbra is operating on 7.020A at 1300-1500. (Engberg, Sweden) Lisbon lists winter schedule of 1900-2100 to North America and North Atlantic, 6.374, 9.746; 0600-0800 to Macau-Timor, 15.125; 0945-1200 to Goa, Damao, Dieu, 15.125; 1230-1530 to Mozambique, Angola, Sao Tome, 9.740, 11.996; 1600-1830 to Guinea, Cape Verde Islands, Brazil, 9.740, 11.964. (WRH) Lisbon, 11.996A, is good level around 1230. (Cox, Del.)

Portuguese Guinea—Bissau, 5.839A,

noted in Portuguese 1630-1800 when closed with "A Portuguesa"; male announcer. (Ridgeway, South Africa)

Portuguese India—Radio Goa, 9.610, noted on a Sun. at 1030 with "Bringing Christ to the Nations" in *English;* at 1100 appeared to continue with similar broadcast in a native language. (Pearce, England) Carries "The Old Fashioned Revival Hour" (*English*) Mon. 1030-1130. (Ridgeway, South Africa)

Rhodes—Latest schedule for relays of VOA by *"The Courier"* is 6.015, 1200-1645 to Near East, and 1730-2245 to Caucasian USSR; 7.200, 2015-2045, 1615-1645, 1730-1900 to Caucasian USSR.

Roumania—Radio Bucharest noted on 6.210 and 9.254 with *English* 1530. (Bellington, N. Y.) Announces *English* for 1500 but when this was written, it was starting 1515; 12.032 is announced as parallel 6.210, 9.254. (Pearce, England) Verified from Strada A. St. Popov Nr. 60-62, Bucharest, Roumania, with new-type card; listed *Radio Romania* on 155 kc.; *Radio Bucuresti* on 854, 1052, 755, and 1457 kc.; *Radio Romania Libera* on 6.210, 9.254, 12.032. (Kary, Pa.)

Saudi-Arabia—Djeddah, 6.175A, noted at nice level from tune-in 2235 to 2315; all-Arabic. (Saylor, Va.)

South Africa—SABC, 9.870, noted 1200 with time pips, then news (on alternate days has news in Afrikaans); has news 1500 and closes 1505. (Pearce, England)

South Korea—Radio Sweden says the *new* 10 kw. transmitter at Seoul is now on the air using 9.555 at 1600-1830, 2130-0030, 0500-0900; heard at weak level in Sweden by Engberg. HLKA, 7.935A, Pusan, noted by Ballou, Calif., at 0615, fair level with slow fading.

Southern Rhodesia—Salisbury, 3.320, noted 1320 with sports results; joined BBC's General Overseas Service 1330. (Pearce, England)

Spain—Many Spanish stations have changed frequencies lately. *Radio Nacional de Malaga* is now on 6.940A; *Radio Mediterraneo,* Valencia, is using 6.995A; *Radio Cartagena* has been heard on 7.370 and also on 7.425 at 1100 and 1600-1700; *Radio Alerta* is operating on 7.500; *Radio Juventud,* Sabadell, is heard at 1700 on 7.345; *Radio Nacional* in Barcelona noted recently on 7.655 at 1100-1600. (Engberg, Sweden)

Spanish Morocco—EA9AH, 6.067, Tetuan, noted closing 1800. (*GDXaren,* Sweden)

Surinam—Paramaribo, 15.405, was noted recently from 1437 tune-in to 1456 with a program of music which sounded Hindu; good level, some *QSB,* no QRM. (Bellington, N. Y.) Noted on 5.757 parallel 15.405 from around 1600. (Ridgeway, South Africa)

Sweden—Radio Sweden, 9.62, noted 2300 with *English* to Southeast Asia, Australia; weak. (Bellington, N. Y.) Heard on 9.535 at 2315 in *English.* (Lund, Iowa) Noted on this channel with *English* 0800. (Chatfield, N. Y.)

Noted on 11.705 in Swedish 1625; on 15.155 at 0900 in *English*. (Geisel, W. Va.)

Syria—*Radio Damascus,* 17.865, noted signing on 0945 with *English* to India-Pakistan. (ISWC, London)

Tahiti—Radio Tahiti, 6.135, Papeete, heard again around 0100-0130 when closed with "La Marseillaise." (Sutton, Ohio) Should open around 2300.

Taiwan—Taipeh, 10.200, noted recently 1845 at fair level, moderate fading; heard on 9.775 at 0535 with fair signal. (Ballou, Calif.) BED29, 6.095, is heard in South Africa from around 1000 in parallel with BED6, 11.735, and BED7, 7.133A in Chinese dialects. (Ridgeway) BED6, 11.735, noted 2345 with *English* program of news and music. (Sanderson, Australia) Heard on 15.235 and 11.735 now at 2300-0200; first hour English; second hour Chinese; third hour Chinese at dictation-speed. (Rosenauer, Calif.)

Tangier—Pan-American Radio, 7.300, relays VOA 1430-1500, then has French session. (ISWC, London) *Radio Africa,* 7.126, noted closing 1900 after final announcements in Spanish, French. (Catch, England)

Thailand—Bangkok, 11.910A and 6.240, noted with news 0515 and 0615. (Sanderson, Australia) The 7.105 channel carries separate program at that time. (Balbi, Calif.)

Trinidad—VP4RD, 3.275, Port-of-Spain, noted at fair level with news 1845; at times has heavy QRM. (Say-

IMPROVING VIDEO AMPLIFIER OPERATION

By CHARLES ERWIN COHN

I RECENTLY purchased an old 7-inch TV set, a Meck XB-702. Although it provided a picture, its performance was not of the best and I was determined to improve it.

One of the difficulties was a low contrast capability. When the contrast control was turned up to a reasonable level, the picture got fuzzy and a buzz appeared in the audio which, of course, was caused by the sync pulses cutting off the video amplifier. The remedy for this condition lay in improving the output voltage potentialities of this circuit.

An examination of the circuit showed that the screen of the 6AU6 video amplifier tube was connected to the 117-volt line, while the plate of the tube was connected to the same line through a 6800 ohm resistor and an assortment of peaking coils and sound traps. Measurement of the plate voltage showed that it ranged from 25 volts with the contrast full up to 60 volts with the contrast full down. With the 7JP4 kinescope requiring around 100 volts signal for full contrast, it was obvious that low plate voltage was the reason for the trouble.

Fortunately, there was a source of higher voltage available—the sweep multivibrators receiving about 300 volts. The video amplifier plate circuit was removed from the 117-volt line and reconnected to this circuit. The additional drain of the video amplifier brought the voltage at this point down to 200 volts, but changing the filter resistor in this supply from 10,000 to 5600 ohms restored the original voltage.

Immediately, things began to improve. The video amplifier plate voltage rose to 160 volts with the contrast control full up and 200 volts with the contrast control full down. In addition, the 6AU6 tube was replaced by a 6BA6 to help reduce the set's tendency to sync pulse cut-off. With all these changes, usable contrast rose considerably, with consequent improvement in picture quality and sync action.

Although this was an obsolescent set, this type of video amplifier circuit is used in many modern sets with transformerless power supplies. The simple circuit changes described here offer a way of improving the picture quality of many sets.

Contrary to the opinions of many, I do not believe that the circuits of TV receivers are sacrosanct, but rather that the circuits of many sets, particularly the older or cheaper ones, can be improved by anyone with the patience to experiment and sufficient background to know what he is doing. —30—

lor, Va.) Heard on 9.625 relaying BBC news 0600, then with recorded music 0615. (West, Va.)

Turkey—The Technical University of Istanbul is now heard on 7.035A most days 1300-1400 with Turkish music and also some classical music. (Engberg, Sweden) In QSL, listed schedule of 1315-1500; said moved to 7.030V from 7.080A to avoid QRM. (Kary, Pa.)

Uruguay—CXA6, 9.623, noted parallel CXA10, 11.90A at 1500. (Ridgeway, South Africa) CXA10 noted in Indiana at strong level around 2000. (Hord)

USI (Indonesia) — Djakarta's *new* 9.866 channel noted to 1030 when closes with Indonesian National Anthem. (Pearce, England) Has news in Indonesian 0730. (Niblack, Ind.) YDJ2, 7.100A, Jogjakarta, Java, has fair signal 0600 with *English* recordings. (*N. Z. DX Times*) Djakarta, 11.947A, noted with dance music 0700, signing off 0730. YDB3, 7.27, Djakarta, heard closing with chimes 1130. (Ridgeway, South Africa, Callarman, Oregon)

USSR—Radio Tashkent, 6.825, noted with news and commentary 1000-1030, 1100-1130. Is directed to India-Pakistan in *English.* (Pearce, England) Ballou, Calif., reports Alma Ata heard on 9.380 at 0505, fair signal. Heard by Catch, England, on 9.340 at 0200 with light music.

After closing *English* transmission 0230 on 7.180, 5.960A, *Radio Moscow* takes oriental languages, and then is also parallel on 6.060A and 6.115A. (Callarman, Oregon) Frunze, 5.059A, noted 1445 with *English* session, good level; goes into foreign tongue 1500.

Vatican—HVJ noted with interval signal 1445 on 7.280, 6.030, 5.969A, then opened in German. Noted with news 1000 on 15.120, 9.550, 11.685, 11.740. (Pearce, England, Niblack, Ind., others) Has *English* also 1315 on most of these channels.

Venezuela—YVKR, 4.920, Caracas, noted with North American popular songs 2300-2330, when identified with four chimes, played band march, and left the air; YVMF has news in Spanish 2130-2135 on 4.800; is "Ondas del Lago," Maracaibo. (Casey, Ky.) Widely reported with *English* 1800-1900 is *Radio Rumbos,* 4.970, Caracas; is now using 10 kw. (West, Va., others)

YVKR, 4.920, *Radio Caracas,* signs off 2328, good level, no interference. YVKC, 4.890, noted with *English* 0630-0730, news 0640; uses commercials. (Callarman, Oregon) *Radio Popular,* Maracaibo, has been heard *testing* on 9.630 at 1730-1800. (Radio Sweden) *Radio Barquisimeto,* YVKJ, 9.510, noted 1500-1630 sign-off. (Sutton, Ohio)

Yugoslavia—Radio Yugoslavia, 6.100, Belgrade, noted with news 1645-1700. (Pearce, England) Heard with *English* 0145-0200. (Balbi, Calif.)

* * *

Press Time Flashes

At press time, *Radio Japan* had

(*Continued on page* 156)

moved from 6.069 to 7.180 in parallel with 9.675 in beam to Western North America 0000-0100. (Rosenauer, Calif.)

A station announcing as TGTE, Zacatecas, Guatemala, has been noted lately on 6.760 to 2300A sign-off. (Stark, Texas) ISWC, London, says Cayenne, Fr. Guiana, has test transmissions on Wed., Sat. 1800-1900 on 6.200; closes with "La Marseillaise." *Not confirmed.*

Bellington, N. Y., recently noticed the clandestine Basque station on 6.235A at 0238 tune-in when a man was speaking Spanish; at 0245 a man announced "Radio Euzkadi," then played a drum and fife interval signal repeated twice; continued in Spanish; good signal, no QRM.

A clandestine Asiatic station—probably located in Russia—is noted on 8.140 at 1200 to *after* 1400; frequency varies. A Bulgarian Freedom Station has been heard on 6.265 at 1055-1130. (Engberg, Sweden) Pearce, England, flashes that *Radio Alerta,* Valencia, Spain, has been noted more recently on 6.940 signing off around 1804.

Radio Free Japan, clandestine Communist station believed located in China, has extended its schedule to 2200-2300, 0500-0600, 0700-0830, 1500-1600 on 10.180, 11.896, uses Japanese *only.* (Radio Australia)

The Japanese Short-Wave Club reports *"Voice of Vietnam,"* Saigon, Indo-China (Vietnam), 9.620, is on the air now 1800-1930, 2215-0030, 0500-1000 (*English* 0930); *Radio Hue,* 7.205, 1830-1900, 2300-0015, 0500-0800; *Radio Dalat,* 7.265, daily except Sat. 0530-0630 (Sat. 0530-0700); *Radio Hanoi* has moved from 6.165 to 9.670, 1800-1900, 2230-0015, 0500-0830; *Radio Hirondella* (*"Radio Swallow"*), 7.408A, Hanoi, 2300-0130, 0530-1000. Says *Radio Laos* is heard in Japan on 7.215 with news in French 0800-0815; *Radio Cambodia* operates on 6.090 from Phnompenh; relays *Radio France-Asie,* Saigon, 1815-1845, and has own news in French 0700.

A station heard opening irregularly around 0055 on 4.97A is believed to be Lagos, Nigeria, probably testing. (Bellington, N. Y.)

Sunspot predictions given by SBC, Berne, include March 21; April 20; May 19. (Ferguson, N. C.)

Latest schedule of NWDR, Hamburg, Germany, is 2300-0500, 6.270; 2300-1110, 15.275, 17.845; 2300-1900, 11.795; 1115-1900, 9.735, 17.815; 0550-1900, 7.290; Sun. sign-on is 0000. (Scheiner, N. J.)

The *Voice of America,* New York 19, New York, USA, will now verify correct reception reports on the stations transmitting programs from the USA and from Overseas Relay Bases at Tangier, Munich, Salonika, Rhodes (*"Courier"*), Honolulu, and Manila. Reports should include station location, call letters (for USA stations), frequency, program details including languages heard, signal strength intelligibility, and interference. (NNRC)

A station announcing Katmandu, Nepal, was heard recently on 9.856 *testing* in Hindi, Pathani, Tamil, and

French at 0630; said was "testing to Afghanistan, West Pakistan, India, and outlying lands to the West."

A clandestine *"Chinese Patriots Radio,"* announced as portable and moving from place to place, has been heard in Chinese on 11.695-11.697, is in Chinese and Korean *only* with anti-Communist propaganda sessions at various hours *every fourth day. Radio Athlone,* 17.840, Ireland (Eire), was heard recently 0645 closing down what seemed to be a *test* transmission; said would be back 1315-1345; good quality but weak level. (Mast, N. Y.)

Acknowledgement

Thanks for the good reports. Keep them coming to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA . . . . . K.R.B.

SIGNAL CORPS RECEIVER

EMERSON Radio and Phonograph Corp. has developed a unique immersion-proof and concussion-proof AM receiver for the Signal Corps, the AN/GRR-5.

The new set covers a continuous frequency range of 1.5 mc. to 18 mc. in four bands. The complete set consists of a receiver chassis and power supply chassis housed in a shock-mounted aluminum case. Venting is accomplished by means of a hole through the spare fuse holder. When the cap is tightened, this unit preserves the immersion properties of the set.

Gears are used to obtain a 34:1 ratio of fine tuning knob rotation to gang condenser rotation. For rapid tuning, the fine tuning knob is pulled out, disengaging the fine tuning control and allowing the use of the "manual-preset" tuning knob with a gear ratio of 1.7:1.

The AN/GRR-5 is designed to be operated from dry batteries, storage batteries, or a.c. lines thus making reception possible in fixed installations, field installations, armored and personnel vehicles, gun carriages, etc. A spare parts kit contains tools, extra tubes and vibrators, whip antenna, and headphones for front echelon maintenance and repair work. -30-

Front panel view of the AN/GRR-5 radio receiver being manufactured for the Signal Corps by Emerson Radio & Phonograph Corp.

NEW TV PRODUCTS on the Market

SENSITIVITY TESTER

Service Instruments Co. of 422 S. Dearborn St., Chicago 5 is marketing a new portable sensitivity tester for measuring TV receiver performance in fringe areas.

The "SensiMeter's" microvolt scale is divided into "sensitive," "medium sensitive" and "insensitive" sections which permit the technician to quickly determine the condition of the set. The unit checks from antenna terminals to picture tube.

The company claims that it is possible to determine receiver performance in a weak signal area within three minutes.

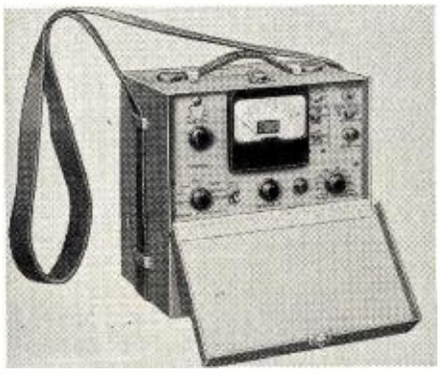
Further information is available from the company on request.

FIELD STRENGTH METER

Jerrold Electronics Corp. has announced a new field strength meter, the Model #704, which is designed for both laboratory and field work.

The new unit is direct reading in microvolts with an accuracy of ± .8 db. It has a continuous tuning range from 50 to 220 mc. It separates and measures video, audio, and adjacent channel carriers and locates r.f. interference. A model with a 6-volt vibrator pack (#704-6V) is available at extra cost.

Full details on either or both of these models is available from the



company's new distributing subsidiary, *Najesco, Inc.*, 1449 S. 26th, Philadelphia 46.

CONTROL KITS

P. R. Mallory & Co., Inc., Indianapolis 6, Ind., has made available three new control kits with which it is possible to service over 50 different models of radio and television sets.

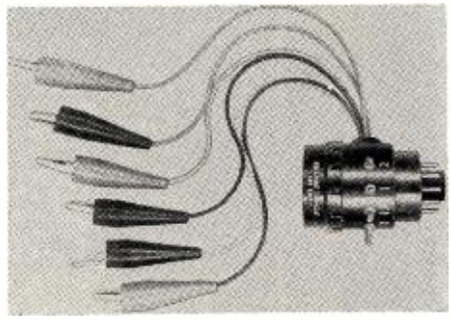
Number and types of controls included in each kit were determined on the basis of recent figures showing which controls are most popular in different geographical areas. Six type s.p.s.t., one type d.p.s.t., and one type s.p.d.t. switches are included with each kit. The kit is housed in a metal cabinet.

Kit 3735 is for the Western states, Kit 3755 is for the Central states, while Kit 3810 is for technicians in the Eastern area.

DYNAMIC ANALYZER

Electronic Beam Corp., 923 Old Nepperhan Ave., Yonkers, 3, N. Y. is offering a CRT dynamic analyzer which will attach to any v.t.v.m. and convert it into a CRT tester.

The instrument will permit a check



of socket voltage while the TV set is in operation, will check emission of the CR tube, and check the CRT for open or shorted elements and leakage.

The unit comes complete with an instruction manual which provides full details on performing dynamic tests.

U.H.F. ANTENNA KIT

Miller Television Co., 2840 N. Naomi, Burbank, Calif. has developed a u.h.f. antenna kit which contains the necessary parts for assembling six complete u.h.f. antennas. No extra parts of any type are required.

The six antennas which can be constructed include the corner reflector, double bow-tie, double-V, yagi, rhombic, and four-stacked X.

JAMPROOF DRILL

The *Carboloy Department* of *General Electric Co.* has developed a new drill which eliminates the possibility of jamming while boring through tough masonry, such as bricks, concrete, plaster, slate, or asphalt.

The self-cleaning action of the new drill is due to the shallow, oval spiral and overhang on the tip which keeps the particles moving out of the holes. The drill is tipped with *Carboloy* cemented carbide.

SINGLE-CHANNEL BOOSTER

Channel Master Corp., Ellenville, N. Y., is introducing a new single-channel TV booster, the "Katy-B."

It incorporates a low-noise 6BQ7 tube and a cascode-type circuit. It has a gain of 12 times (22 db) on the

low band and 6.5 db on the high band. The booster incorporates double-tuned transformers, wound for each specific channel, and an antenna bypass switch. It provides for both 72 and 300 ohm input and output.

CONTACT LUBRICATOR

A new remote control lubricating device for radio and television service

work has been introduced by *General Cement Mfg. Co.,* 919 Taylor Ave., Rockford, Illinois.

Essentially an "oil can" with a flexible tube four inches long, the new unit permits the technician to oil or grease electronic controls and bearings from virtually any position.

TV ANTENNA TOWER

Tele-Vue Towers Inc., 701-703 49th St., S., St. Petersburg, Fla., has developed a welded aircraft-type-tubing television antenna tower which weighs only 60 pounds, extends to a full height of 40 feet, and telescopes to 20 feet.

A removable crank at the base of the tower operates a telescoping mechanism which permits the tower to be lowered in high winds or, when used for fringe area demonstration work, to be packed away for transportation. The tower can be carried on the roof of any automobile. No guy wires are required. The base of the tower is hinged so that it may be raised from the ground, without climbing, after the antenna itself has been set in place on the mast.

"AUTOCOUPLERS"

Industrial Television, Inc., 369 Lexington Ave., Clifton, N. J., has two new "AutoCouplers" available, the Models IT-117A and IT-118A.

These units permit the operation of two or four receivers from a single antenna. Housed in inconspicuous cabinets, the new units feature microloss, interaction suppressing distribution, and adaptability to either twin-lead or open-wire line.

INSULATED TEST CLIPS

Industrial Devices, Inc., Edgewater, N. J., has designed a completely insulated test clip, the Model #1410A.

The plastic insulation covers the entire clip, including the nose. The new

unit can be used in pairs as a source of power for equipment under test without danger of short circuit due to the clips touching each other or other components.

The nylon insulation forms to the shape of the metal clips thus allowing the same degree of flexibility as bare metal clips. They are available in various colors for easy identification on test equipment leads.

DEFLECTION YOKES

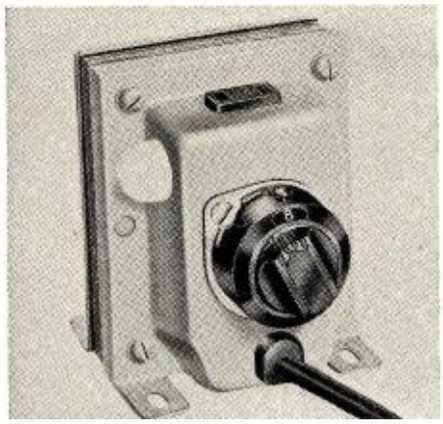
Standard Transformer Corp., Chicago, has added four deflection yokes with or without leads and networks.

The new *Stancor* units are the DY-1A, DY-8A, DY-9A, and DY-10A which are basic versions of the DY-1, DY-8, DY-9, and DY-10 respectively. Leads and networks are available on the new models if desired thus eliminating the necessity for removing and replacing network components in applications where they cannot be used.

LINE VOLTAGE BOOSTER

Crest Labs, Inc., 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y., has introduced the LVB-117 line voltage booster designed to be plugged in between the wall outlet and set.

The unit is automatic, turns on and off with the set, has an overload cutout to protect against unsafe line voltage increases, and a multi-tap selector switch for exact selection of the required boost, plus a visual indicator for precise determination of required boost.



MATCHING TRANSFORMER

Blonder-Tongue Labs of 526 North Ave., Westfield, N. J., now has a Model MT-1 75-300 ohm matching transformer available.

Precision impedance match at its 75 and 300 ohm screw terminals provides a means of eliminating standing waves and line reflections in individual installations as well as in master TV systems.

H.V. RECTIFIERS

International Rectifier Corp., 1521 E. Grand, El Segundo, Calif., has developed two high voltage selenium rectifiers, Type V-75HF and Type V-100HF, for TV applications. Full details on these units are available on request. —30—

Within the Industry

(*Continued from page 26*)

on a routine flight to Goose Bay, Labrador on October 16, 1952. With Mr. Kurtz on the flight was Frank McLaughlin, the pilot.

His wife, Lillian, of 547 Bedford Ave., Brooklyn 11, New York has appealed to Mr. Kurtz' fellow hams for any assistance they can render in helping to locate the missing flyer.

* * *

W. WALTER JABLON has been appointed vice-president in charge of sales by the *David Bogen Company* of New York.

He formerly held the same post at the *Espey Manufacturing Co.* prior to which he was associated with *Hammarlund* for nearly twenty years.

In his new position he will direct the sales of the company's line of p.a. amplifiers and systems, FM and AM radio tuners and amplifiers, intercoms, TV boosters, sound systems, and speaker enclosures.

* * *

CARL H. DICKE, chairman of the board of *Crown Controls Co., Inc.,* died recently at Old Mill Lodge, Medix Run, Pa. He was 50 years old.

He and his brother organized the firm, which manufactures antenna rotators, in 1945. He served as president until 1950 when ill health forced him to turn the presidency over to his son, James F.

-30-

RTMA CO-SPONSORS TV TRAINING COURSE

THE Radio-Television Manufacturers Association will make available, through its Service Committee, a syllabus and companion teaching aids for the training of radio and television service technicians. These courses are designed for both the beginner and the practicing service technician who desires to improve his background in business practices and obtain experience in the latest servicing techniques.

A pilot course, sponsored by RTMA, is now being given at the George Westinghouse Vocational High School in New York City. At present, the course has an enrollment of sixty high-school age students who have signified their intention of entering the servicing field. Two laboratories are being prepared with test equipment and training aids furnished by RTMA. When the labs are completed, it is planned to use them in the evenings for courses held for practicing service technicians.

The RTMA is desirous of extending such aid to service technicians all over the country. Any service organization interested in sponsoring such a course of training in its locality should contact the Service Coordinator, Radio-Television Manufacturers Association, 777 Fourteenth Street, N.W., Washington 5, D.C.

-30-

Radio Control
(*Continued from page* 38)

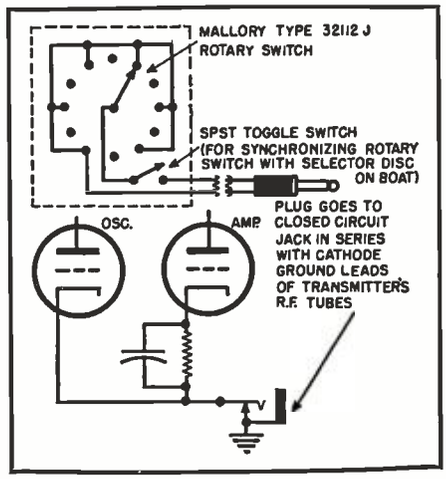
lengths of 1/16" by 3" balsa wood, and then fastened together with radio service cement (see Fig. 3). It is absolutely necessary that balsa be used, otherwise the cabin will weigh too much and will make the boat top-heavy. Balsa may be purchased in strip form at almost any store selling model airplane supplies. It is easily worked, the only tool required being a sharp razor blade.

Both the hull and superstructure are finished with a good grade of white enamel. The deck, cabin roof, and pilot house roof are painted gray. Doors and windows may be drawn on heavy paper with India ink, cut out and then applied to the cabin with rubber cement. A hole in the roof allows the cabin to be slipped down over the smoke stack. The superstructure merely sits on the deck and may easily be removed for making receiver adjustments.

Since the motors used in the *"River King"* are very small, it is important that little power be wasted in friction. Make certain that all bearing surfaces are kept well oiled. The fingers and segments of the selector switch, as well as the points of the receiver relay must be kept very clean. Apply a little carbon tet to them at regular intervals. Steer clear of any kind of contact dope, though, because it will pick up dust and dirt, thus resulting in unreliable selector operation.

The Citizens Radio Service transmitter, designed as a companion for this receiver (Fig. 13), will operate either on the Citizens Service frequency or in the amateur band 26.960-27.230 mc., depending on the crystal used and your license privileges. If you are already lucky enough to be the owner of an 11-meter amateur mobile transmitter, you have little reason to build a whole new rig just for radio control purposes. All you have to do is connect a switch in

Fig. 10. Remote selector switch for use with an 11-meter amateur transmitter. A key or toggle switch may be used instead.



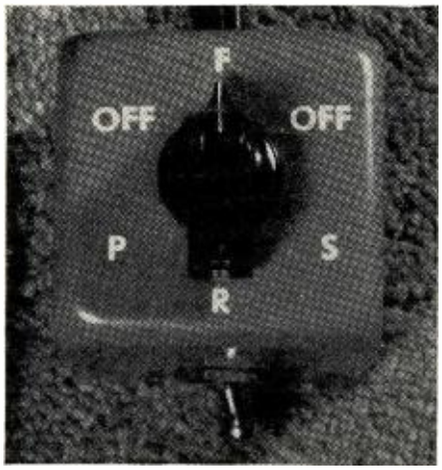


Fig. 11. The ham-rig switch of Fig. 10. It is turned counter clockwise to control the receiver selector switch on the boat.

series with the ground leads to the cathodes of the r.f. tubes as shown in Fig. 10. Although a telegraph key or toggle switch might be used, a rotary switch is superior, because it gives a visual indication of the various ship maneuvers. As long as the switch is not rotated too rapidly, and in a counter clockwise direction, the selector disc on the boat and the switch knob will stay in sync. Should the two get out of step for any reason, a toggle switch in series with the rotary switch may be opened and the knob set to the position corresponding to the maneuver being performed by the boat. Such a switch is shown in the remote-control switch box, Figs. 10 and 11. It is not included in the self-powered Citizens Band transmitter, because the transmitter can be turned off to reset the selector switch and turned right on again, as the 3V4's require no warm-up time.

One precaution must be observed when adapting a mobile rig to radio control. Be sure to key both the oscillator and the final. Otherwise there is a possibility that some r.f. energy will be radiated, even though the final is off. The superregenerative receiver is very sensitive and the slightest amount of r.f. leakage from the transmitter will keep the relay from operating properly.

In those cases where no amateur mobile rig is available, it will be necessary to construct a special radio control transmitter. For greatest convenience and portability, dry battery operation is a "must." Since no great distances are to be covered, only small power output is required. At first thought it might appear that a one tube crystal oscillator would perform the job satisfactorily. However, there seems to be no easy way to obtain adequate power from any of the common 1.4-volt filament tubes when used as oscillators with 11-meter overtone crystals. Even the simplest transmitter for 27 mc. appears to require a minimum of two tubes.

The first circuit I tried employed a crystal near 6800 kc., doubled in the oscillator and also doubled in the final.

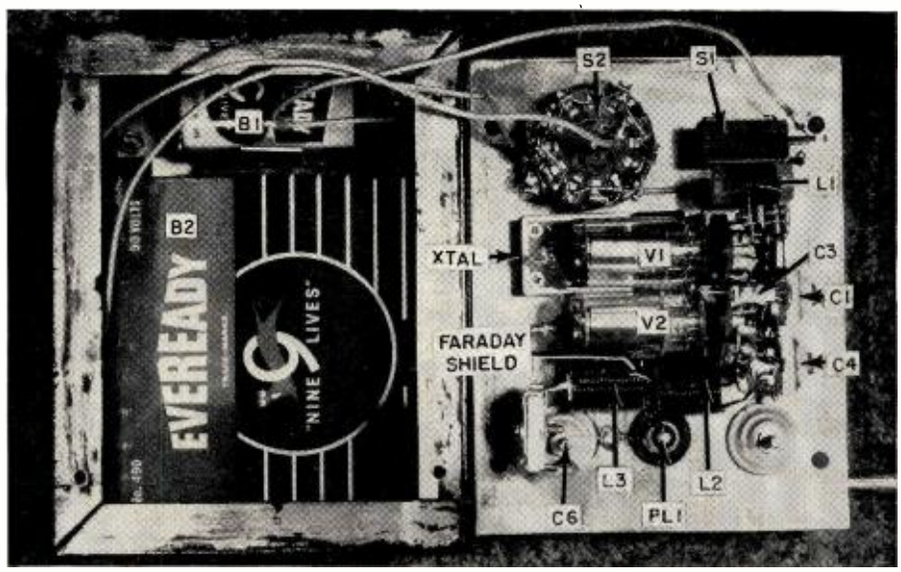


Fig. 12. All transmitter parts are mounted on one cover of a 3"x4"x5" utility box. The tube sockets mount on L-shaped brackets. Holes should be drilled in the case opposite C_1, C_4, and C_6 for adjustment after the cover is fastened to the box.

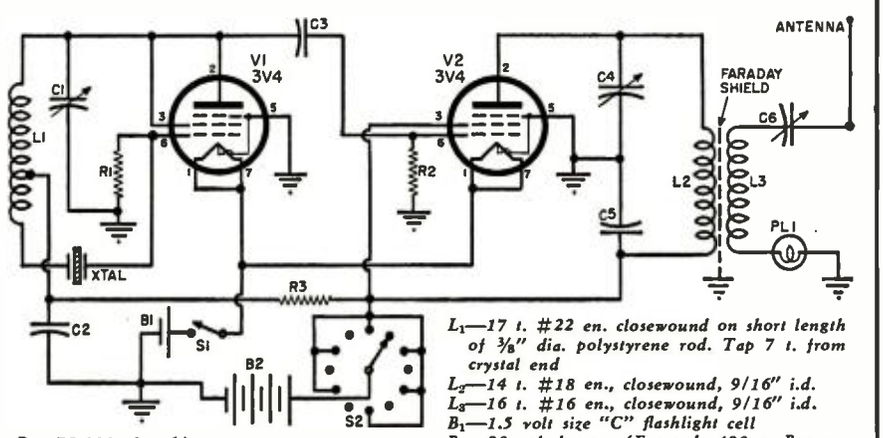
Usable output was obtained on 27 mc., and since a low frequency crystal is much cheaper than one of the overtone type, the circuit looked quite promising. That is, until a check with an all-wave receiver revealed that the transmitter's output in the vicinity of the twenty-meter amateur band was less than 30 db below the 27 mc. output. Consequently this particular circuit failed to meet the technical requirements for Class C Citizens Radio Stations, which state that spurious emissions must be at least 40 db down.

The transmitter finally evolved is diagrammed in Fig. 13. It uses a 3V4 as a 27 mc. overtone crystal oscillator and a 3V4 amplifier. Checks show that when the 27 mc. signal is 30 db over S9, the 54 mc. output is so low that it fails to move the needle of an SX-71 receiver's "S" meter, thus easily meeting the FCC's requirements. There are two main factors which hold the harmonic output to such a low level. The amplifier is operated with only a little more than "Class A" bias, and a Faraday shield (Fig. 9D) reduces capacity coupling between the final tank and the antenna coil.

All transmitter parts are mounted on the front cover of a 3" by 4" by 5" metal utility box, as shown in Fig. 12. Paint should be scraped from the inside of the covers and from the edges of the box so that good electrical contact will be maintained.

The crystal fits into a miniature

Fig. 13. Schematic of the Citizens Band transmitter. Switch S_2 turns the carrier on and off. The receiver selector switch moves one position each time a carrier signal is received. If the transmitter and receiver switches fall out of step, the transmitter can be turned off and S_2 reset to the boat's present maneuver.



R_1—75,000 ohm, 1/4 w. res.
R_2—50,000 ohm, 1/4 w. res.
R_3—1000 ohm, 1/4 w. res.
C_1, C_4—1-10 μμfd. mica trimmer
C_2, C_5—.005 μfd. disc ceramic cond.
C_3—50 μμfd. tubular ceramic cond.
C_6—9-180 μμfd. mica trimmer
S_1—S.p.s.t. toggle switch
S_2—S.p. 12-pos. rotary switch (Mallory 32112J)
L_1—17 t. #22 en. closewound on short length of 3/8" dia. polystyrene rod. Tap 7 t. from crystal end
L_2—14 t. #18 en., closewound, 9/16" i.d.
L_3—16 t. #16 en., closewound, 9/16" i.d.
B_1—1.5 volt size "C" flashlight cell
B_2—90 volt battery (Eveready 490 or Burgess N60)
PL_1—No. 48, 60 ma. pilot bulb
Xtal.—27.255 mc. crystal (Valpey Type CM-5)
Faraday Shield—See text and Fig. 9D
Antenna—Replacement antenna rod (ICA Type 4545)
V_1, V_2—3V4 tube

socket made by sawing in half the dual crystal socket from a BC-746A tuning unit. Of course, any small FT-243-type socket may be used, such as the *Cinch-Jones* #2 KM. unit. The tube sockets are fastened to the panel with small L-shaped brackets.

A pilot bulb in series with the antenna coil gives an indication of output current. It is merely pressed into a rubber grommet in the front panel. No socket is employed, leads being soldered directly to the base of the bulb. The oscillator and amplifier trimmer condensers are soldered to the panel. Two ceramic feedthrough insulators support the 36" telescoping antenna, as shown in Fig. 2, the bottom insulator being used to feed the transmitter's output *via* C_6.

An *Eveready* 490 or *Burgess* N60 "B" battery will fit into the box and still leave room for a single small flashlight cell to supply filament power. Regular snap-on connectors are used with the "B" battery while a clip-type holder constructed from pieces of aluminum makes for easy "A" battery replacement. The self-tapping screws supplied with the 3" by 4" by 5" box should be removed from the back cover. Replace them with short 6-32 machine screws and nuts. Otherwise, the sharp points of the self tapping screws may work their way into the "B" battery and ruin it. A square of corrugated cardboard used as a buffer between the rear of the transmitter and the batteries will keep the latter from flopping around inside the box. Despite its small size, the life of the "B" battery should be quite long because it furnishes current only when a command is transmitted.

Adjustment of the transmitter is very simple. If you are a ham and plan to employ the 11-meter amateur band, you can make use of the simple instructions which follow. On the other hand, if you expect to operate the transmitter as a "Class C" Citizens Radio Station, the adjustments will have to be made by someone holding a commercial operator's license.

Preliminary tests are made with the front cover removed from the box so a temporary jumper should be run from the cover to the box in order to complete the filament circuit. A milliammeter is then hooked in series with the "B-plus" lead going to the tap switch. Turn on the filaments, make sure the tap switch is on a live spot and note the plate current. If it exceeds 25 ma., the chances are that the crystal is not oscillating. Adjust C_1 until a point is reached where the current drops sharply, denoting crystal oscillation. C_4 should be tuned from minimum to maximum capacity. Somewhere in this range, the milliammeter will show a small dip, probably not more than a mil or so. Set C_4 at this point of minimum current.

Pull the antenna out to its full length and tune C_6 for maximum brilliance of the pilot bulb. When the transmitter is operating correctly, total plate current will be in the

neighborhood of 20 ma. and the bulb should glow brightly. Attach the cover and, through holes drilled in the case, readjust C_4 and C_6 to maximum bulb brightness. C_1 should then be tightened as much as possible. However, if it is set too tightly, the crystal will oscillate erratically, on the wrong frequency, or it may not start at all as the tap switch is rotated. Choose a setting where the bulb lights just as soon as the tap switch hits a live contact.

Finally, the carrier frequency must be checked. If the unit is to work in the 11-meter amateur band all one has to do is make sure that the output appears somewhere in that band. When the transmitter operates as a "Class C" Citizens Station, however, a very critical frequency check must be made. The FCC requires that the carrier be within .04% of 27.255 mc. According to my slide rule, this is a deviation of not more than 10.9 kc. Actually, the transmitter should be much closer to the assigned frequency in order to allow for temperature variations, etc. which can crop up in normal use.

Although no operator's license is required for Citizens Band equipment, a Citizens Radio Station license must be obtained by completing FCC Form 505 and mailing it to the nearest Commission field office. Before filing Form 505, it will pay you to read carefully Part 19 of the Commission's "Rules Governing the Citizens Radio Service." You can obtain it from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for ten cents in coin.

I've had a great deal of pleasure from the *"River King."* If you decide to build and operate a similar model, you, too, can look forward to many hours of fun. And don't overlook the fact that a Citizens Station may be operated by anyone, provided he has permission from the licensee. Youngsters, especially, get a kick out of putting the boat through its paces. Maybe you can go in partnership with your son or younger brother—he to build the boat, you to wire the radio equipment. No matter how you go about it, try a radio-controlled model. I know you'll find the effort worthwhile.

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H.V. Supply for CRO

(*Continued from page* 67)

age may be employed, with a resulting savings in cost. On the other hand, if higher accelerating voltages are to be used, correspondingly higher voltage condensers should be installed.

Installation and Adjustment

Once the wiring is finished and the r.f. high-voltage supply tested, it may be installed in the CRO and adjusted for optimum operation.

Sometimes the builder will find that the accelerating potential obtained is much lower than expected. In most cases, it will be found that the high-voltage supply voltage divider (*"Intensity Control," R_4, R_5, "Focus Control,"* and R_6 in Fig. 4) offer too much of a load for the high-impedance supply. This difficulty may be easily overcome by changing each resistor and control in the divider circuit, substituting one with exactly twice or three times the original resistance value. Be careful that you follow the same ratio throughout, however, so that the same voltage division will take place as previously as far as ratios are concerned. In this manner, the load on the high-voltage supply may be reduced without changing the ratio of the various voltages applied to the electrodes of the CRT.

The tuning condenser (C_2 in Fig. 2) may be adjusted for *near maximum* output by watching spot or line brightness. Do not set this condenser for maximum output voltage, however, as a certain degree of instability may result with this setting.

Whether the experimenter wishes to modify an existing scope to reduce 60-cycle intensity modulation, to increase spot brightness, and to improve focus, or to build a new scope without purchasing a special scope transformer, the r.f.-type high-voltage supply offers an ideal solution. The supply may be easily assembled using readily available and inexpensive parts and is much safer to work with than the more conventional 60-cycle type of supply.

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". . . complete with chimney—just what you need."

String-Belt Turntables

(*Continued from page 69*)

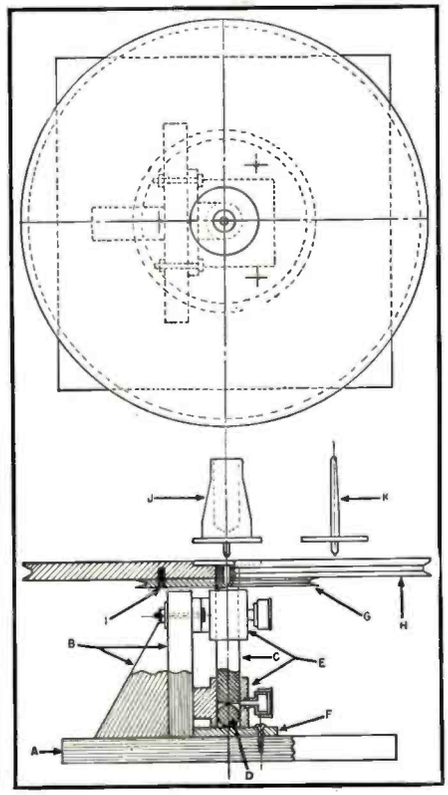
turntable. Fig. 5 shows how it is used. The record is threaded onto it and the peg, held by the long upper end, is dropped into the center hole. It need not be released until safely seated. The record is taken off again by simply seizing the peg and lifting, and it spins harmlessly to a stop on the peg. This is much easier and safer than catching the moving record by the edges. Actually, it is possible to handle the records without fingerprinting them at all. A different peg is of course used for 45 rpm records.

Fig. 4 is a design for a two-step motor pulley in accordance with Table 3. This is the motor pulley used in Fig. 1. It may be turned from one piece or assembled from two or three.

Fig. 6 indicates in cross section a suggested design requiring less material and less lathe work than the unit shown in Fig. 2, which was built in 1940 when steel was cheap and the author had access to a lathe. Lettered parts in Fig. 6 are as follows:

A. Base, hardwood
B. Bracket and base, hardwood
C. Shaft, ⅝" or ¾" steel. Requires no turning if accurate
D. Ball, hard steel, same diameter as shaft
E. Babbitted pillow blocks with grease cups, inexpensive but scraped and run-in to good fit if necessary. 2 required
F. Bottom plate, ⅛" steel
G. Auxiliary drive pulley, ¼" steel.

Fig. 6. Design details of an "economy" version of the string-belt turntable unit. See text for identification of lettered parts.



Groove bottom diameter 5.00", o.d. 5½"

H. Main plate, ½" steel. Groove bottom diameter 11.75", o.d. 12.25"

I. Pin, steel. 3 required. Press fit in parts G and H

J. Peg for 45 rpm records. Solid if aluminum or dural; otherwise bored out to lighten. Tip is accurate slip fit in hole in part C and shoulder fits flush into part H. The shoulder gives a firmer seat than the short bearing of part K in Fig. 2

K. Peg for 33⅓ and 78 rpm records. Fits like part J

Notes: (*a*). Hot-rolled machine steel is recommended for the plate, part H. Cold-rolled steel, though cheaper, may have strains that will cause belated warping. Drill rod is best for the shaft because the ball will not sink into it, but might be difficult to drill for the top center hole. (*b*). The butt of the shaft is faced off square and has no center hole. For taking the final facing cut from the plate and turning the groove in it, the butt of the shaft should be held in a collett and the top supported by the tailstock center. Part G should also have its groove turned at this time but this may not be possible without a special tool to get at it. Parts G and H are reamed or bored to a press fit on part C after pinning them together. Before they are mounted on part C, they can be held to the face plate of the lathe by bolts through holes such as those seen in Fig. 3.

A professional machinist may have better ways of doing some of these operations, but the procedure suggested will result in an accurate job.

It will be noted that the cushioned separate upper plate has been abandoned in the interest of economy, in Fig. 6 as compared with Fig. 2. In 12 years the sponge rubber has perished so that it no longer cushions much, yet there is no noise as long as noise is kept from the pedestal; hence it is considered unnecessary. The plain bearings of Fig. 6 should be quieter than ball bearings. Further economy could be effected by giving up the special pegs and using a plain one integral with the shaft. Instead of the thick plate, a thin one with a thick rim could be used to provide the same moment of inertia with less weight; but this would require more machining unless cast. An auto flywheel from a junkyard might be used with a thin plate on top of it. This is not so fantastic as it sounds: the late Daniel Hilferty, formerly a recording engineer with *RCA-Victor,* told the author how that company once bought a *manhole cover* from the city of Camden and machined it into a turntable!

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1. *Graumont and Hensel: "Encyclopaedia of Knots and Fancy Rope Work," Cornell Maritime Press, New York, 1945.*
2. *Ashley, Clifford W.: "The Ashley Book of Knots," Doubleday, 1945.*

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MANUFACTURERS' LITERATURE

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

JFD CATALOGUE

JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y. has issued a 36-page, 3-color television antenna and accessory catalogue, No. 450.

This elaborate publication lists hundreds of items needed by the television installation technician, ranging all the way from complete antenna units to stand-offs, insulators, and other small but important accessories.

TV REPLACEMENTS

Sprague Products Co., 51 Marshall St., North Adams, Mass. is now offering copies of a new 44-page 5th edition of its "TV Replacement Capacitor Manual."

The new publication lists accurate, up-to-the-minute condenser replacements for a total of 2460 receiver models made by 78 manufacturers.

Copies are available free from all *Sprague* distributors or by sending 10 cents, to covering handling and postage, to the company direct.

ANTENNA "HANDI-GUIDE"

A 76-page book which catalogues radio and television antenna systems, antennas, and accessories is now being offered free of charge by *United Catalog Publishers, Inc.,* 110 Lafayette St., New York 13.

The "Handi-Guide" contains data on all types of antenna equipment with detailed specifications, illustrations, descriptions, and prices included. It covers the products of 32 leading manufacturers and includes FM, AM, and u.h.f. antennas, TV towers, masts, TV boosters, auto antennas, insulators, wire, mounting hardware, etc.

ANTENNA FILM

Channel Master Corp., Ellenville, N. Y. is currently using its 45-minute sound-and-color film, "The Antenna is the Payoff," to present pertinent data on antenna installations.

The movie covers basic antenna facts not heretofore available to technicians. The major part of the film is devoted to a presentation of the three standards of antenna performance: gain, directivity, and impedance.

Those interested in arranging showings of this film should contact Harold Harris, vice-president in charge of sales and engineering for the company.

FREE INDEX

Supreme Publications, 3727 W. 13th St., Chicago 23 is offering a copy of the newly-published 1952 edition of its "Index" to readers of this magazine if a 3 cent postage stamp accompanies the request.

The index cross references all of the publisher's radio and TV service manuals by make and model number. At the present time there are twelve radio manuals and six TV manuals. The index normally sells for 25 cents a copy.

NEWARK CATALOGUE

Newark Electric Co., 223 W. Madison St., Chicago has published a 196-page catalogue which lists thousands of items for industry, labs, high-fidelity, radio, and television.

Whole sections of Catalogue No. 55 are devoted to test gear, industrial equipment and supplies, hi-fi systems and components, TV chassis, accessories, and antennas, ham equipment, etc. Copies of the new publication are available on request.

NEW "RADIO'S MASTER"

United Catalog Publishers, Inc., 110 Lafayette St., NYC 13 has announced publication of a new edition of its completely cross-indexed, fully-illustrated buying guide and reference book.

The new "Radio's Master" contains 80,000 items of current electronic products bound in a hard-covered, permanent edition containing 1220 pages. The buying guide is available through local electronic parts distributors or from the publisher.

REPLACEMENT MANUAL

Ram Electronics Sales Co., Irvington-on-Hudson, N. Y. has published a newly-revised edition of its "TV Replacement Manual."

The 1953 edition contains over 6200 listings—complete with manufacturer's name, chassis numbers, model numbers, and corresponding *Ram* part numbers. The listings are also cross-indexed with *Rider* Manual and "Tek-File" references.

This 32-page manual is available from the company direct or from parts distributors. It sells for $1.00 a copy.

ANTENNA DATA

Snyder Mfg. Co., Philadelphia 40, Pa. has brought out a new and revised edition of its handy, pocket-sized book "T-V 'Tenna-Tips."

The new edition carries information on u.h.f. antennas, fundamental antenna types, yagi antennas, the company's indoor "Directronic" TV antenna system, antenna installation "do's and don't's," antenna dimension guide, channel frequencies, helpful hints, and proper feed methods for stacked arrays.

Although listed at $1.00 a copy, the new book may be obtained without charge by writing direct to Dick Morris at the company address.

CLAROSTAT CATALOGUE

A wide choice of resistors, controls, and resistance devices is included in Catalogue 52 recently issued by *Clarostat Mfg. Co., Inc.,* Dover, N. H.

The catalogue features expanded listings of carbon and wirewound controls, aircraft-type metal-cased power rheostats, miniaturized carbon and wirewound controls, and outdoor-theater L-pads.

Copies are available either from the company direct or from the company's distributors.

TEST EQUIPMENT

Radio City Products Co., 152 W. 25th St., NYC 1, has issued a new 8-page catalogue covering its line of radio and television test equipment.

The new publication describes and illustrates oscilloscopes, tube testers, multi-testers, signal generators, v.t.v.m.'s, in addition to a variety of accessories to be used with these instruments.

Copies of Catalogue No. 135 are available without charge.

TIMING RELAYS

Allen-Bradley Co. of Milwaukee, Wis. is offering a 16-page bulletin featuring its complete line of timing relays.

Fluid dashpot, pneumatic, and electronic timers are fully described. It also contains complete operation and engineering data. Timers are shown in a wide variety of standard enclosures. A selector chart is also included.

MASTER TV SYSTEMS

Blonder-Tongue Laboratories, Inc., 526 North Ave., Westfield, N. J. has issued a new installation manual giving complete technical data on all types of master TV systems.

Entitled "The *B-T* Unit System for Better Television," the new manual describes the characteristics and functions of each *B-T* unit and accessory.

TRANSFORMER DATA

Microtran Co., 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y. has released a new, expanded catalogue covering transistor and standard type transformers. Copies will be forwarded upon request.

CONDENSER DATA

Aerovox Corp., New Bedford, Mass. is now offering copies of its bulletin "Miniature Metal-Cased Capacitors" to interested persons.

The publication contains standard listings, specifications, drawings, how-to-order, and other pertinent data on the company's line of foil-paper condensers which are housed in compact tubular metal cases with vitreous ceramic terminal end seals. —30—

Technical BOOKS

"UHF PRACTICES AND PRINCIPLES" by Allan Lytel. Published by *John F. Rider Publisher, Inc.,* New York. 380 pages. Price $6.60.

This is a basic text designed especially for the student or technician who has a working knowledge of standard broadcast receivers.

The author's style is lucid and concise and those encountering u.h.f. theory for the first time should have little trouble grasping the subject matter as presented in this text.

The book itself is divided into eleven chapters. The author introduces the subject matter and makes pertinent comparisons between the ultra-high frequencies and those with which the reader is more familiar, *i.e.,* the broadcast frequencies. He then discusses those features of u.h.f. which differ from the broadcast frequencies, then goes on to cover the electromagnetic radio wave, receiving antennas, transmission lines and wave guides, new types of tuned circuits, oscillator tubes and circuits, receivers and converters, transmitters, developmental vacuum tubes, and test equipment and techniques for u.h.f.

A comprehensive bibliography has been included for the reader who wishes additional information on any phase of the subject.

The text material has been lavishly supplemented with photographs of u.h.f. equipment and circuit diagrams illustrating the various points. Mathematics is held to a minimum and what is included is confined to arithmetical operations. This book is entirely suitable for self-instruction or home-study work.

* * *

"RADIO OPERATING QUESTIONS AND ANSWERS" by J. L. Hornung & A. A. McKenzie. Published by *McGraw-Hill Book Company, Inc.,* New York. 539 pages. Price $6.00. Eleventh Edition.

In this, the eleventh, edition of a well-known reference work, the authors have completely revised the material to include answers to all questions suggested for study in the FCC Study Guide of 1951 and have added questions on the newer Element VII (aircraft radiotelegraph) and Element VIII (ship radar techniques).

A chart in the front of the book indicates which elements are included in the various classes of licenses and then the pages covering the elements in question are given. In this way the student working on his, say, radiotelephone first license, would cover elements 1, 2, 3, and 4, etc.

The circuit diagrams and photographs used to illustrate the text have been brought up-to-date. A series of appendices contain a wealth of valuable material in tabular or concise form for ready reference.

Any prospective license holder or

radioman who is planning to up his license grade would do well to work with this text for a complete and comprehensive picture of his exam requirements.

* * *

"PHOTOELECTRIC TUBES" by A. Sommer. Distributed by *John Wiley & Sons, Inc.,* New York. 115 pages. Price $1.90.

This compact little volume wastes no words in tackling the problems involved in the application of photoelectric tubes to various devices.

The first two chapters are devoted to a survey of the principles of photoelectric emission and a brief historical sketch of the work done in the field.

Following this introductory material, the author provides a detailed description of the manufacture and characteristics of photocathodes, devotes three chapters to vacuum, gas filled, and multiplier photocells and their relative advantages and limitations, and then covers applications of photoelectric cells, or tubes.

The text material is accompanied by line drawings and graphs which help to clarify the subject matter. Formulas are used throughout the text but the non-mathematical reader should be able to obtain considerable benefit from this book without knowing the steps by which the formulas are derived.

* * *

"ELECTRONICS EVERYWHERE" by Prof. A. M. Low. Published by *The John Day Company, Inc.,* New York. 188 pages. Price $2.50.

This is a non-technical treatment of a subject about which today's layman is not only vitally concerned but openly curious.

In a thoroughly lucid style the author discusses the fundamental concept of electronics, electronic tubes in radio and television, electronic "feeling" devices (radar, sonar, etc.), electronic controls, fluorescent lighting, electronic heating, electronic music, etc.

Throughout the text the author has dealt with his subject matter in terms and analogies familiar to the reader. This would be an excellent book for the high school student or any adult whose knowledge of electronics is thus-far limited to switching on his television set. A thoroughly readable contribution to elementary literature in the field.

* * *

"SIM BARTON, GIRL RADIO OPERATOR" by Helen H. Cloutier. Published by *Pageant Press,* New York. 171 Pages. Price $2.50.

W8GJX, who has been a ham for over twenty-three years, has drawn freely on her operating experiences to write this novel of a girl radio operator.

Sim Barton, who holds a First Class ticket, has to meet and overcome the opposition of Great Lakes shipping firms, ship captains, and crewmen to a woman aboard ship. By sheer "stick-to-itiveness" Sim manages to land a job on a Lake freighter, first as a "va-

cation operator" and then as regular Second Radio Officer.

She forces her male co-workers to admit her competence but finally retires from the field to act as full-time "first mate" for Captain Bill Smith.

The story moves along rapidly with career tips neatly woven into the plot. Mrs. Cloutier has made a subtle plea for more radio opportunities for women but whether or not her cry will be heard in the wilderness remains to be seen. The book is a good yarn whether or not it opens the employment rolls to lady ops.

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Spot Radio News

(*Continued from page* 18)

During the past few months, all of the 50-kilowatt broadcasters have been cooperating in a series of tests, involving round-the-clock skywave programming, not only to familiarize themselves with system operation, but to aid the Civil Defense Administration and the Air Defense Command of the USAF.

Although it is not mandatory for stations to join the plan and stay on the air, over 1000 have signified that they would particiate and have spent over one and a half-million dollars of their own funds to make the necessary equipment adjustments.

This unusual deception technique, based in part on a similar plan used successfully in Great Britain during the last war, will eventually involve an outlay of a half-million dollars for line interconnections for programming purposes.

TVI, which a year ago was a wrangling problem harassing amateurs, service technicians, distributors, and others, has now reached a stage featuring exemplary coordinated cooperation among about 200 community committees. In a report on this striking progress, the FCC has revealed that the results have been due to TVI combat committees established in the Central State region (30 committees); Great Lakes (26 committees); Gulf States (18 committees); North and South Atlantic (48 committees); North and South Pacific (52 committees) and Alaska and Hawaii (3 groups). In addition, 30 committees have been proposed.

Amateurs have been particularly active, with two basic cooperating types in operation. Where there are a number of amateur clubs in a metropolitan area, the usual approach has been to pool individual resources into one unified amateur committee. In more isolated areas, individual amateur clubs have provided their own committees on a purely local basis.

Describing the success of the plan, the Commission reports that TVI search activity has decreased the workload of metropolitan interference complaints to the extent that survey time can now be given to cases in rural areas. In general, this assistance has been found to permit the Commission's field offices to handle more investigations relating to unauthorized operation, and interference to radio services other than broadcast from non-TV and non-amateur sources.

Some rather odd complaints and methods used to track down interference are described in the report. One committee was asked to investigate an interference condition whereby a local TV channel was affected by an ". . . awful squealing noise" every Friday night during the telecasting of wrestling matches. It developed that on these particular nights, an elderly uncle regularly visited the family reporting the interference to watch the wrestling programs. Investigation further pinned down the interference to weak batteries in a hearing aid used by the uncle, resulting in an oscillating condition within the TV receiver.

Of all the accomplishments of the TVI committees, the one that stands out prominently is its demonstration of the fact that TV viewers and ham enthusiasts can live in the same neighborhood without interfering with each other's enjoyment. Some TV set owners have become so interested in amateur operation, the report discloses, that they have taken advantage of the private-message handling services of ham stations, and others have even joined the amateur fraternity.

Actually, the report reveals, the FCC and its predecessor agencies helped to organize groups outside their own ranks to deal with aural broadcast interference problems long before the advent of TV. The so-called *Chicago Plan* was developed in 1920 by a group of Chicago hams, called together by a local radio supervisor of the Radio Division of the Department of Commerce. A similar plan was later put into effect in Boston.

THE GRAND JOB AMATEURS have done and are doing was further extolled by none other than FCC Commissioner George Sterling, during a talk before the N. Y. Radio Club in the auditorium of the American Red Cross recently.

Scarcely a day goes by, he said, but what an . . . "amateur station . . . somewhere in the country is brought into service to render communication to the public, where it is due to an earthquake, flood, snowstorm, an accident, or because of a death or sickness in the family."

Noting that this is no news to the hams, but it is to the average citizen, the Commissioner stated that . . . "the service amateurs render to the nation, whether it be in time of peace, emergency, or war, must be constantly kept before the public eye, so that if the time comes when . . . the privileges of the amateurs . . . are threatened . . . they can have the voice of the people back them up in the fight with those who seek to take away . . . the

privileges and frequencies . . . of amateurs."

The ability of the hams (of which there are over 117,000 today) to serve in all kinds of emergencies has been one of the important factors which has helped this country retain international frequency allocations for them. They should therefore be on the alert, the Commissioner stressed, to resist any attempts to bypass them, as some branches of the military have attempted recently. He warned that the tendency to consider the use of the facilities of CAP as a civil defense communications service and to contemplate establishing a permanent civil defense communication system, perhaps on amateur bands when considered with a recent development in the MARS system, wherein a marriage of MARS and FCDA for civil defense communications is proposed, led him to believe that perhaps a pattern is developing which could finally result in bypassing the amateurs, with respect to their participation in disasters or civil defense. A very serious constitutional question is raised, the Commissioner declared, when in a democracy like ours, a military organization proposes to engage in a civilian activity such as rendering a civil defense communication service. Amateurs must begin defending themselves against this dangerous and deplorable action, the FCC expert added.

This is a big job, he said, but the amateur has done big jobs before, and given the will to accomplish the purpose, one has no doubt of the results in the future.

Hams and radio fans, too, will be forever grateful for that bold pledge of constant support . . . . . L.W.

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ERRATA

In the circuit diagram appearing on page 59 of the January 1953 issue ("Modernizing the SCR-274N Transmitter) the plate and grid of the 1626 oscillator are connected together. This connection should be omitted. C_2 is a Johnson 70F30 not 70F20 as stated.

* * *

The diagram accompanying the item "The Backtracker" (page 145 of the January 1953 issue) shows the filament winding on the heater transformer to be 6.3 volts. The value should have been shown as 2.5 volts for the 56 tube used in this circuit.

* * *

In Fig. 3, page 64 ("A Low-Cost Audio Oscillator") of the January issue, the positions of R_3 and R_4 should be interchanged and the common terminal for C_5, C_6, C_7, and C_8 should be grounded.

INDEX OF Advertisers

MAR. 1953

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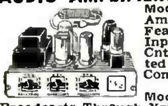

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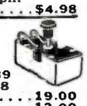

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2	.65
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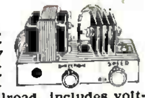

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6BC7	1.23
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6BQ7	1.65
6BY5G	1.45
6C21	29.45
6CB6	.69
6CD6G	1.69
6D4	2.70
C6J/5C21	6.95
6J4	6.66
6J5GT	.47
6J6	.63
6K4A	6.45
6L6	2.09
6L6G	1.35
6L6GA	1.35
6L6GAY	2.29
6SA7GT	.63
6SA7GTY	3.37
6SB7Y	1.19
6SC7	.90

Tube	Price
6SD7GT	.80
6SF5	.77
6SF7	.73
6SG7	.72
6SH7	.61
6SJ7	.70
6SK7GT	.69
6SL7GT	.69
6SN7GT	.70
6SN7WGT	2.25
6SQ7GT	.63
6SR7	.65
6SS7	.75
6ST7	.98
6SU7GTY	2.69
6V6	1.39
6V6GT	.57
6W4GT	.57
12AH7GT	1.45
12AK5	1.98
12AK5W	2.98
12AL5	.75
12AT6	.52
12AT7	.81
12AU6	.72
12AU7	.63
12AV6	.49
12AV7	.98
12AW6	1.79
12AX4GT	1.20
12AX7	.79
12AY7	2.95
12AZ7	1.49
12BA6	.59
12BA7	.79
12BD6	1.23
12BE6	.59
12BF6	.85
12BH7	1.29
12BY7	1.35
12BZ7	1.25
12SA7GT	.69
12SC7	.80
12SF5GT	.72
12SF7GT	.49
12SG7	.83
12SH7	.63
12SJ7GT	.59
12SK7	.72
12SL7GT	.65
12SN7GT	.75
12SQ7GT	.63
12SR7	.63
FG17	3.95
19T8	1.09
19V8	1.62
RK20A	8.95
24G/3C24	1.90
25BQ6GT	1.19
25L6GT	.69
25Z5	.79
25Z6GT	.99
FG27A	8.70
RK28A	4.89
28D7	1.95
FG32/5558	13.85
35Z5GT	.59
RK39	2.89
RK48	6.85
RK49	7.50
50L6GT	.69
RK61	3.05
80	.69
81	1.69
82	1.19
82V	1.39
83	1.45
83V	1.79
84/6Z4	.99
FG95/5560	24.85
FG98	19.95
100TH	7.83
FG104	37.98

Tube	Price
FG105	17.64
117L/M7GT	1.59
117N7GT	1.79
117P7GT	1.39
117Z6GT	1.19
117Z7GT	1.49
F123A	7.90
F127A	19.98
VT127A	3.90
CV148	4.98
FG166	49.00
FG172	29.00
250TH	22.25
250TL	17.75
304TH	8.90
304TL	8.90
388A	1.49
WL417A	8.95
417A/5842	18.50
GL434A	18.45
446A	1.05
446B	3.89
450TH	45.00
450TL	52.00
460/HF200	15.95
GL471A	2.69
CK501X	1.26
CK501AX	2.20
GL502A	1.79
CK502AX	1.49
CK503AX	1.49
CK505AX	1.79
CK506AX	1.49
RH507	9.98
CK509AX	1.79
CK512AX	1.45
CK522AX	1.29
CK525AX	1.29
CK526AX	1.49
CK528AX	1.49
CK529AX	1.79
GL530	22.00
CK531DX	1.89
531	6.98
CK532DX	1.89
WL532	3.98
CK533AX	1.29
CK534AX	.99
CK536AX	.99
CK537AX	3.04
CK538DX	.98
CK539DX	2.19
CK541DX	1.99
CK542DX	.99
CK543DX	.99
CK544DX	.99
CK546DX	1.99
CK547DX	1.98
CK571AX/5886	2.49
CK573AX/6029	3.49
WL579	10.49
WL579B	12.98
KU627	18.00
WL652	65.00
WL673	117.00
WL676	39.95
WL677	34.00
WL686	35.00
707A	7.90
707B	13.50
715A	6.00
715B	8.40
715C	19.80
717A	.90
718BY	48.45
718CY	48.45
719A	28.50
721A	2.49
722A/287	2.45
723A	11.95

Tube	Price
723A/B	25.00
724A	3.95
724B	3.45
725A	8.49
726A	14.25
726B	45.00
726C	52.00
801A	.45
803	3.89
805	3.90
807	4.65
808	2.59
809	2.43
810	9.95
811	2.90
812	2.70
813	12.49
814	2.75
815	2.98
816/866Jr.	1.07
826	.95
829	11.49
829B	12.45
832	7.65
832A	9.65
833A	39.45
834	5.95
836	4.75
837	1.45
849	29.45
860	4.90
861	23.95
865	1.29
866A	1.50
872A	3.29
CK1005	.85
CK1027	2.98
CK1028	15.98
5654	2.79
5670	5.30
CK5672	1.29
CK5678	1.89
5687	5.49
CK5702	3.49
CK5703	1.29
Xtal Diodes	
1N21A	$1.55
1N21B	2.89
1N21C	21.50
1N22	1.25
1N23	1.35
1N23A	2.20
1N23B	3.49
1N25	4.98
1N26	8.75
1N27	1.55
1N29	3.50
1N32	23.75
1N34	.64
IN34A	.90
1N35	1.65
1N38	1.43
1N39	4.15
1N40	10.49
1N43	1.73
1N44	1.24
1N45	1.45
1N46	.69
1N47	4.00
1N48	.55
1N51	.45
1N52	1.62
1N54	.89
1N55	2.35
1N56	.89
1N57	.89
1N58	1.19
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1N64	.69
1N67	1.95
1N69	1.19
K34	1.35

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840VCT/110MA, 530vct/21ma, 2x5V /3A, 6.3vct/1A. 6.3vct/.3A...... 4.98
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700VCT/120MA, 2x6.3V/3A. 6.3V/ 1A ....$3.98; 2 for 7.25
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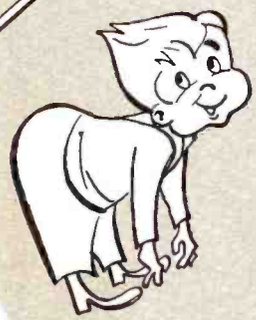

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