Television Sound Tuner for Your Car

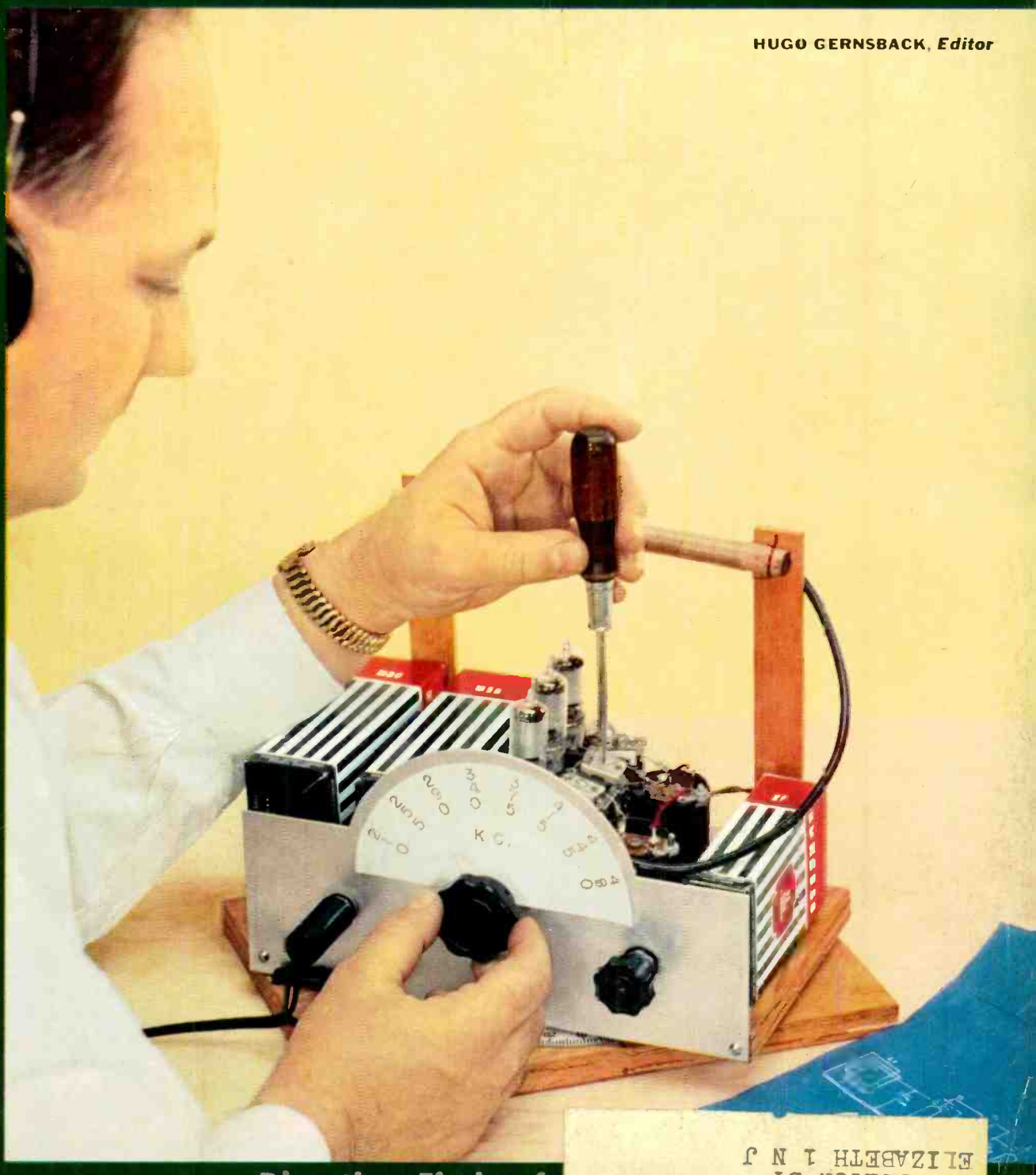
RADIO-ELECTRONICS

MAY 1955

TELEVISION • SERVICING • HIGH FIDELITY

HUGO GERNSBACK, *Editor*

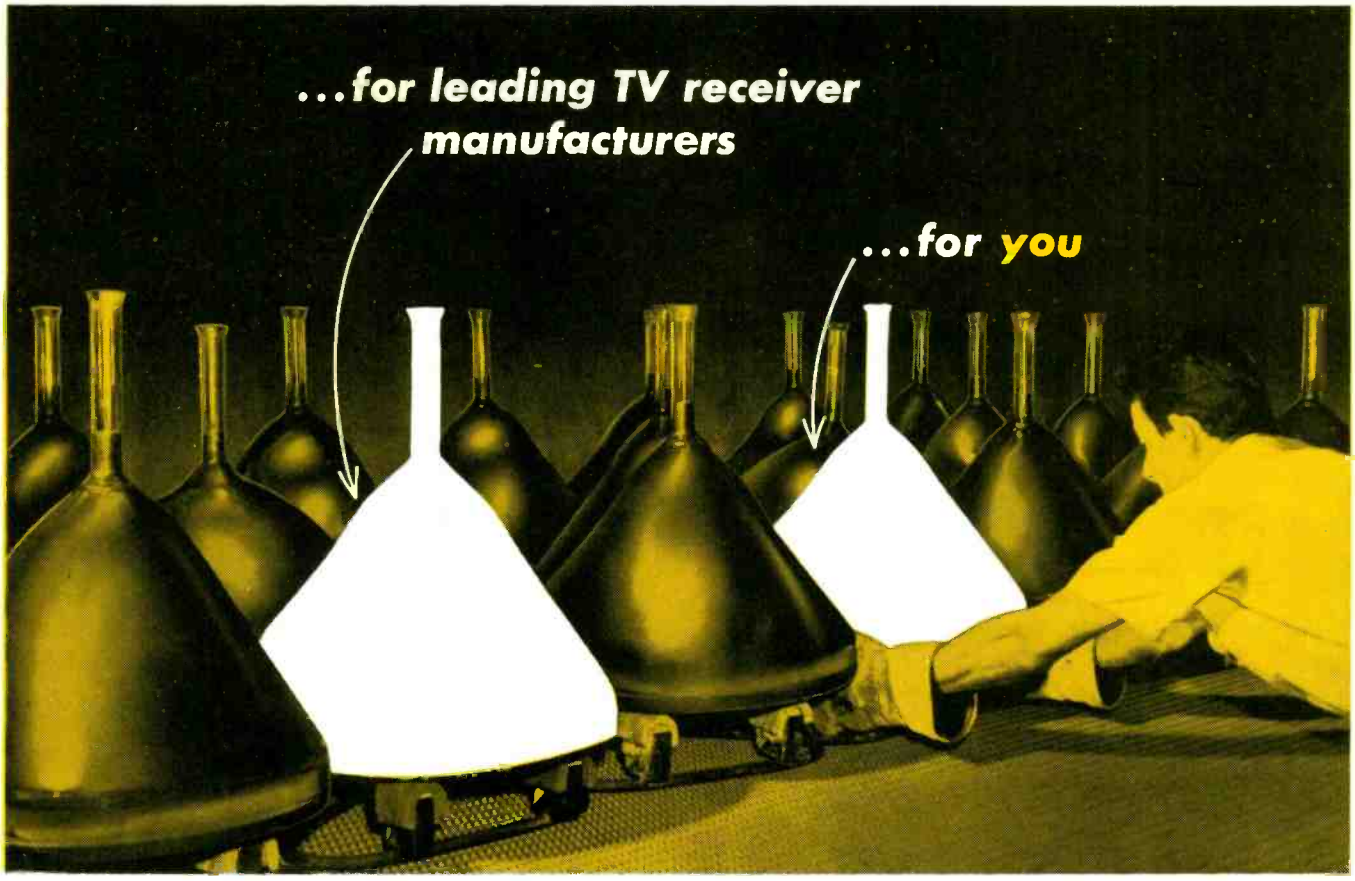
In this issue:



35¢
U. S. and CANADA

Direction Finder fo

(See page



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You take no chances with quality when you use Du Mont picture tubes. *Every* Du Mont picture tube is manufactured to the same exacting quality standards – whether it's for a leading television receiver manufacturer to be used as initial equipment, or for you to be used as a replacement.

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Look for the Initial Quality Picture Tube tag packed with every Du Mont picture tube. Use it to show your customers that you have provided the finest quality components with your service.

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Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I send to build many circuits common to Radio and Television. With my Servicing Course you build the modern Radio shown at left. You build a Multitester and use it to help make $10, $15 a week fixing sets in spare time while training. All equipment is yours to keep. Coupon below will bring book of important facts. It shows other equipment you build.

You Practice BROADCASTING with Kits I Send You

As part of my Communications Course I send you parts to build low-power Broadcasting Transmitter at left. Use it to get practical experience. You put this station "on the air" . . . perform procedures demanded of broadcasting station operators. An FCC Commercial Operator's License can be your ticket to a bright future. My Communications Course trains you to get your license. Mail coupon. Book shows other equipment you build for practical experience.

I Will Train You at Home in Spare Time to be a RADIO-TELEVISION Technician

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J. E. SMITH, President
National Radio Institute
Washington, D. C.

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N.R.I. Training Leads to Good Jobs Like These

I TRAINED THESE MEN

"I have progressed very rapidly. My present position is Studio Supervisor with KEDD Television, Wichita."—Elmer Frewaldt, 3026 Stadium, Wichita, Kans.

"Fix sets part time in my shop. Made about $500 first three months of the year. Could have more but this is about all I can handle."—Frank Borer, Lorain, Ohio.

"I've come a long way in Radio and Television since graduating. Have my own business on Main Street."—Joe Travers, Asbury Park, New Jersey.

"I didn't know a thing about Radio. Now have a good job as Studio Engineer at KMMJ."—Bill Delzell, Central City, Nebraska.

BROADCASTING: Chief Technician, Chief Operator, Power Monitor, Recording Operator, Remote Control Operator. SERVICING: Home and Auto Radios, Television Receivers, FM Radios, P.A. Systems. IN RADIO PLANTS: Design Assistant, Technician, Tester, Serviceman, Service Manager. SHIP AND HARBOR RADIO: Chief Operator, Radio-Telephone Operator. GOVERNMENT RADIO: Operator in Army, Navy, Marine Corps, Forestry Service Dispatcher, Airways Radio Operator. AVIATION RADIO: Transmitter Technician, Receiver Technician, Airport Transmitter Operator. TELEVISION: Pick-up Operator, Television Technician, Remote Control Operator.

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My training is practical, complete; is backed by 40 years of success training men at home. My well-illustrated lessons give you basic principles you need and my skillfully developed kits of parts "bring to life" things you learn from the lessons. I start sending you special booklets that show you how to fix sets the day you enroll. Multitester you build with my parts helps you discover and correct set troubles, helps you make money fixing neighbors' sets in spare time while training. Many make $10, $15 a week extra this way

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Act now to get more of the good things of life. I send actual lesson to prove NRI home training is practical, thorough. My 64-page book "How to be a Success in Radio-Television" shows what my graduates are doing and earning. It gives important facts about your opportunities in Radio-Television. Take NRI training for as little as $5 a month. Many graduates make more than the total cost of my training in two weeks. Mail coupon now to: J. E. SMITH, President, Dept. 5EF, National Radio Institute, Washington 9, D. C. Our 40th year.

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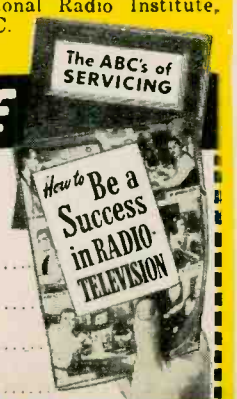

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ON THE COVER:

(Story on page 48) Mr. Robberson making some final adjustments on his portable marine direction finder, before putting it in its case.

Color original by Habershaw Studios, New York, N. Y.

MAY, 1955 **Vol. XXVI, No. 5**

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National Schools prepares you for your choice of many job opportunities. Thousands of home, portable, and auto radios are being sold daily—more than ever before. Television is sweeping the country, too. Co-axial cables are now bringing Television to more cities, towns, and farms every day! National Schools' *complete* training program qualifies you in all fields. Read this partial list of opportunities for trained technicians:

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the Radio month

TWELVE NEW STATIONS have gone on the air since our last report. These are:

WTVY	Dothan, Ala.	9
KFAR-TV	Fairbanks, Alaska	2
KTVF	Fairbanks, Alaska	11
KBET-TV	Sacramento, Calif.	10
WFLA-TV	Tampa, Fla.	8
WLEX-TV	Lexington, Ky.	18
WGBH-TV	Boston, Mass.	2
KEYD-TV	Minneapolis-St. Paul, Minn.	9
KRCG	Jefferson City, Mo.	13
KLRJ-TV	Henderson, Nev.	2
KLOR	Portland, Ore.	12
WDXI-TV	Jackson, Tenn.	7

Six stations have gone off the air:

WTRI	Schenectady, N. Y.	35
KMPT	Oklahoma City, Okla.	19
WKST-TV	New Castle, Pa.	45
WKNA-TV	Charleston, W. Va.	49
WJPB-TV	Fairmont, W. Va.	35
WCAN-TV	Milwaukee, Wis.	25

Canada's 25th station has gone on the air, CKX-TV, Brandon, Manitoba, channel 5.

The following stations have changed their call letters:

KFIA now KENI-TV, Anchorage, Alaska, channel 2; WDTV now KDKA-TV, Pittsburgh, Pa., channel 2; WAYS-TV now WQMC, Charlotte, N. C., channel 36; KFIF, now KFAR-TV, Fairbanks, Alaska, channel 2.

SYLVANIA NEWS, oldest publication of its type in the country, celebrated its 25th anniversary March 1. The first issue (March 1, 1930, shown with the 25th anniversary issue in the photo) had a circulation of 30,000, aimed primarily at Sylvania service dealers. Today the circulation is 130,000 and the paper is known to all service dealers and technicians, as well as to a multitude of distributors, colleges, and industrial and foreign accounts.

The present editor is C. J. Luten, who has held the position since 1951. Among his widely known predecessors have been Bob Penfield, who held the post from 1947 to 1951, and Mrs. Jean Devoe, one of the most renowned and talented women of Emporium, Pa., who was editor for 13 years—more than half the life of the paper.

ULTRASONIC WAVES keep honey from spoiling. Dr. S. A. Kaloyereas of Louisiana State University stated that crystallization, the first step in honey deterioration, can be prevented by using ultrasonic waves.

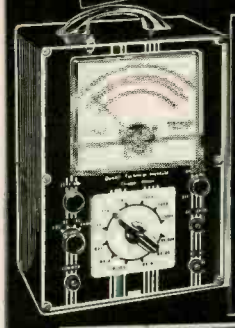
It was found that ultrasonically treated honey, stored from one to four weeks at temperatures ranging from 40° below zero F to 102° above, showed no signs of crystallizing. Untreated control samples showed signs of spoiling. In addition to keeping honey fresh, ultrasonic waves also improve its taste, giving it a slightly tart flavor.

(*Continued on page* 10)

Use and keep ALL these units to get all-important PRACTICAL EXPERIENCE

NOW... at home... get D.T.I.'s amazingly effective *NEW* training in

TELEVISION



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ABOVE: Also build and keep this quality Oscillescope—almost a "must" for Television servicing.

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***Exclusive* HOME MOVIES** help you grasp important points FASTER . . . EASIER . . . BETTER. A tremendous advantage!

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Insert pictorial diagram on transparent styrene base. (See insert.) Mount parts to follow pattern—using handy "snap in" fasteners. Eliminates wiring errors. Tops for speedy circuit changes . . for providing maximum circuit experience in minimum time. Build and operate scores of interesting projects — such as the electronic circuit shown below.

THOUSANDS OF SUCCESSFUL GRADUATES

WHY has D.T.I. become one of the largest training organizations of its kind? Because it provides EVERY MAJOR HOME TRAINING AID to help make the subject EASIER to learn . . . EASIER to remember—the kind of training so helpful for REAL PROGRESS. Students get thorough, up-to-date, practical training that TAKES ADVANTAGE of new and improved training developments. Study the ADVANTAGES shown on this page. Think what they can mean to YOU . . . to YOUR FUTURE! Or come to D.T.I.'s big Training Laboratories in Chicago. MAIL COUPON TODAY for complete facts—including valuable publication, "89 Ways to Earn Money in Television-Radio-Electronics." Also, valuable information for men subject to MILITARY SERVICE.

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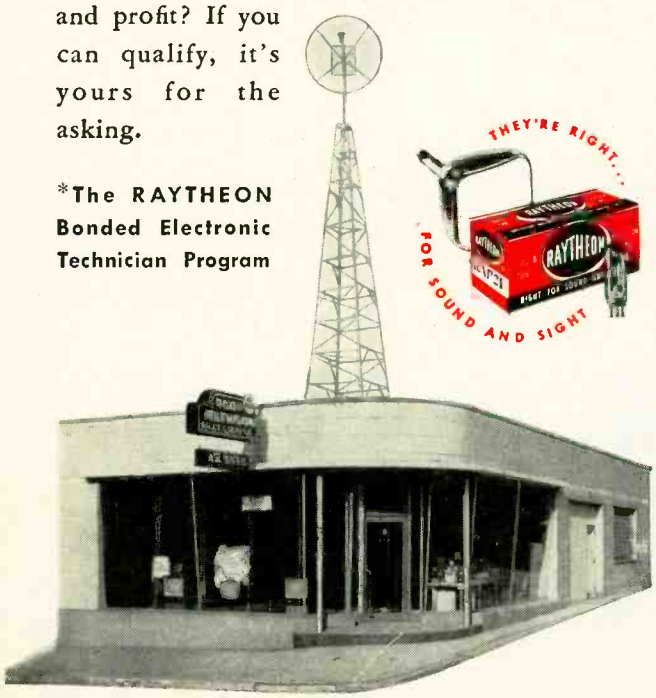
One need only glance at these pictures of ROOT TELEVISION'S modern, efficient looking operation and competent staff of technicians to realize that here is a well organized, dependable, profitable Radio-TV service business.

We're proud that they are Raytheon Bonded dealers, and happy that we could play a part in their success story. Why not ask your Raytheon Tube Distributor if you can qualify for the Raytheon Bond that helps thousands of Service Dealers throughout the country gain prestige and profit? If you can qualify, it's yours for the asking.

*The RAYTHEON Bonded Electronic Technician Program



"Let ROOT get to the root of your trouble"

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As one T.V. - service dealer we appreciate the effort which your entire organization has put forth over the past years in behalf of we dealers. We for one, feel that your program has gone far toward the needed understanding between customer and dealer. You are setting a perfect example for other tube and part manufacturers to follow. Keep up the good work.

Yours very truly,

Bailey S. Root

BSR/bb

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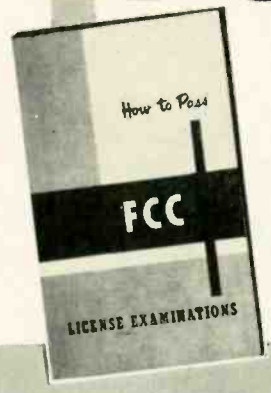

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Get this Amazing Booklet FREE

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If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial license.

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting

TELLS HOW *Employers make*

An Approved Member

JOB OFFERS Like These to Our Graduates Every Month

Letter from nationally-known Airlines:

"Radio Operators and Radio Mechanics are needed for our company. Periodic wage increase with opportunity for advancement. Both positions include many company benefits such as paid vacations, free flight mileage allowance and group insurance."

Letter from nationally-known manufacturer:

"We have a very great need at the present time for radio-electronics technicians and would appreciate any helpful suggestions that you may be able to offer."

These are just a few examples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs . . . it might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME

Name and Address	License	Time
Harry G. Frame, Box 429, Charleston, W. Va.	2nd Class	13 Weeks
Charles Ellis, Box 449, Charles City, Iowa	1st Class	28 Weeks
Omar Bibbs, 1320 E. 27th St., Kansas City, Mo.	1st Class	34 Weeks
Kenneth Rue, Dresser, Wisconsin	2nd Class	20 Weeks
B. L. Jordan, Seattle, Washington	1st Class	20 Weeks

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TELLS HOW TV ENGINEERING INCLUDED IN OUR TRAINING & COACHING

Our Amazingly Effective
JOB-FINDING SERVICE
Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results

BROADCASTING

"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for your graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitting Engineer at WMMT."
Elmer Powell, Box 274, Sparta, Tenn.

CIVIL SERVICE

"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with my landing this desirable position."
Charles E. Loomis, 4516 Genessee Ave., Dayton 6, Ohio.

AIRLINES

"Due to your Job-Finding Service, I have been getting many offers from all over the country, and have taken a job with Capital Airlines in Chicago, as Radio Mechanic."
Harry Clare, 4537 S. Drexel Blvd., Chicago, Ill.

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NAME.....

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TELEVISION CAMERAS are now working on the railroad. In the first permanent installation of its kind in the United States, two TV cameras in a shed in the Potomac Yard at Alexandria, Va., maintain a constant vigilance on freight cars arriving from the South. As the trains pass through the shed, the number and initials of each car are picked up and relayed to a TV screen in the record office 2 miles away. Floodlights make it possible for the cameras to operate day and night, under all weather conditions.

This new system replaces the conventional ground identification process, which yard officials said consumes considerably more time.

TV ENTHUSIAST FINED for having a television set installed in his automobile dashboard. The arrest was made by a highway patrolman of Wickenburg, Ariz. The offending motorist, who has gained the dubious distinction of being among the first to be arrested for this violation, had a 7-inch receiver.

CANCER CELLS may soon be distinguished from normal cells by an optical electronic device called the Cytoanalyzer. Now in experimental form, the instrument (see photo) is being developed by the Airborne Instruments Laboratory in cooperation with the American Cancer Society and the United States Public Health Service.

The Cytoanalyzer uses basic television techniques, with the TV camera viewing slide specimens through a microscope and transforming the picture into an electric signal. A computer then distinguishes between normal and cancer cells.

Four characteristics of cells are now measured by the Cytoanalyzer: color; size; diameter of nucleus; optical density of the nucleus.

42,000 ENGINEERS attended the 1955 IRE convention and exhibition in New York City March 21-24. The Kingsbridge Armory was not able to hold all the displays, and the nearby Kingsbridge Palace was hired to provide another 100 booths. Technical papers numbered 275, and a number of informal discussion meetings were held.

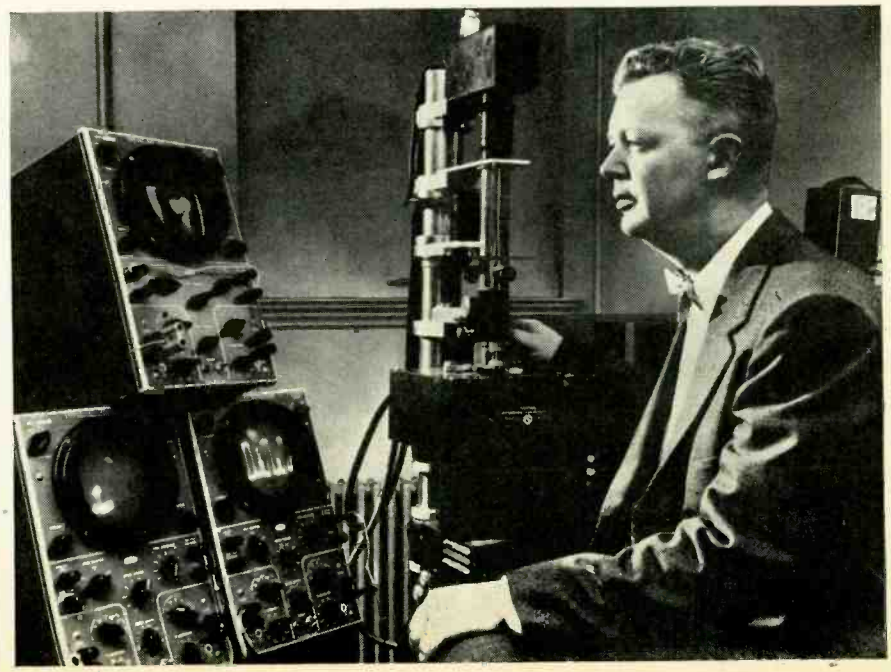
Possibly most interesting of these discussions was the symposium on telemetering and remote control, devoted entirely to the problems of space stations. Besides the military and scientific uses of such stations, it was pointed out (by John Pierce of Bell Laboratories) that a space satellite 100 feet in diameter orbiting 22,000 miles above the earth could be used as a practical reflector to transmit television signals across the Atlantic.

Special attention was paid to ultrasonics—now used in diagnostic work that may lead to early detection of cancer, and in dentistry to provide a painless drill.

Several new types of TV tubes were described, as well as highly improved special cathode-ray tubes of the Charactron type. Most interesting of the C-R tubes was Raytheon's "frozen television" equipment, with which any image that can be picked up by a TV camera can be held as a still TV image and scanned thousands of times over a period of more than a week.

Another important device using the C-R tube was Du Mont's Iconumerator, a device which counts objects in its field of vision. Du Mont also exhibited a completely transistorized oscilloscope.

A color TV tube with three to four times the brightness of present-day tubes was announced by Rauland, and a color TV camera tube which responds to all three primary colors—doing the work of the present three color camera tubes—was reported by RCA. END



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Get ALLIED's 1955 Catalog—308 pages packed with the world's largest selection of quality electronic equipment at lowest, money-saving prices. Select from the latest in High Fidelity systems and components; custom TV chassis, TV antennas and accessories; AM and FM receiving equipment; P. A. systems and accessories; recorders and supplies; Amateur receivers, transmitters and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—the world's *most complete* stocks of quality equipment. ALLIED gives you *every* buying advantage: fastest shipment, expert personal help, lowest prices, assured satisfaction. Get the big 1955 ALLIED Catalog. Keep it handy. Send for your FREE copy today.

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To keep up with the latest and best in High Fidelity, look to ALLIED. Count on us for *all* the latest releases and largest stocks of Hi-Fi equipment. We specialize, too, in TV supply, and are foremost in the field of Builders' Kits.

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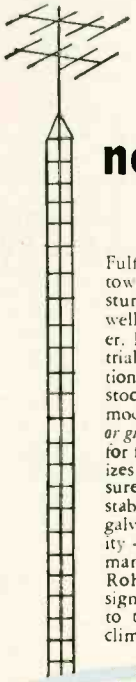
Depend on the COMPLETE line of ROHN

"SUPERIOR DESIGN" towers and accessories

for LARGER PROFITS MORE SATISFACTION GREATER EASE IN HANDLING

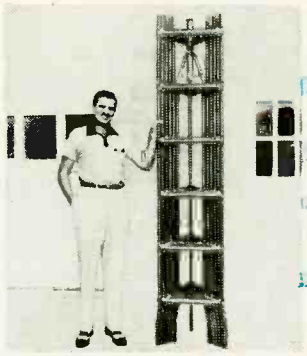
3 added towers to solve ALL your needs



no. 6 tower

"All-Purpose" tower.

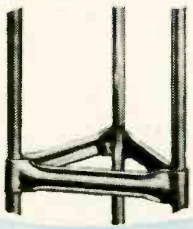
Fulfills 75% of your general tower needs—is structurally as sturdy—yet *costs less* than the well-known Rohn No. 10 Tower. Ideal for home and industrial installations, communication requirements . . . eliminates stocking many different tower models. *Self-supporting to 50 ft. or guyed to 120 ft.!* Easy to climb for fast, efficient servicing. Utilizes *"Magic Triangle"* which insures *far* greater strength and stability. Permanent hot-dipped galvanized coating. Dependability — a feature customers demand — is assured with the Rohn No. 6 Tower . . . designed to "stand up" for years to the rigors of weather and climatic conditions.



Package Tower

"Space Saver"— cuts storage space 300% or more!

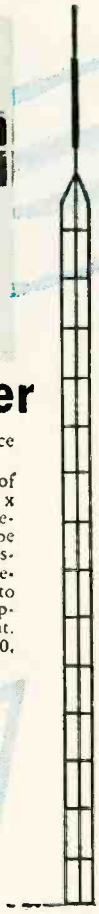
Popular PT-48 has almost 50' of sturdy tower within a compact 8' x 20" package! "Magic Triangle" design is adapted to a pyramid shape using a wide 19" base with progressively decreasing size upward. Decreases your overhead . . . easy to transport and assemble — cuts shipping costs. Galvanized throughout.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



Both Towers Feature.

HOT-DIPPED GALVANIZING!

Famous First for Rohn Towers . . . to add more profits in your cash register. Yes, you can have these two famous towers in hot-dipped galvanized finish—the most durable and permanent coating of all! What a sales feature for you!



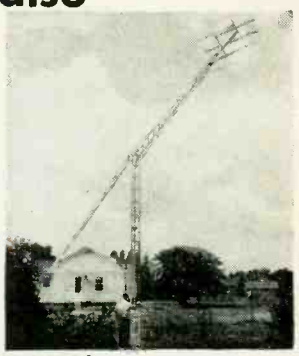
no. 30 tower

Heights up to 200' or more when guyed

Self-supporting up to 60'

Sturdy communication or TV tower that "stands up" to *all* the stresses of weather and climatic conditions . . . will withstand heavy wind and ice loading. Heavy gauge tubular steel, electrically welded throughout. Weather resistant, non-corrosive *double* coating provides durable finish. All sections in 10' lengths. Only 2-4 manhours required for installing 50' tower!

also



ROHN Fold-over tower

For experimenters, TV service departments and retailers. Use this kit with regular Rohn tower sections. Simple and easy to use.

ROHN Telescoping Masts

Heavy-duty hot-dipped galvanized steel tubing and rigid joints give extraordinary strength. *Quick installation* . . . mast attached to base—antenna fixed, then mast hoisted quickly to desired height. Utilizes special clamp and guy ring arrangement. Flanged interior section; crimped exterior section gives mast stability that can't be beat. Complete with guy rings and necessary erection parts. In 20, 30, 40 and 50 ft. sizes. Bases and ground mounts available.

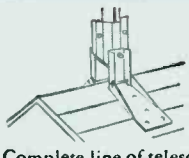
and a complete line of ROHN accessories —*all galvanized*

PEAK ROOF MOUNT

Heavy duty for quick, secure mounting of tower to top of peak roof. Flanges hinged, fastened to roof with 2 lag screws in each flange.

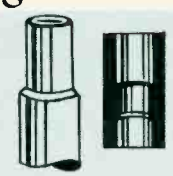
FLAT ROOF MOUNT

For all types flat surfaces. 3–1" solid steel projections permit first section of tower to be mounted directly on roof mount by inserting usual ⅜" bolts.



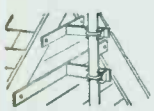
MAST BASES

Complete line of telescoping mast bases for every requirement, accommodating masts from 1"–2¼" diameter. Also available—drive-in mast bases.



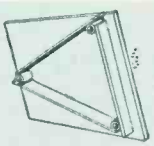
MAST 'N TV TUBING

Heavy-duty, hot-dipped galvanized steel tubing. Machined to perfection. Extra sturdy joints slotted for full, perfect coupling.



PEAK and WALL MOUNTS

For mounting of mast or pole to roof or wall. Heavy-duty steel. Variable sizes. Models for most every need.



DRIVE-IN BASE

Set on top of ground . . . 3–4' drive rods driven through base into ground. First tower section secured to rods with single bolt in each leg. Instant erection.

SERVICE TABLE

Perfect answer for television servicing, display and storage. Truly one of the finest of its kind in economy price range.

ALSO AVAILABLE

Rotator posts for mounting rotator to tower; House Brackets; Guying Brackets; UHF Side Arm Mounts; Mounts for Additional Antennae on a Tower; Erection Fixtures; Guy Rings; Installation Accessories; and dozens of other items!

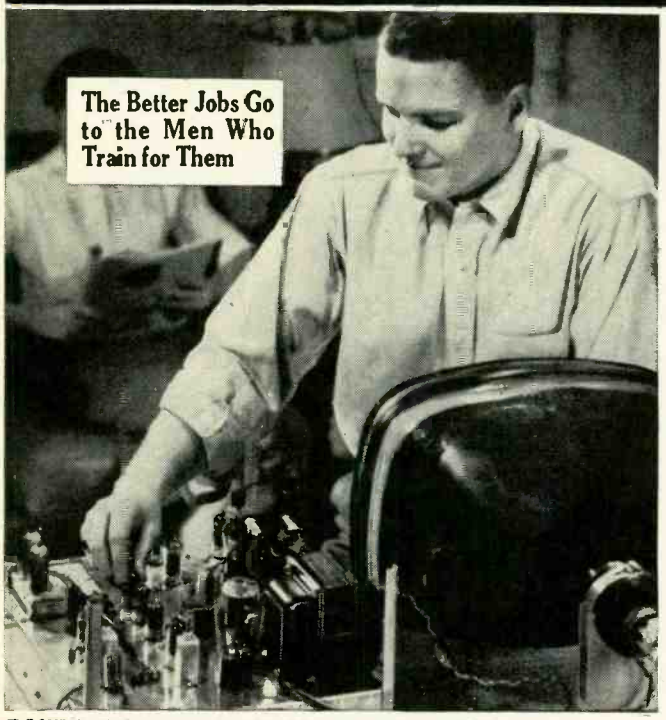
For complete catalog and prices, see your authorized Rohn Representative or Distributor; or write or wire direct.

Designed and Manufactured Exclusively by

ROHN *Manufacturing Company*

Dept. RE 116 Limestone, Bellevue Peoria, Illinois

Why Guess? There's a Quick, Sure Way to Find TV Set Troubles



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

NEW ALL-PRACTICE COURSE Shows How top TV servicemen fix ANY MAKE or model

Home Training includes 17" Picture Tube, components for a TV Receiver, Scope, Signal Generator, HF Probe, all for introductory price under $200 on easy terms.

ACQUIRE SUPERIOR SKILLS AT HOME IN SPARE TIME

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

Be one of these experienced TV Servicemen. NRI's new course is 100% learn-by-doing, practical training. We supply all the equipment plus comprehensive manuals covering a thoroughly planned program of practice. You learn how experts diagnose TV receiver defects quickly. You learn the causes of defects . . . audio and video . . . accurately, easily. And you learn how to fix them.

ALL LEARN BY DOING

You do more than just build circuits. You get experience aligning TV receivers, isolating complaints from scope patterns, eliminating interference, use geranium crystals to rectify the TV picture signal, adjust the ion trap and dozens of other professional TV Servicing techniques.

Many fellows "go around in circles" trying to isolate TV receiver defects. Don't guess! Learn professional techniques. Take this training now. If you want to go places in TV servicing you will act quickly to find out what you get, what you practice and how you can advance with better practical knowledge through NRI's new course in Professional Television Servicing. Accept this personal invitation to get a free copy of our booklet which describes this training in detail. Mail the coupon now. Remember, with this course you keep right on working, keep right on earning at your job while you learn through actual practice at home in your spare time.

UHF AND COLOR CREATE GROWING OPPORTUNITIES

To cash in on the present UHF and the coming Color TV boom you'll need the kind of knowledge and experience this Professional Television Servicing Course gives you. There is no other training like this. Here, condensed into a few months of training at home, is everything that TV servicemen learn in months, even years, of bench work. You get practice installing front-end channel selector strips in modern UHF-VHF receivers. You learn UHF servicing problems and their solution. Mail the coupon below. Discover how this new course meets the needs of the man who wants to get ahead in TV Servicing.

NOT FOR BEGINNERS

NRI's Professional All-Practice Television Servicing Course is for men with some knowledge of Radio and TV fundamentals but who need intensive, practical training and actual experience with TV circuits and professional servicing techniques to be self-reliant, confident, expert TV servicemen. Get this book FREE and judge for yourself how NRI's course will further your ambition to reach the top in TV Servicing. Mail the coupon . . . there is no obligation . . . and it can open the door to a better career for you.

MAIL THIS NOW

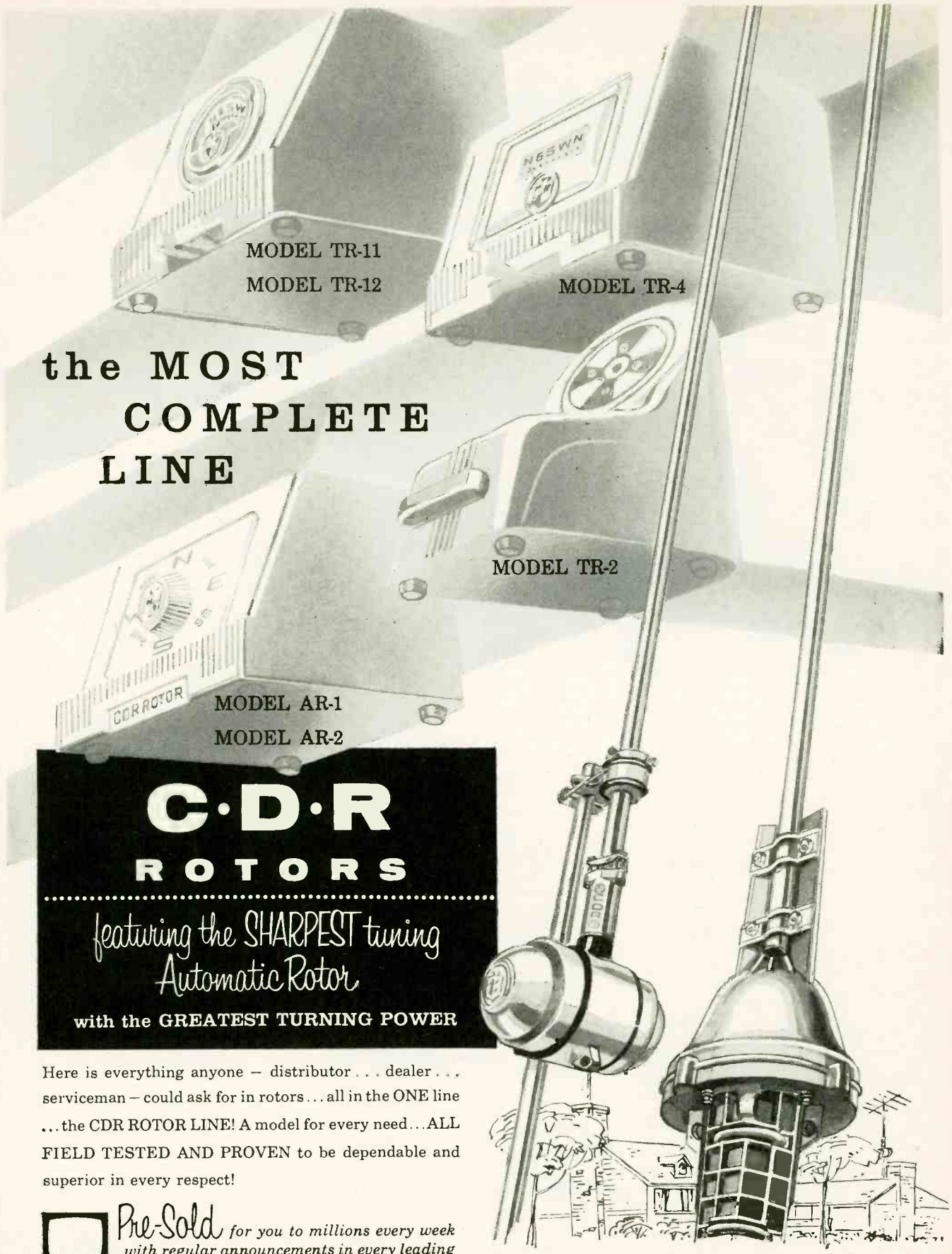
NATIONAL RADIO INSTITUTE, Dept. 5EFT
16th and U Sts., N. W., Washington 9, D. C.

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

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

Address .....

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



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featuring the SHARPEST tuning Automatic Rotor

with the GREATEST TURNING POWER

Here is everything anyone – distributor . . . dealer . . . serviceman – could ask for in rotors . . . all in the ONE line . . . the CDR ROTOR LINE! A model for every need . . . ALL FIELD TESTED AND PROVEN to be dependable and superior in every respect!

Pre-Sold for you to millions every week with regular announcements in every leading rotor market across the nation.

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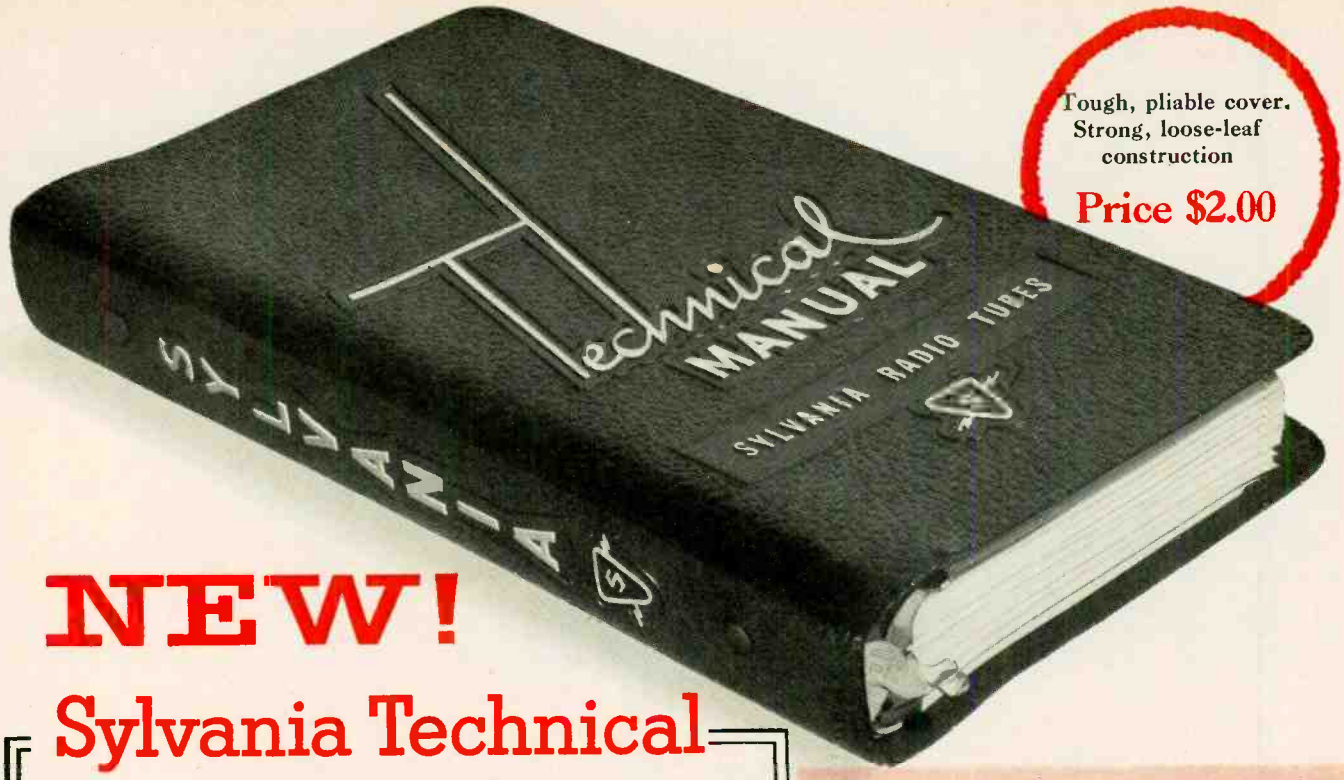

Tough, pliable cover. Strong, loose-leaf construction

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NEW!

Sylvania Technical Manual

—the most complete, up-to-date, tube reference available

- **Streamline, loose-leaf format makes it easy to use.**
- **Supplement service keeps you up-to-date month by month.**

The new 10th edition of Sylvania's Technical Manual has been brought up to date completely to include the latest receiving tubes, picture tubes, and special-purpose tubes. More pages, more tubes, more features; yet because of its versatile format it's still the handiest, comprehensive manual to use.

Manual owners receive newly released tube data in loose-leaf form regularly so it can be inserted in the manual.

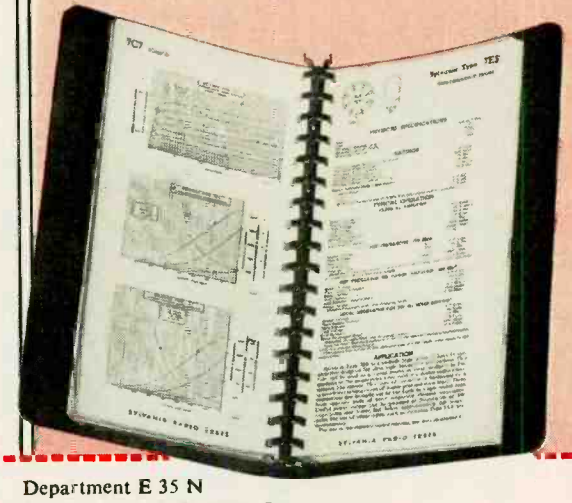
Your copy of the 10th edition of the Sylvania Technical Data Book is available at your Sylvania Distributor —or you can act right now and mail the coupon below.

Lists over 1000 tube types including:

- series-string television types
- color television receiving types
- complete picture-tube listing
- new special-purpose tubes

plus:

- complete characteristic curves on all important types
- tube tester settings for 184 most popular tubes
- new Crystal Diode Chart
- new special-purpose tube chart
- new Resistance-Coupled Amplifier Data.



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LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

IN DEFENSE OF JOE DOAKS

Dear Editor:

I take exception to J. M. McCan's criticism of all Joe Doakses. I guess I might be called a Joe Doaks, although I am operating a full-time service shop. When I tried to get a service position in established shops around town, all I received was replies that they were completely staffed or that my experience was inadequate. This despite the fact that I had received a great deal of excellent technical training.

As for Joe Doaks doing poor service work, I had been in business for a very short time when a customer came in who was so dissatisfied with the service work he had received from the "established shops" in town that he had decided to try a neighboring town—until he saw my advertising. This person was followed by many others who had given up the established shops. In most instances they had received sloppy work.

Mr. Farad's articles gives me the impression that society is not so highly organized. Free enterprise is greatly suppressed when the service technician is driven into a form of slave labor by excessive legislation, or must be a combination lawyer, tax consultant and banker to open and operate his own shop.

PAUL W. CONNER
Idaho

SCREWDRIVER MECHANIC

Dear Editor:

I have never been one to shrink from controversy. In fact I must confess to a keen delight, an exhilarating pleasure gained from the crossing of mental swords. I waited in vain to see someone take a stand in your "letters to the editor" column contradicting the oft-repeated fallacy that the day of the screwdriver mechanic is over for the servicing profession. The truth is that the screwdriver mechanic never had it so good.

A tube puller today earns in the vicinity of $20 a day net; on the basis of five calls a day and three tubes sold per call. What price theory?

Of all TV calls, 75% are satisfied by the replacement of tubes. The remaining 25% are no problem to the screwdriver mechanic; he merely jerks the chassis and hauls it to some technician operating a shop. In most cases the technician rolls out the red carpet and fondly embraces the one cause above

Write your Own Ticket

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

Use your experience in radio to step into a higher paying television job by studying AT HOME in your SPARE TIME.

The fabulous television industry has seen many booms — in building of broadcasting stations, manufacture of black and white VHF sets, and sale of these sets to millions of families — *but the biggest booms are yet to come.*

From my experience in the radio-television-electronics field and my contacts in high places, I can tell you that past TV booms will look small compared to the booms that will come with construction of new VHF and UHF stations and perfection of low-cost color television sets.

These developments are just around the corner. If YOU want to be in on the ground floor for the jobs that will be created, *now* is the time to do it. You can keep your present job and study one of my two NEW courses — FM and Television Technician Course — TV Cameraman and Studio Course.

These Courses — especially prepared for home study — will train you for top-paying jobs in the ever-expanding radio-television-electronics industry. You'll be able to write your own ticket to get a better pay job or set up your own business.

VETERANS!

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

FREE FCC COACHING COURSE

Important for BETTER PAY JOBS requiring FCC License. You get this training AT HOME and AT NO EXTRA COST. Top TV jobs go to FCC-licensed technicians.

EARN while you LEARN

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

EXPERT FM-TV TECHNICAL TRAINING

My FM-TV Technician Course lets you take full advantage of your previous experience — either civilian or Armed Forces. YOU CAN SAVE MONTHS OF TIME. My FM-TV Technician Course completes your training by providing a thorough background in Frequency Modulation and Television Theory and Practice.

You "Learn by Doing", working with parts and equipment I send you. Six large kits of FM and TV parts are given to you as part of the course. You build and keep a professional GIANT SCREEN TV RECEIVER complete with big picture tube (designed and engineered to take any size up to 21-inch).

Upon completion of your training you may — if you desire — take two weeks of shop training at my associate resident school in New York City AT NO EXTRA COST!

PRACTICAL TV CAMERAMAN AND STUDIO COURSE

My TV Cameraman and Studio Course is designed to train TV Studio Technicians and TV Cameramen, urgently needed today by Television Broadcasting Stations throughout the nation.

New TV Stations are now mushrooming throughout the country. Men who can work as Audio Technicians, TV Cameramen, Microphone Boom Operators, Monitor Operators, Turntable Operators, Control Room Technicians can write their own tickets.

I will train you for an exciting high pay job as the man behind the TV camera. Work with TV stars in TV studios or "on location" at remote pick-ups.

Available if you want it . . . one week of actual work with studio equipment & TV Cameras at my associate resident school in New York City.

This course is a MUST for those who wish to increase their technical knowledge of television operations.

TRAINING FOR BEGINNERS

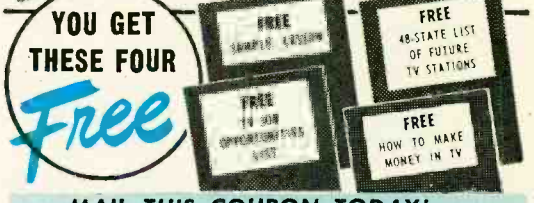
My Radio-FM-Television Technician Course is especially prepared for men with no previous experience or training. I have trained hundreds of men for successful careers in radio-television-electronics. Many of them had only a grammar school education and no previous experience whatsoever in the field.

Two weeks of intensive shop practice at my associate resident school is also included with this Course.

Radio Television Training Association

52 EAST 19th STREET • NEW YORK 3, N. Y.

Licensed by the State of New York • Approved for Veteran Training



MAIL THIS COUPON TODAY!
NO SALESMAN WILL CALL!

Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSOCIATION
52 East 19th Street, New York 3, N. Y.

Dept. B-5

Dear Mr. Lane: Mail me your NEW FREE BOOK, FREE SAMPLE LESSON, and FREE aids that will show me how I can make BIG MONEY IN TELEVISION. I understand I am under no obligation and no salesman will call.

(PLEASE PRINT PLAINLY)

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I AM INTERESTED IN:

- ☐ Radio-FM-TV Technician Course
- ☐ FM-TV Technician Course
- ☐ TV Cameraman & Studio Technician Course

VETERANS! Write discharge date

CHANNEL MASTER

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the New

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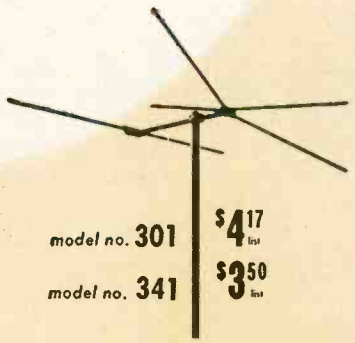
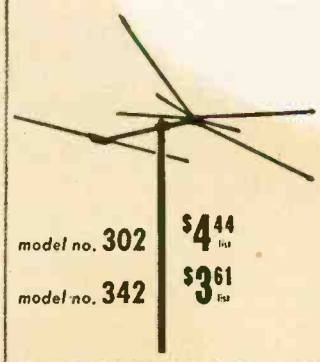


model no. 301 $4.17 list
model no. 341 $3.50 list



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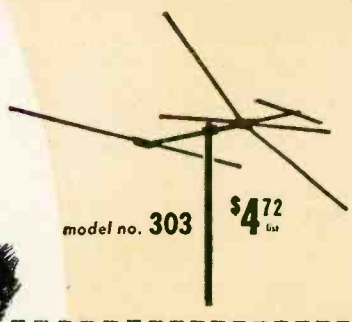
model no. 342 $3.61 list



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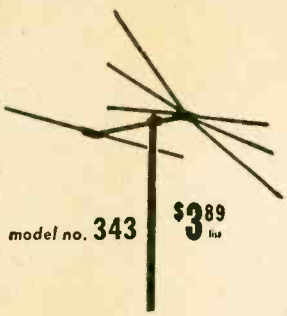

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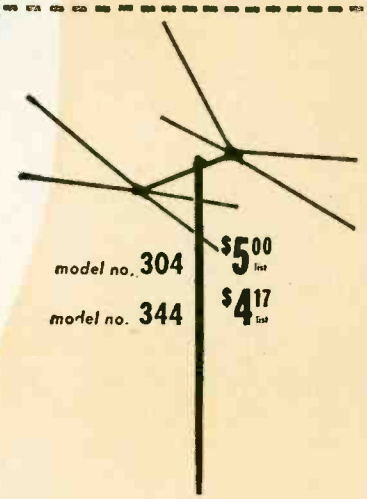

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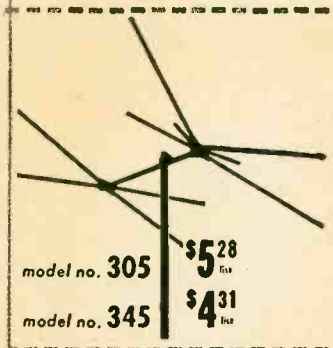
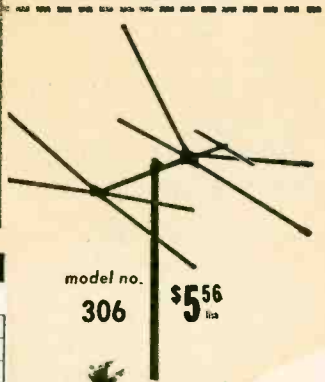
model no. 344 $4.17 list



model no. 305 $5.28 list
model no. 345 $4.31 list



model no. 306 $5.56 list

Never before such a complete line of conicals at such fabulous LOW PRICES!

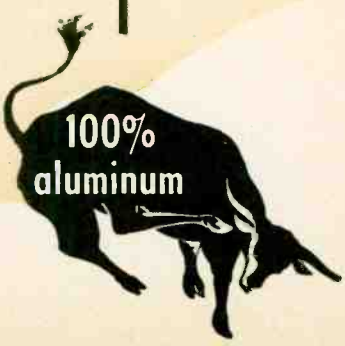
Low-priced conicals? Here is the LOWEST-PRICED, fullest conical line you've ever seen—a complete series of 22 *different models*. Checked out and approved by the Channel Master laboratory, every "MAVERICK" antenna provides outstanding Broad Band reception wherever conical antennas find application. Available both "Super-sembled" and non-assembled, the "MAVERICKS" are, without doubt, today's most sensational antenna buy.

"MAVERICK 300"

model no.	desc.	pack'd	list
301	1-Bay	6	$4.17
301-2	2-Bay	3	8.75
301-8	2-Bay	1	9.31
302	1-Bay	6	4.44
302-2	2-Bay	3	9.31
302-8	2-Bay	1	9.86
303	1-Bay	6	4.72
303-2	2-Bay	3	9.86
303-8	2-Bay	1	10.42
304	1-Bay	6	5.00
304-2	2-Bay	3	10.42
304-8	2-Bay	1	10.97
305	1-Bay	6	5.28
305-2	2-Bay	3	10.97
305-8	2-Bay	1	11.53
306	1-Bay	6	5.56
306-2	2-Bay	3	11.53
306-8	2-Bay	1	12.08
301-3	Conn. Rods		.56

"MAVERICK 340"

model no.	desc.	pack'd	list
341	1-Bay	6	$3.50
341-2	2-Bay	3	7.36
341-8	2-Bay	1	7.92
342	1-Bay	6	3.61
342-2	2-Bay	3	7.64
342-8	2-Bay	1	8.19
343	1-Bay	6	3.89
343-2	2-Bay	3	8.19
343-8	2-Bay	1	8.75
344	1-Bay	6	4.17
344-2	2-Bay	3	8.75
344-8	2-Bay	1	9.31
345	1-Bay	6	4.31
345-2	2-Bay	3	9.03
345-8	2-Bay	1	9.58
341-3	Conn. Rods		.56



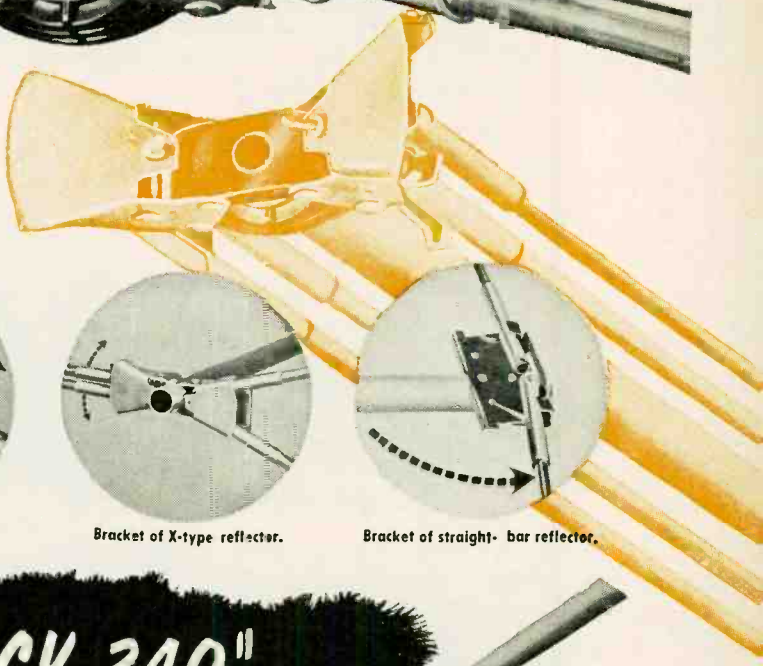
"MAVERICK 300"

12 different models

Extra "sleeve" on element provides 400% greater strength where it is needed most.

Conical "head."

The **first** and **only** full line of conical antennas completely "Super-sembled"



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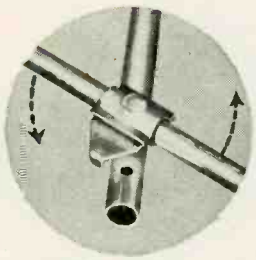

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all others responsible for his losing struggle to exist and prosper.

Technicians, like school teachers, are being driven out of the game by lack of a living wage. At the present rate of defection, it won't be long before the field is deserted.

I am anticipating some lively retorts to my sentiments, but let them come. Let the chips fall where they may.

HARRY M. LAYDEN
Judd-Bennett Co.
New York, N. Y.

OBJECTS TO BLURB

Dear Editor:

In the "blurb" which appeared above my story on the Wurlitzer organ in the December, 1954, issue, the organ is described as "magnificent." This has unfortunately given rise to the thought on the part of some readers that I prefer this instrument to others.

I have tried to be as impartial as possible in all the descriptions of products that I have written for RADIO-ELECTRONICS. Although I have opinions, like anyone else, I dislike very much to have anyone think I would depart from this practice. As a practical matter, it would be bad business for everyone concerned since I cover the entire electronic music industry and could hardly afford to favor any one manufacturer.

I would appreciate it, therefore, if readers could be informed that not I, but the magazine's editorial staff, wrote the blurb and that, as is standard practice, I did not see it until the issue was printed. While I think the Wurlitzer is a good organ, I would not describe it or any other product as "magnificent" simply out of fairness to competing companies. I am in accord with the usual policy of the magazine, which is to describe accurately and allow the reader to draw his own conclusions.

RICHARD H. DORF
New York, N. Y.

TECHNICAL EDUCATION

Dear Editor:

I was greatly interested in your editorial, Tec-Teleducation. Today, 31 years old and with a family to support, I make my living as an auto parts salesman.

However, since I was 10 years old I have been very interested in radio and electronics. I have constructed numerous electronic circuits and serviced radio and television receivers as a sideline. Had I had the opportunity to receive special technical training during my early years, I would have become an expert because of my great desire to learn. I am sure that mine is not an isolated case.

I hope you continue to publish your views on this subject of technical education. Perhaps it will help bring about greater opportunities for technical study.

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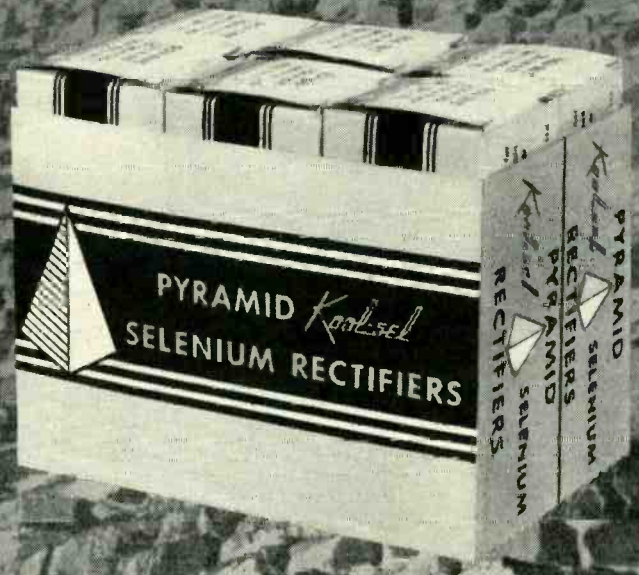

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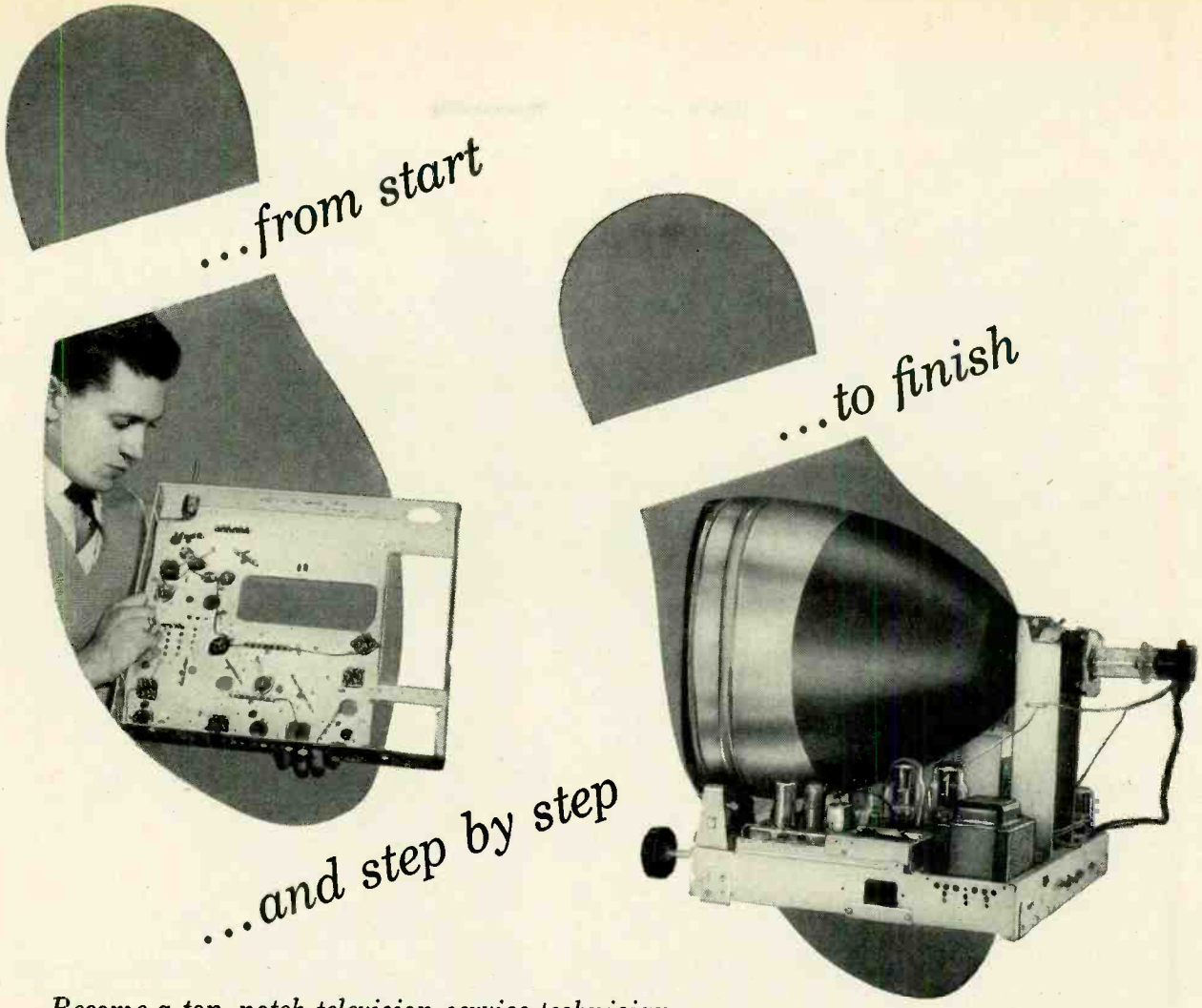

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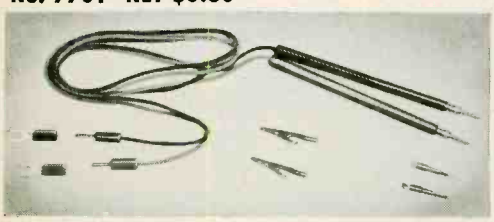

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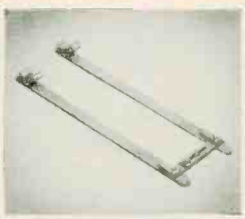

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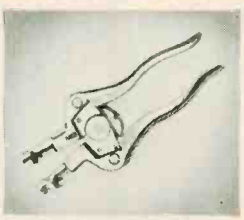

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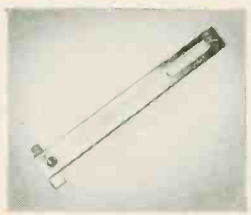

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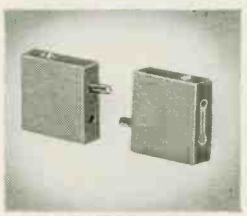

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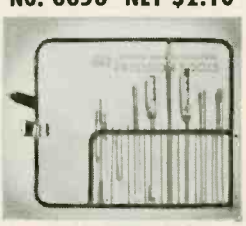

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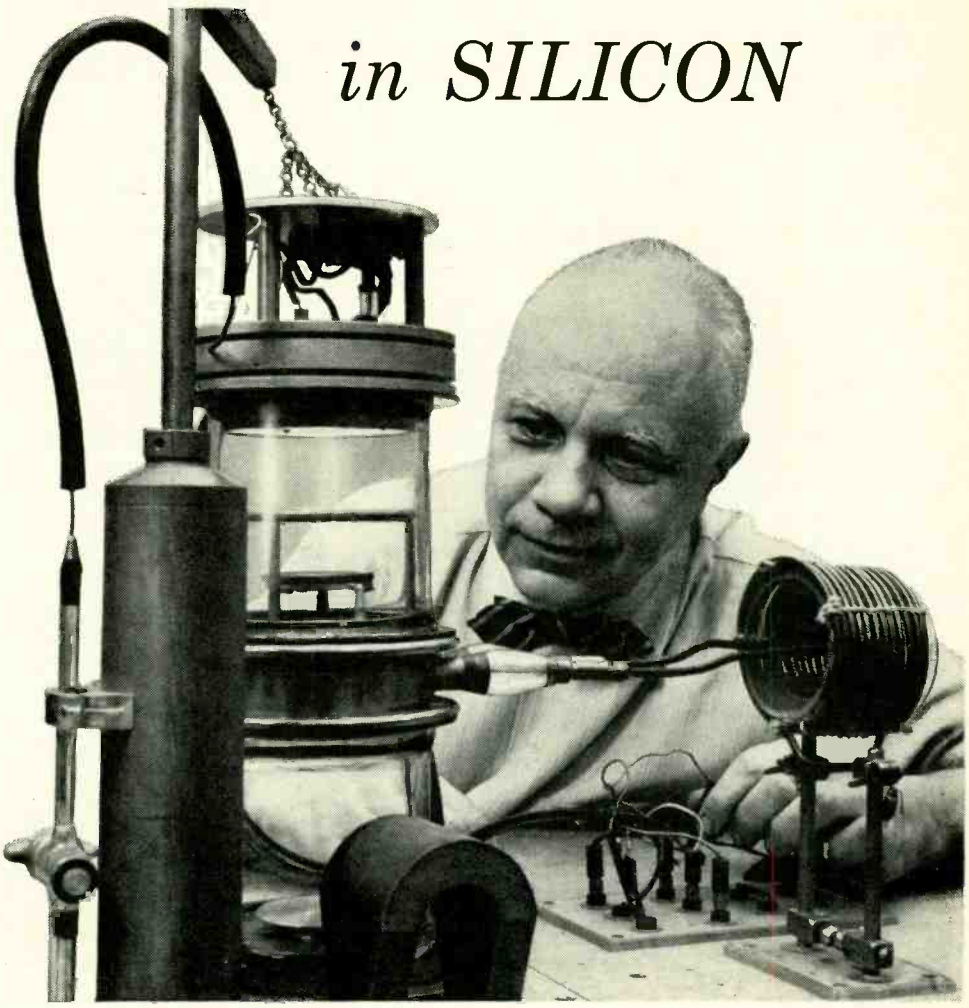

One example of junction technology at Bell Laboratories. Here a junction is produced on the surface of silicon by bombardment with alpha particles. Bombardment enhances silicon's performance at very high frequencies.

One day in the 'thirties a revolutionary adventure began for Bell scientists. They were testing an experimental silicon crystal they had grown to make microwave detectors.

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The scientists went on to develop a theory of junction phenomena. They showed that two junctions placed back-to-back make an amplifier. They devised ways to make reproducible junctions. Thus, junction technology came into being, and the 20th Century had a new horizon in electronics.

This technology has already produced at Bell Telephone Laboratories the versatile junction transistor (useful in amplifiers and switches); the silicon alloy diode (surpassingly efficient in electronic switching for computers); and the Bell Solar Battery which turns sunshine directly into useful amounts of electric current.

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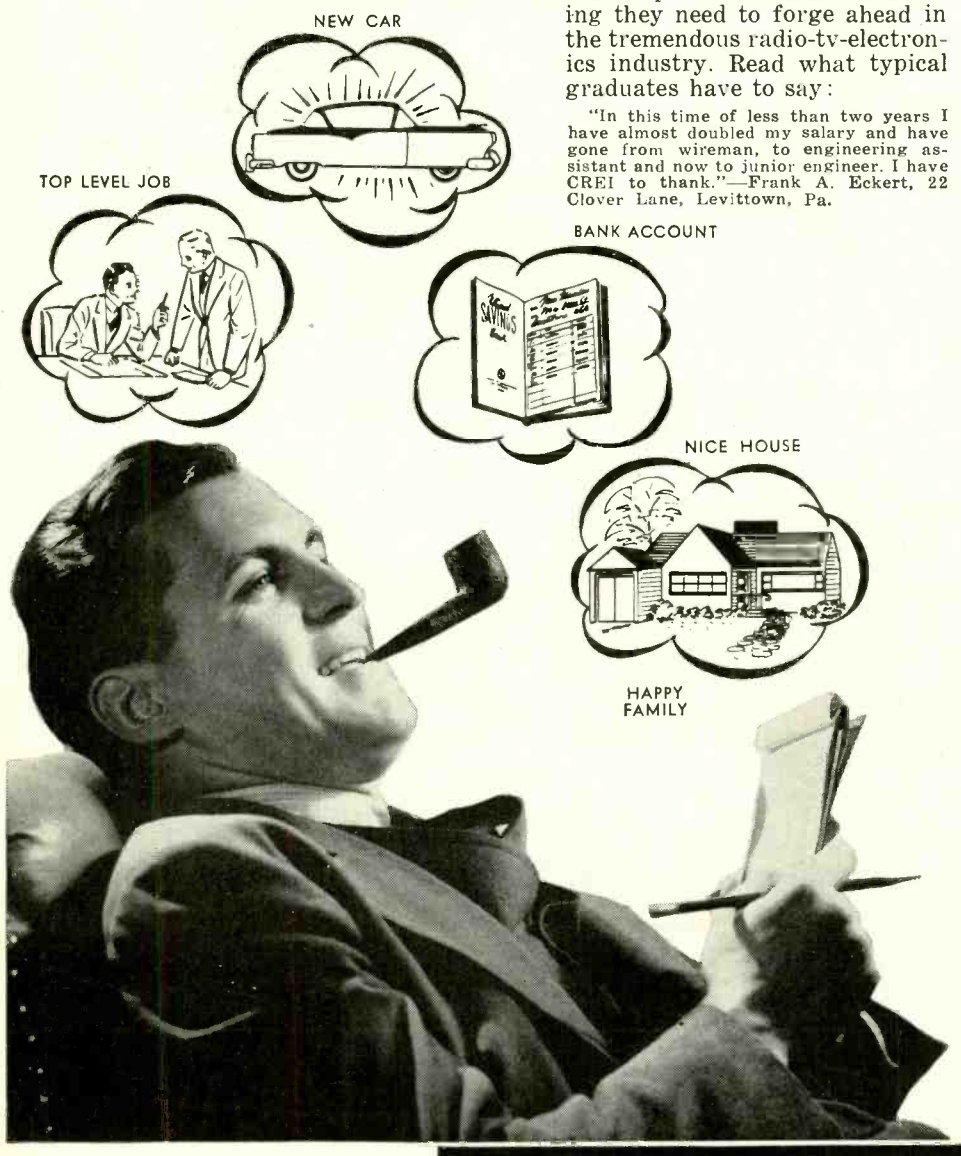

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RADIO – ELECTRONICS
Hugo Gernsback, Editor

TOLLEVISION

. . . A great economic television battle is shaping . . .

EVER since the first days of radio in the Twenties the question has been: Who pays for the service? The answer always was and always will be: The public! The only point in the age-old discussion that needs clarification is *how* the payment is to be made.

In the United States, payment is *indirect* through advertised merchandise or services offered by the broadcaster to the radio listener or television viewer. In many other parts of the world the government or other legal authority usually requires *direct* payment in the form of a receiver license. In most countries it is illegal to own a radio or television set unless you pay a regular stated fee for listening or viewing purposes. This parallels our auto license system in many respects.

Another idea advocated for many years is pay-as-you-see TV—*toll television*—or, as we may call it, *tollevision*. The station emits a scrambled-up picture letting nonpaying set owners see only blurred, fuzzy lines on their screen. To view the program you need a *decoder* attached to your receiver. This decoder can be connected to your telephone, the phone company billing you monthly for the service.

There is yet another method—the *direct-prepayment* system through an automatic coin machine or other means which unlocks a decoding device. There are a number of patents on such systems.

Still another system requires inserting a special punched-hole card which you buy from the broadcast station once a month. A new card with differently punched holes is required each month, or your set won't work on the selected *tollevision* channel. It can be seen from above that there can be dozens of systems or methods to accomplish *tollevision* if it becomes established.

The pressure on the Federal Communications Commission by *tollevision* interests has become so great in recent years that the FCC fixed May 1, 1955, to begin reviewing the pros and cons of all affected television interests in the United States.

It should be noted that the ensuing battle will be along purely legal and economic lines—no technical problems are involved. In short, the issue is solely the question of whether the FCC is empowered legally to authorize *tollevision*. If not, would Congress have to enact new legislation for the purpose?

The present broadcast laws were of course drawn up long before the advent of television. The law says that all broadcasts are intended to be received "by the public." Point-to-point communication is excluded for broadcasters. So the question arises: Is it in the public interest to broadcast to one section of the public willing or able to pay and exclude that part of the public either unwilling or unable to pay?

Another question: Who would fix and control the toll charges? What about Federal taxes on such tolls—similar to present communication taxes on phone and telegraph?

Innumerable other legal and economic points come to mind, such as competition with present-day sponsored programs: How are tolls to be calculated?—by elapsed time or by intrinsic value? And how would you evaluate a two-reel comedy *vs.* a full-length live opera with famous singers?

But let us assume for the moment the pious hope that all these points are straightened out. This brings the next question, so far never answered by economic experts. With how many *extra* millions will the American viewing public be taxed annually? It surely would run into hundreds of millions of dollars. If *tollevision* becomes successful, it might in time wipe out all "free," i.e., sponsored television, with the complete loss of our present-day useful advertising. Might this not in turn seriously hurt our country's economy? After all, manufacturers and others who invest enormous sums in their sponsored programs would not continue them year in and out if the programs did not move huge quantities of merchandise which in turn helps to keep our country prosperous.

Of interest, too, is the fact that after 30 years' experience with licensing—*direct payment*—the rock-ribbed British this year are setting up a sponsored TV service to compete with the noncommercial BBC (British Broadcasting Corp.). This to us seems most significant.

All this does not imply that *tollevision* is to be roundly condemned on all counts, forever. Quite the contrary. There is, we believe, a good deal of merit to it *in the future*. But, in our opinion, the time is not ripe for *tollevision* now.

Television is too young and in too constant a state of flux at present to be saddled with an impossible EXTRA financial burden which might well break its back and would certainly impede its progress seriously.

Color television is still in its infancy; some of the motion picture industry still considers television—foolishly, we think—its arch-enemy. The coming future picture-on-the-wall type TV set is still in the laboratory under wraps. The legitimate theater is still groping for an alliance with television.

If one considers all these various endeavors and interests which some day may fuse into one great homogenous television ensemble that will profit all concerned, there *is* a good possibility that *tollevision* may find its own particular niche of usefulness—*not* perhaps in *broadcast* television but in a *closed-circuit* system.

It may thus be possible that in the future our television receivers could have one or more *closed-circuit* channels, labeled *Motion Picture, Theater, Opera,* these to be controlled by *tollevision*. They would *not* be broadcast channels, but strictly *closed circuit*. By that time the technical–economic problem of carrying all video frequencies over a wire probably will have been solved. In this manner TV broadcast and closed-circuit *tollevision* could live side by side and give a maximum of service to the public. —*H. G.*

New Techniques in COLOR DEMODULATION

Simplified circuit improves color fidelity

By W. W. COOK*

AS THE art of color television progresses, better methods of color demodulation are being discovered. Latest type demodulator circuits use one twin triode which produces enough output to drive the color picture tube directly. Extra controls and amplifiers are unnecessary —another step toward the ultimate low-cost color receiver.

The color demodulator receives the high-frequency color information (sidebands of 3.58 mc) and converts this information into low-frequency video information (0–1.5 mc). Color receivers using a three-gun picture tube must produce three separate video signals because the tube contains three separate electron guns, each activating its own color phosphor. Because these phosphors produce independent red, green and blue rasters, the three video signals are often referred to as the red, green and blue signals.

The demodulated video information may be in the form of I–Q, R − Y and B − Y or several other combinations. The I and Q signals must, however, be matrixed to form R − Y, B − Y and G − Y. This system of demodulation allows for full color reproduction (0–1.5 mc). The demodulation of R − Y and B − Y signals simplifies demodulator and output circuitry somewhat. Although this method is satisfactory for average requirements, high-definition color reproduction cannot be fully realized.

Most systems to date, whether I–Q or R − Y and B − Y, are of the low-level type. That is, the demodulated signals require further amplification before they are applied to the kinescope grids. Differential controls must be used with these additional amplifiers to maintain color balance. These additional stages with their controls add to the cost of the receiver.

The most economical method of demodulation is to drive the grids of the picture tube directly from the output of the color demodulator. This high-level demodulation makes additional amplifiers and controls unnecessary.

High-level demodulation can best be described by considering the use of three individual demodulators providing R − Y, B − Y and G − Y outputs as shown in Fig. 1. A 3.58-mc CW signal, generated in the receiver, is applied to the control grids of the three triodes. Chrominance signals are applied to the plates through a coupling transformer. With no chrominance swing on the plate, the plate voltage will assume a steady value and there will be no video output, as shown in Fig. 2-a. The resulting 3.58-mc CW swing on the plate is filtered by a 3.58-mc trap. A chrominance signal applied to the plate causes the plate voltage to shift due to the change in plate current.

When the chrominance signal is in phase with the 3.58-mc CW signal, tube conduction is maximum and plate voltage is minimum. This corresponds to the maximum negative video output. When the two signals are 180° out of phase, tube conduction is reduced and the plate voltage is increased above the no-signal value to its maximum positive value. Demodulation of in-phase and out-of-phase chrominance signals is shown in Fig. 2-b. The plate voltage for phase differences between 0° and 180° will lie between these maximum values and will be proportional to the cosine of the phase angle between the two signals. When the two signals are separated in phase by 90°, there is no output since the plate voltage is the same as for a no-signal condition. Demodulation of a 90° chrominance signal is shown in Fig. 2-c.

Fig. 2 shows that the signal on the plate simply adds to or subtracts from the signal on the control grid as the phase difference of the signals varies from 0° to 180°. In these illustrations all chrominance input signals are of the same amplitude and only the variation of demodulator output with change in phase is shown. But the amplitude of the demodulated output is also directly proportional to the amplitude of the chrominance input. In fact, the peak-to-peak demodulated output is approximately equal to the peak-to-peak input of the chrominance signal. Thus, if 100 volts of kinescope drive is required, the chrominance input to the demodulator is adjusted to 100 volts peak to peak. Since each of the demodulators provides one of the color-

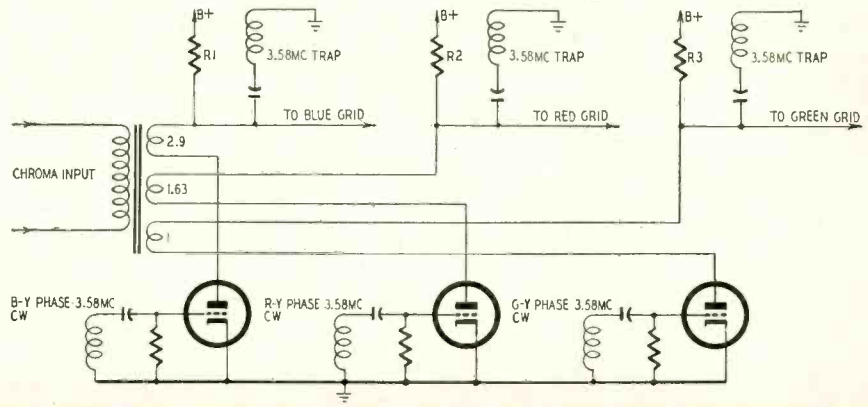


Fig. 1—Diagram shows separate demodulators for red, blue and green signals.

*RCA Service Co., Camden, N. J.

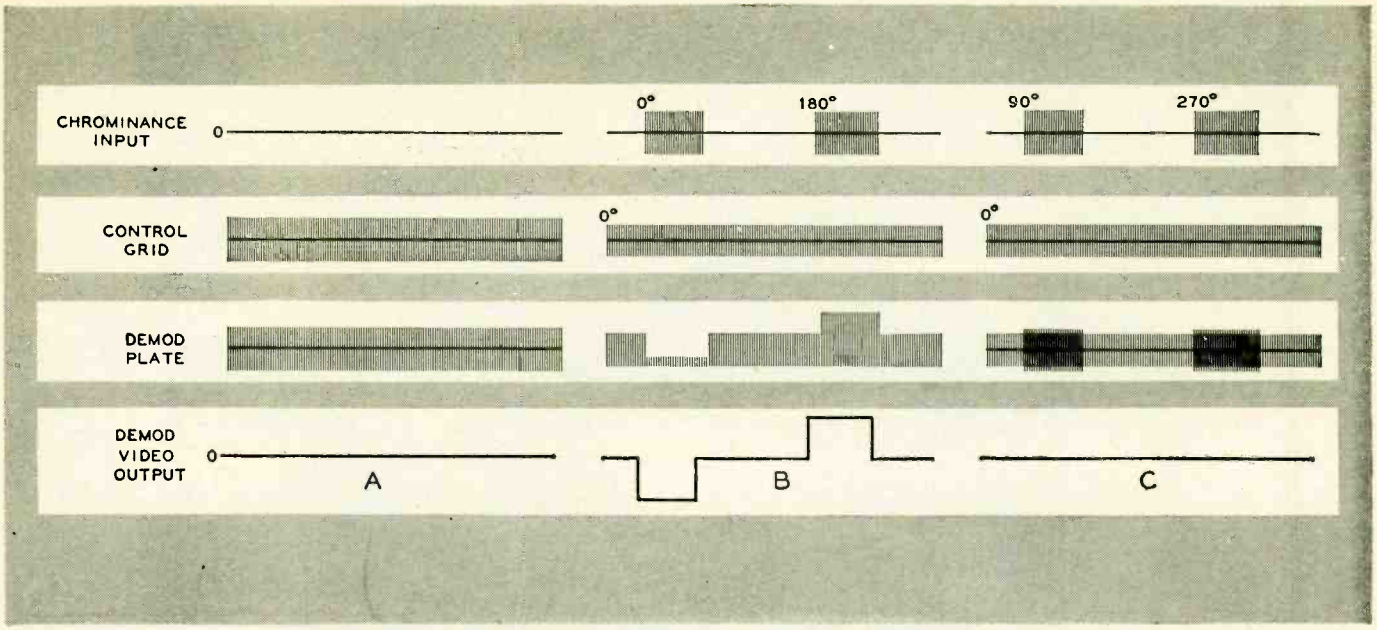


Fig. 2—Effect of the chrominance input on the demodulated video output.

difference signals (R − Y, B − Y, G − Y), the proper phase of 3.58-mc CW must be provided at the grids of the demodulators.

The proper ratios of chrominance drive to the demodulators can be obtained by correct selection of the turns ratios in the coupling transformer. These ratios must be designed to overcome the unequal amplitudes of the transmitted chrominance signals. The chrominance signals are attenuated (by unequal amounts) before transmission to prevent overshoots. These unequal proportions of R − Y, B − Y and G − Y must be restored to equal amplitudes at the demodulators. This can be done as shown in Fig. 1, by using a coupling transformer having its secondary windings in the ratios: R − Y : B − Y : G − Y as 1.63 : 2.9 : 1. Full-amplitude B − Y, R − Y and G − Y signals will then appear across load resistors R1, R2 and R3, respectively.

The bandwidth of the color-difference signals is limited to 0 − 0.5 mc to prevent crosstalk. Limiting the bandwidth of the chrominance amplifiers to 1 mc allows 0.5 mc of each sideband to be amplified in the chrominance channel.

The output of this type of demodulator is independent of the demodulator tube characteristics. Color fidelity is assured since the turns ratio cannot drift and the tube output is dependent only upon chrominance input.

This system of demodulation can be further simplified by using two triodes instead of three. The G − Y signal is composed of −0.51 R − Y and −0.19 B − Y. Thus, with the circuit arrangement of Fig. 3, the G − Y signal can be obtained by using a common cathode resistor in the R − Y and B − Y demodulators.

From the simplified circuit of Fig. 4, it can be seen that the plate currents of the R − Y demodulator i_1 and the B − Y demodulator i_2 flow through cathode resistor R_k. By selecting the proper plate load resistors (R1 and R2), a G − Y signal can be developed across R_k. For example: $R1i_1$ equals R − Y and $R_k i_1$ equals 0.51 R − Y. Thus $R1/R_k$ equals R − Y/0.51 R − Y; and if R_k equals 1,000 ohms, R1/1,000 equals 1/0.51 and R1 equals 1,960 ohms. Also, $R2i_2$ equals B − Y and $R_k i_2$ equals 0.19 B − Y. Thus $R2/R_k$ equals B − Y/0.51 R − Y, and, since R_k equals 1,000 ohms, R2/1,000 equals 1/0.19 and R2 equals 5,230 ohms. Therefore the plate and cathode resistors are in the ratios of R1 : R2 : R_k as 1.96 : 5.23 : 1.

It can be seen in Fig. 4 that some R − Y current flows in the B − Y circuit through the common cathode resistor and some B − Y current flows in the R − Y circuit through the same resistor. This means that part of the demodulated output at the plate of each tube is the result of its quadrature signal. To cancel these quadrature components, the R − Y demodulator chrominance input must contain some B − Y signal of opposite polarity to cancel the B − Y component present in its plate circuit due to the common cathode resistor. The B − Y demodulator input must contain some R − Y signal to cancel the R − Y component in its output. This means the two tubes cannot be operated in quadrature. Actually, they operate approximately 63.5° apart in phase instead of the 90° that would be used with quadrature demodulation. When this cancellation occurs, pure R − Y information is produced across R1, B − Y across R2 and G − Y across R_k.

The amplitudes of the input signals are the remaining points for consideration. Their amplitudes must be selected to restore the chrominance amplitudes as before. A chrominance input transformer having a turns ratio of 1 : 1.41 provides a chrominance signal which will produce exactly the proper amplitudes.

END

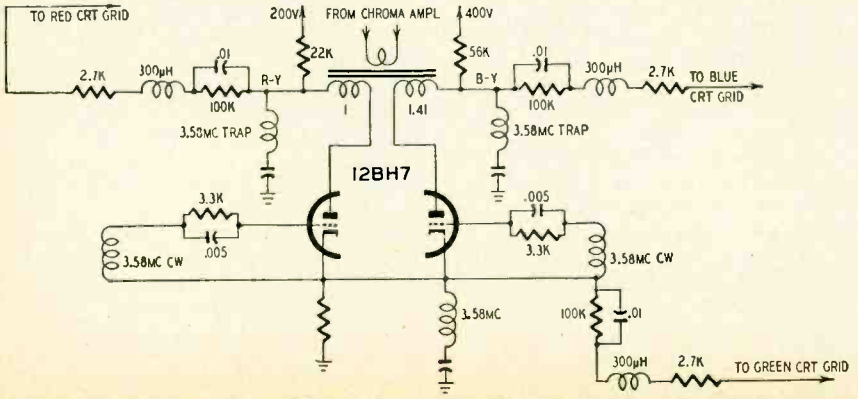


Fig. 3—Common cathode resistor is used in R − Y and B − Y demodulators.

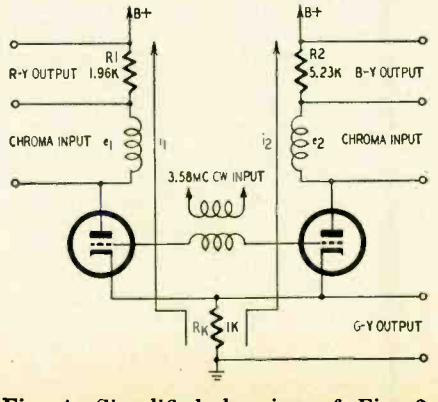


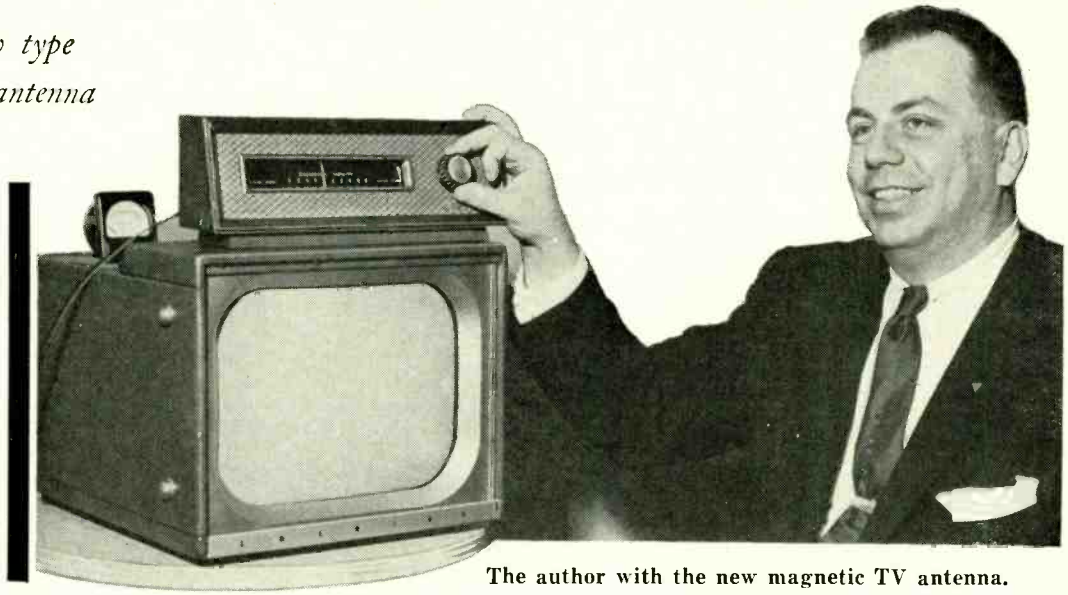
Fig. 4—Simplified drawing of Fig. 3.

TELEVISION

New Departure in TV ANTENNAS

A revolutionary new type of indoor television antenna

By IRA KAMEN*



The author with the new magnetic TV antenna.

THE beginning of the end of indoor and outdoor metal TV antennas is here as forecast by Hugo Gernsback in his 1954 Christmas booklet. The television set of the future may no longer require today's antennas, except possibly in the super-fringe areas. Even there they may sometime be replaced by magnetic-material antennas. (This is conjectural, of course; the present antenna is comparable to tuned indoor types.—*Editor*)

The new TV antennas work by magnetic absorption and concentration: the magnetic signal induces the highest possible r.f. voltage into the antenna coil winding. The indoor antenna that uses this fundamental principle is shown in the photograph at the head of this article. The quantity of signal voltage induced is based upon the permeability and Q of the magnetic material at TV frequencies as well as the Q of the tuned circuit, which multiplies the voltage induced into the coil. In other words, the signal voltage available to a TV receiver from this type antenna is equal to the voltage induced into the coil as a result of the magnetic line concentration multiplied by the Q of the tuned circuit.

To understand the operation of these new magnetic antennas, we must free our minds of the analysis applicable to metal antennas of the type used prior to this development. As you can see from the comparison table there are many basic differences between the magnetic antennas and the metal or rod types. Looking at the table, we can amplify its summaries as follows:

Velocity of propagation

The term "velocity of propagation" normally refers to the speed of transmission of TV signals through air or its lower speed in a metal type antenna. The velocity of propagation for a magnetic antenna is very much slower. This means that a wavelength of magnetic material is much shorter than a wavelength using metal element material such as aluminum or brass. Expressed in another way: since the travel of TV signals through magnetic materials is much slower, due to the atomic lineup of the magnetic particles, a TV wavelength is compressed to fit the speed of the medium through which it travels. Therefore, while a quarter-wavelength of metal rod at 200 megacycles would be in the neighborhood of 14 inches, its equivalent in magnetic material might be less than 5 inches long.

Permeability

The term "permeability" or "effective permeability" is usually applied to coil circuits and is considered the ratio of the inductance of a coil with a metallic or magnetic core to the inductance of a coil with an air core. Obviously, if the core used in place of air offers an easier and more concentrated path (lower reluctance) at TV frequencies than the air medium, the material has a much greater permeability than air. As you see from the photo which shows the components of one of the first devices developed using this principle, the core is of magnetic material and will accept a greater number of magnetic lines and induce a greater voltage into the coil than if the coil had a straight air core and was tuned for resonance.

The engineering term referring to permeability is "μ." It is therefore said that a circuit using this type of magnetic material represents a high-μ circuit, resulting from the high permeability of the material. In magnetic antennas the higher the permeability of the material, the greater will be the TV signal pickup. Antenna μ will be the rule-of-thumb reference used in evaluating all magnetic TV antennas.

In a rod type antenna, the primary function of collecting the signal energy is performed by currents induced into the metal elements by the *electrostatic* field. As rod type antennas work from the electrostatic field, the term "permeability" is of little consequence. The magnetic antenna receives its stimulation from the *electromagnetic* rather than the electrostatic field. Therefore, it works in a field where the permeability or lower reluctance paths are important to efficiency. The higher the permeability of the material and the higher its Q, the greater will be its ability to pick up signals.

Material Q

The Q of any magnetic material used at TV frequencies is determined by the reciprocal of its losses, which means that the lower the losses in the material the higher the Q. The three losses in a magnetic material are eddy current, hysteresis and residual losses. The high frequencies do not travel on the surface of a magnetic material. They travel *throughout* the material, which makes the distribution of magnetic lines uniform throughout the core. Because of this uniform distribution of the flux lines, the losses in this specific new magnetic material designed for TV frequencies are very low. In a metal antenna at TV frequencies, the signal currents are forced to the surface due to the resistance of the metal at these frequencies. This phenomenon is known as *skin effect*. These skin effect losses, in which the signals may be traveling on only a few ten-thousandths of the metal surface, result in resistive losses. Fundamentally, it may be said that any

* Vice president, Brach Division, General Bronze Corp.

metal is a low-Q material for TV frequencies. The Q of the magnetic material shown (see photo) may be in the order of 100 at TV frequencies. There are, of course, various other arrangements which improve the Q of this material by narrowing its bandwidth.

The overall efficiency of the magnetic material used for TV signal pickup and the expected performance of the circuit will be determined by what is called the "μQ product," which means anything that you do to the core material to raise the permeability and the Q simultaneously will increase both the signal pickup and the overall efficient operation of the magnetic material in the designed circuit.

Circuit Q

The circuit Q possible in any arrangement using the magnetic material is usually higher, since inserting this material in a coil allows greater inductance with less wire. In an air coil considerably more wire is needed to obtain the required inductance. Since wire has high resistance losses at TV frequencies, much less energy will be lost in a circuit using this magnetic material. This theory has been proven in the use of ferrite materials for broadcast antennas and other purposes. (It should be understood that the magnetic material described in this article *is not* the standard ferrite material, which will not function at TV frequencies without high losses. This is a special magnetic material atomically constructed for minimum losses at TV frequencies. Its molecular structure is different from that of ferrites.)

Aperture area

The aperture area of an antenna is that area which can be seen and cut by the magnetic lines in air. Fundamentally, the greater the aperture area, the greater the signal induced into the antenna. This is demonstrated practically almost daily to most individuals by their automobile radios. The longer the wire above the car, the greater the signal induced into the antenna. This is due to the increased aperture area or the increased length of wire in which signals can be induced. The magnetic-material antenna is very much smaller in size and must depend upon magnetic concentration in a minimum aperture area for its gain. The antenna shown in the design here will provide signal strength comparable to that of an indoor antenna adjusted for frequency. Of course, it is much more convenient to be able to tune this type of antenna —either as a top-of-set or a built-in unit—than to push around ungainly rods.

Stability

As these new magnetic materials have a minimum of ferrous content, they are not subject to corrosion. They are free of temperature and aging effects. Metal antennas, both indoor and outdoor (unless they are either anodized aluminum or triple-plated brass), are subject to surface corrosion. Surface corrosion, as every technician knows, will drop the signal level available from the antenna by an amount proportional to the percentage of corrosion on the surface of the elements and the frequency of operation.

Operation

The *Magne-tenna* circuitry is adjusted for resonance on each channel. This develops a high signal-to-noise ratio. Further, when tuned to its individual channel, the magnetic circuit is so highly resonant that it precludes cross-modulation between channels and, of course, prevents i.f. signals from entering the receiver. The resonant circuit can also be adjusted to act as an attenuator when necessary to prevent overloading. The tuning feature of this design simplifies adjustment of color TV receivers, which are very sensitive to fine tuning.

With the regular indoor or outdoor antenna on black-and-white, problems like cross-modulation and i.f. interference often require stubs and filters to eliminate the interference. On color reception, indoor antennas require—in many cases—an adjustment for each individual channel. It is much easier to adjust a unit in which it is necessary only to turn the control knob rather than to move the rods up and down until you hit frequencies that favor the color TV subcarrier.

Ghost reduction

In tuning the *Magne-tenna*—by moving the magnetic core through the coil —various pickup patterns are developed which enable it to select different wavefronts within its small aperture area. By being able to select various aperture areas, it is possible to remove a ghost from the picture by tuning the antenna. This feature is very important in complex areas where the increased aperture area of a regular indoor type antenna makes it more susceptible to reflected signals. In practical application as an indoor antenna, the consumer is instructed to tune slowly for best picture. Many times the best picture is not where the channel is normally expected on the dial. This is especially true in critical areas, as the best pickup pattern to discriminate against reflections is not necessarily the point of resonance. Therefore, the dial indicates only the normal position for channel 2 and the normal position for channel 13. All other points are determined empirically by the user.

In many cases, it is possible to phase-out a ghost being picked up by an outdoor antenna by connecting the *Magne-tenna* lead parallel with the downlead connections from the outdoor antenna at the set terminals. Under these conditions the *Magne-tenna* is tuned to pick up a ghost that will enable the user to phase-out the ghost picked up by the outdoor antenna. This has been very successful in areas with one bad ghost.

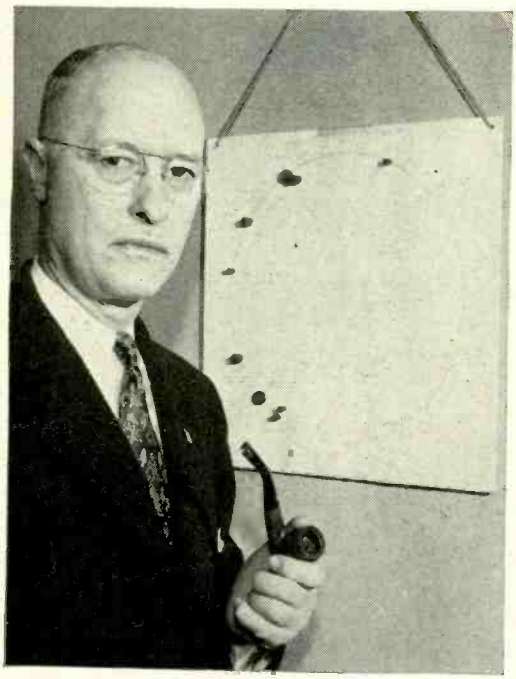
The future holds many fascinating developments in the field of magnetic TV antennas. Service technicians will learn to handle μ, hysteresis and *B-H* curves with the same agility they have adapted to all new TV terms. END

COMPARISON TABLE

MAGNETIC VS. METAL ANTENNAS

CHARACTERISTICS	MAGNETIC	METAL
Velocity of propagation	Much slower—requires much less material to equal a wavelength	Uses air as much faster medium—requires more material to equal a wavelength
Permeability	Much greater—more conductive to magnetic lines	Much less—accepts signals and introduces inherent surface losses
Material Q	Much greater—minimum r.f. resistivity losses	Any metal is considered low-Q due to skin-effect losses
Circuit Q	Usually higher—due to higher inductance with less wire-resistance losses	Usually lower—due to wire-resistance losses
Aperture area	Limited by size of material. Antenna gain due to magnetic concentration	Greater—due to length and configuration of metal rods
Stability	Minimum effects from temperature, aging—free from corrosion.	Increased losses in aging due to surface corrosion
Operation	Black-and-white—precludes cross-modulation, overloading and i.f. interference Color—simplifies tuning	Black-and-white — requires stubs and filters to reduce interference Color—indoors may require adjustment per channel

The antenna is composed of a magnetic core (right) inserted into a cylinder around which a conductor is wound.



THE *Planets* AND TV DX

By J. H. NELSON*

Mr. Nelson and wall chart showing positions of the planets during the March 10, 1955, blackout, predicted six weeks in advance. Mercury and Venus are in line and 90° from the planet Pluto.

FOR the past five years, the author has been using the interrelationships of the Sun's nine planets for the basis of a shortwave radio forecasting system for RCA Communications, Inc., and its overseas correspondents. Details of the way in which the planets are used to forecast changes in those solar radiation characteristics which control the Earth's ionosphere are described in considerable detail in three formal papers. The first appeared in the March, 1951, issue of *RCA Review;* the second in *Electrical Engineering* in May, 1952, and the third in *Transactions of the IRE*, in January, 1954.

Briefly, the method consists of seeking out certain angular relationships between the various planets. When three or more of them are interrelated on the same day, at certain angles, a change in solar radiation characteristics is anticipated. The primary angles of importance have been found to be 0°, 90°, 180°, and 270°, and 60°, 120° and 240°.

Research covering a period of fifteen years has shown that shortwave radio signal qualities on trans-Atlantic circuits are influenced by these angular arrangements between groups of planets. The family of angles relating to 90° is associated with a disturbed ionosphere and consequently, unstable shortwave signals, while the family relating to 60° have been found most often associated with a strong, quiet ionosphere. (There are, however, a few unusual arrangements in the 60° family of angles which can be associated with a disturbed ionosphere.)

Jupiter and Saturn are the two most important planets in relation to long-term effects—six to eight months. Mercury and Venus have greatest effect for shortterm periods of two to four days.

*Propagation Analyst, RCA Communications, Inc., New York, N. Y.

In April, 1951, the author issued a forecast that 1954 would be a year of unusually good shortwave radio reception, based solely on the fact that Jupiter and Saturn would reach a quieting angle of 120° with each other in June, 1954, Jupiter being 120° behind Saturn.

In July, 1954, the RCA Department of Information released a notice to the press and radio industry that this forecast had been correct.

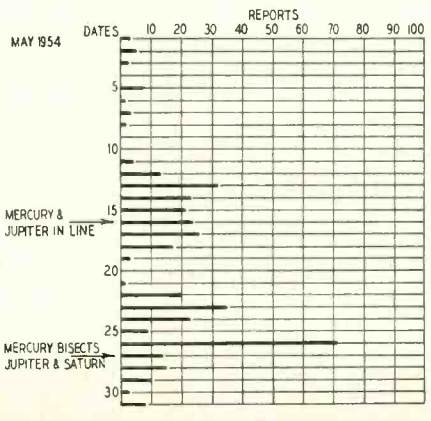
This is where RADIO-ELECTRONICS came into the picture. A phone call from its editor to the author started a program that appears likely to have far-reaching effects. The author was asked if he would compare planetary arrangements with some unusual TV dx days in 1952 and 1953 to see if any correlation could be found between the two phenomena. Of the thirteen cases sent for analysis, ten showed strong correlation with angles of 60° and 120°. The editor of RADIO-ELECTRONICS was asked for more data.

A suitcase full of reports, probably as many as 2,000 letters and cards, subsequently reached the author for analysis. The majority of these reports was presented in such a manner as to make analysis extremely difficult, but ten reporters made their reports in a very consistent manner.

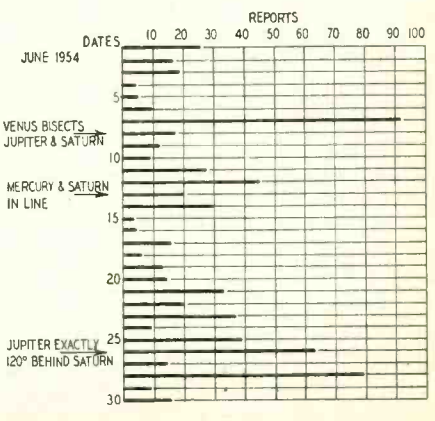
Their reports for May and June, 1954, were used and correlated to Jupiter and Saturn, which had reached a separation angle of 120° on June 26 while fortunately not being themselves importantly related to any other slow planets (Uranus, Neptune or Pluto). Therefore, it became a simple matter to pick dates when Jupiter and Saturn became importantly related to any fast planet (Mercury, Venus, Earth or Mars).

Results of the research

Two graphs have been prepared showing the correlation. The only days of important relationships were found to be May 16, May 27, June 8, and June 13. May 27, when Mercury bisected Jupiter and Saturn (then 121° 30′ apart), and June 8, when Venus also bisected Jupiter and Saturn (then 120° 54′ apart) are the most important dates since here we have two identical planetary phenomena with identical effects showing up on TV dx. (Note graphs.)



Correlation of TV dx and astronomical phenomena in the month of May, 1954.



TV dx for June, 1954. Drop on June 27 is probably due to Sunday viewing lull.

Great emphasis may be placed on the fact that in each case the peak in the dx curve appears one day ahead of the actual date of bisection. Such excellent correlation in ionospheric research is rare. The correlation shown when Mercury made a 0° contact with Jupiter on May 16 and a 0° contact with Saturn on June 13 is also considered very good.

Unfortunately Jupiter and Saturn will not be spaced at 120° again until 1968—at which time Jupiter will be 120° ahead of Saturn—so we cannot observe this exact phenomenon again until then, and then only if Mercury and Venus are in the right relationship to Jupiter and Saturn. However, there will be many similar arrangements between the slow and the fast planets in the intervening period. It is doubtful, however, if any will be as strong as those that took place in May and June, 1954.

"One swallow doesn't make a summer" and we should not jump to conclusions, but it can be said that the correlation found in this case is encouraging to a rare degree.

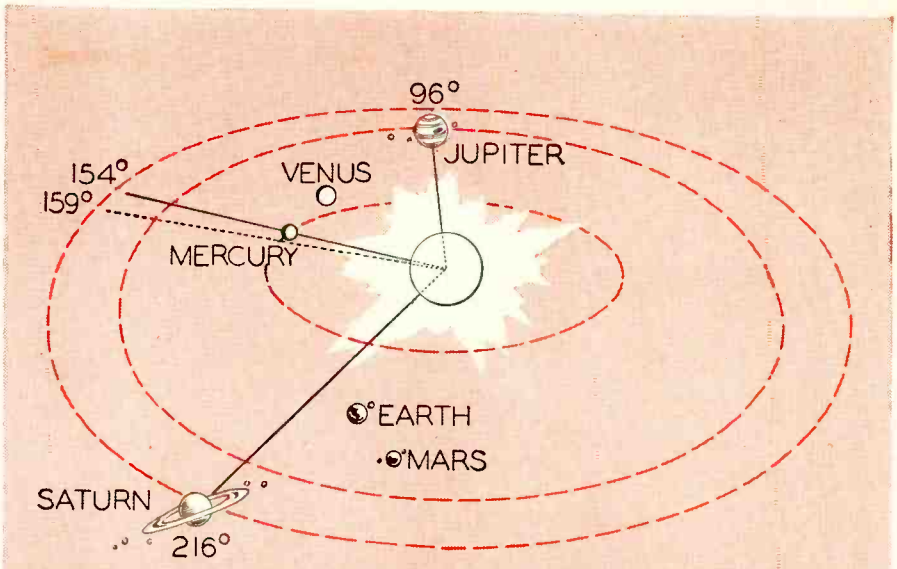
Not enough data is available to make a detailed analysis of July, but the few reports on hand indicate that considerable TV dx took place from July 4 to 10. On July 4, Mercury came in line with Mars while both were 60° ahead of Saturn and on July 6, reported as an exceptional day, Mercury came in line with Earth while both were 65° ahead of Saturn. On July 6, 59 dx reports were made by five reporters.

Value of dx reports

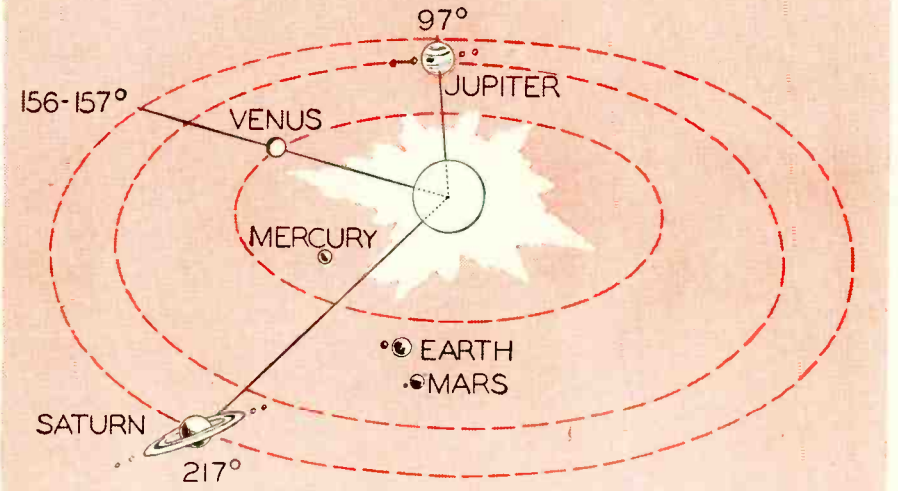
Finding the causes in nature that make TV dx possible is both important and intriguing and the proper collection of data becomes of paramount importance. To analyze this phenomenon properly the investigator must have good data to work with. Those enthusiasts who assist in this work can make their efforts even more valuable by preparing forms to record their reports on. These reports should follow what we might call the CCC rule. The should be correct, concise, consistent. The first is, of course, most important, but to produce data that lends itself to good analysis we should also adhere to the second and third.

The best reporters use a page lined in vertical columns and label each one at the top. The first column is headed date; the second, time; the third, call letters of the station; the fourth, city heard; the fifth, distance, if known. A sixth column should be used for remarks pertaining to quality. Any date when no observation is made should also be so indicated in the remarks column (such as "July 17—no observation"). This last has to do with being consistent.

The transmission of signals at television frequencies over great distances is little understood. TV dx-ers here have a new field of science to work in and one in which they can, by consistent and concerted effort, make valuable contributions. END



Heliocentric positions of planets May 27.



Positions of the planets June 8, which was in a period of high TV dx activity.

TV DX REPORT

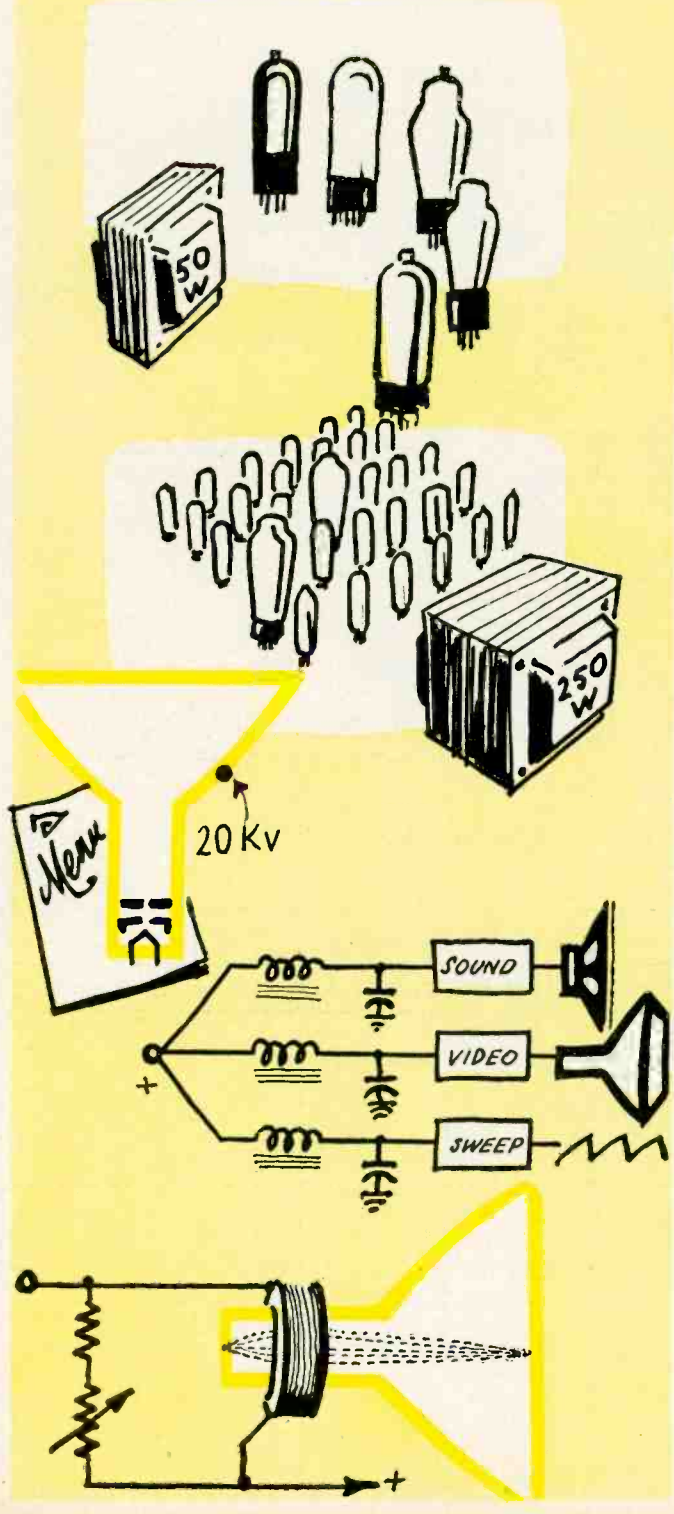
Date	Time	Station	City	Distance	Remarks

Suggested form for reporting TV dx. Some reporters use even more detailed forms.

TELEVISION . . . it's a cinch

By E. AISBERG

Sixteenth conversation, first half: Voltage supplies, what a TV set needs, the simplest supply, watch that high voltage!



WILL—Well, at last we've finished! We've studied every part of the television receiver!

KEN—You're right—up to a certain point. But if you build yourself a TV receiver with only the things we've talked about so far, you'll have much the same things as a motor car without a gas tank.

WILL—Of course! We never did bother to talk about a power supply! But there isn't anything in television that's so different from radio that I couldn't design a power supply for a TV set! Of course, a televiser of 20 to 30 tubes will take a lot more power than a five-tube superhet. But with a good, sturdy transformer—250 watts or heavier—and a heavy-duty rectifier, there shouldn't be any trouble.

KEN—Very fine as far as it goes, but the real difficulty seems to have escaped you.

WILL—What's that?

KEN—The thousands of volts you need for the high-voltage anode (ultor if you like) of the picture tube. But let's forget that for the moment. It's true that you can use a good big radio-receiver type power supply for the rest of the set. But you'll need a little extra filtering for the power to the sweep circuits. If not, the rapid voltage rises and drops of the sawtooth waves will kick back into the power supply and get into both your sound and video channels. The best approach is to have separate filter systems for the sweep circuits, the video and the sound.

WILL—Nice stuff for the choke and capacitor manufacturers!

KEN—Doesn't help them too much. In practical circuits the extra filtering usually comes down to some extra electrolytic capacitors and decoupling resistors. On some old sets you'll even see a focus coil pressed into use as a filter choke.

WILL—Just like the field coil on a radio speaker?

KEN—Exactly—though you'd look pretty hard to find a radio speaker with an electromagnetic field nowadays.

WILL—But in sets that use the focus coil as a filter choke, doesn't the focus need any adjustment?

KEN—It does! And you'll find that part of the current goes through a variable resistance in series with a fixed one, shunted across the focus coil. Then by varying the current through the resistance you can change the current through the coil, and thus the magnetic field it produces.

WILL—In this diagram you've drawn, the focus coil has another filter choke ahead of it. I suppose that's to keep ripple out of the focus circuits?

KEN—Correct. Too much a.c. in the focus coil might not be good. But notice also that I've indicated a potentiometer in the negative lead. The voltage drop across it makes that lead negative with respect to ground. By vary-

ing it we can make the control grid of the picture tube more negative than the cathode—in short, it's our brightness control. The potentiometer often forms part of a voltage divider across the whole power supply, and sometimes it's positive with respect to ground. Then, of course, the control grid returns to ground, and the cathode of the picture tube is connected to the moving arm of the pot.

WILL—I've seen such circuits. And you say that the three separate filter circuits following the second choke often consist of resistors and capacitors buried in various parts of the set? I see we also have an extra filament winding—for the filament of the damper tube?

KEN—Yes, you'll find out the reason for that shortly. Some sets have a number of windings—they may have several filament circuits with the filaments in series in each circuit. And especially in older sets, you may find the picture tube filament on a separate winding. Pity the manufacturers abandoned it—it's a valuable precaution, especially if you bias that tube by the variable-cathode-voltage method instead of the variable-grid-bias method I've shown.

WILL—Well then, we've got the supply problem 90% solved, and all we need is to find out how to feed the second anode of the picture tube. What do we put on the menu for it?

In the land of kilovolts

KEN—You'll find the picture tube no hog, but it does have rather refined tastes. TV picture tubes demand anything from 12,000 to 20,000 volts (less for some of the older smaller tubes). Projection tubes—we'll talk about them some day—may use from 25,000 to 35,000 volts, or even more.

WILL—You'll blow the house meter if you go after voltages like that!

KEN—No danger—to the house meter least of all. You have kilovolts, but no kilowatts. The anode currents of cathode-ray tubes are measured in microamperes. A tube with a voltage of 16,000 may have an anode current between 100 and 200 microamperes—that is, between 1.6 and 3.2 watts. A watt-hour meter would hardly notice such small amounts of power.

WILL—Well, then, we shouldn't have any trouble. Any circuit that will give you low B voltage will also work for high voltages, if we use higher-voltage transformers, I imagine?

KEN—They would, and 60-cycle TV power supplies were originally designed on that basis. Here is a very common older type. Since the current is so small, a single half-wave rectifier is all you need . . .

WILL—But the filter is pretty crude for half-wave rectification—only a capacitor and two resistors.

KEN—The capacitor alone would probably be enough. It's being charged 60 times a second and is discharging such a small current that it remains at practically the peak voltage of the power transformer's high-voltage secondary. A 0.25- or even 0.1-μf capacitor is big enough.

WILL—I suppose that R2 does improve the filtering quite a bit, though?

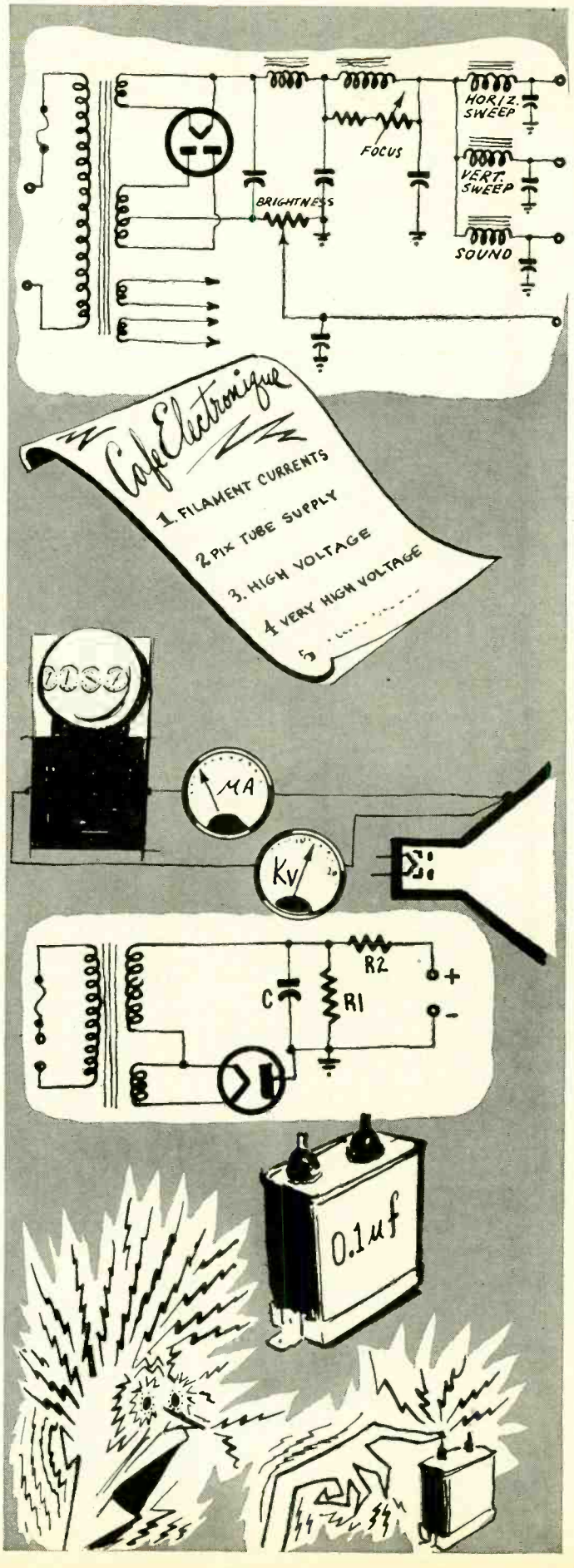
KEN—That's not what it's there for. It prevents overloading the rectifier or transformer in case of accidental short circuits. You need about 50,000 or 100,000 ohms.

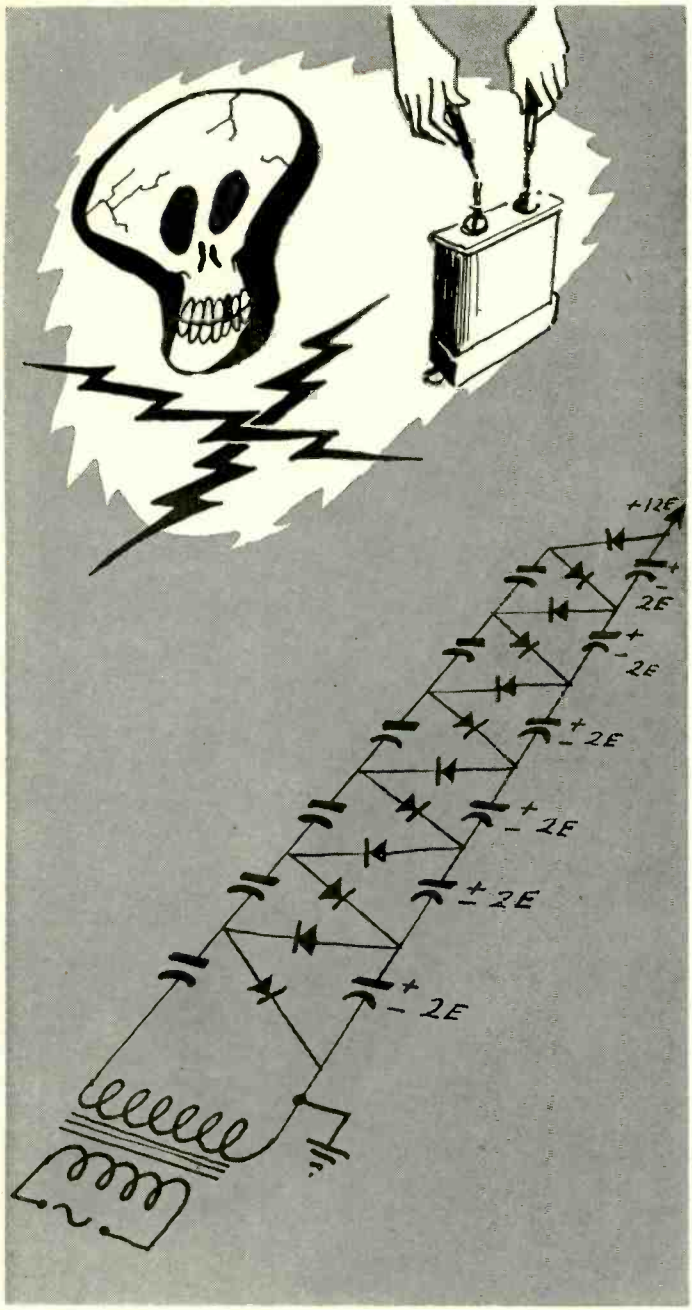
WILL—And what is R1 for?

KEN—It's another protective resistor—this time for the repairman. That resistor—in the order of 20 megohms—discharges the capacitor when the set is turned off. In dry weather that capacitor will hold a charge for hours—even for days. And getting across even a 0.1-μf capacitor charged to 16,000 volts or more is no fun. At worst it can be fatal, and even at best it will create quite a commotion.

WILL—So, with R1 to discharge the capacitor, there isn't any risk . . .

KEN—When you're dealing with electrical circuits—from





100 volts up—*never* assume there isn't any risk! (And never touch any part of a high-voltage circuit with the juice on!) Even with the current turned off, don't depend on R1 for safety. *It may be open!* Short the capacitor with a screwdriver—one with an insulating handle of course. And if you hear a loud crack and see a big spark, you'll know you have to replace the resistor. Probably the capacitor too—a sudden discharge can destroy it.

WILL—Thanks, Ken. If I ever do see such a spark, I'll sure think of you!

High-voltage difficulties

KEN—There are other troubles and dangers—dangers to the equipment itself. The transformer and tube are subjected to very high voltages and insulation breaks down, especially in warm, humid weather.

WILL—I won't ask you how to avoid all those dangers, Ken, because I happen to know there isn't any high-voltage transformer in a television receiver. You're not leading me out on a limb again!

KEN—You're right, Will—at least, not in the sense in which you are using the term. But they were very common in the early days, and I can probably find you a few old receivers that are still holding out, high-voltage transformer and all! But before we look at other types of high-voltage power supplies, it will be interesting to see a circuit that has been used in Europe to get high voltage from a low-voltage 60-cycle transformer.

WILL—Looks screwy. But it's some kind of voltage multiplier.

KEN—Correct. It's an ordinary half-wave multiplier. During the first alternation, the current passes through the top diode and charges the top capacitor at the right to E, the voltage of the secondary. On the next alternation, the voltage on the secondary is added to that on the capacitor, charging the top capacitor at the left to 2E. At each succeeding alternation the action is passed down the line in true voltage-doubler fashion, so with 12 capacitors you get an output voltage 12 times that of the transformer.

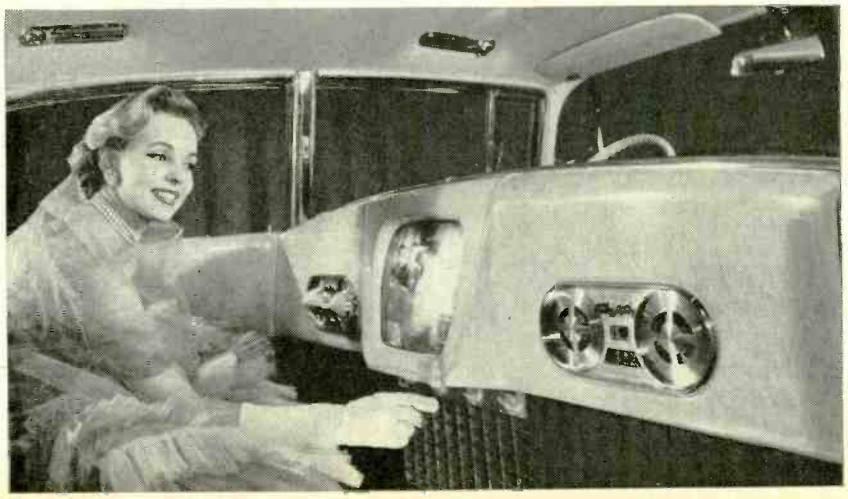
WILL—I don't remember seeing any sets that used a system like that.

KEN—I said they were used in Europe. The large number of rectifiers and capacitors make this kind of voltage supply expensive to construct and maintain. But it's one way to get high voltage with low-voltage components. The atom scientists cascade a whole series of voltage multipliers to get the millions of volts they need for those atom-busting machines whose names end in "tron."

WILL—I've heard of cyclotrons, synchrotrons and betatrons. But let's get back to the simple cathode-ray tube that ends in "scope" and just uses a few kilovolts instead of megavolts.

TO BE CONTINUED

DE LUXE AUTOMOBILE RECEIVER



How TV may look in your future car may be seen from this photo of an installation in a Cadillac 60 Special Sedan. The power unit for the receiver is in the trunk, and a special housing built into the front seat accommodates the neck of the tube. The housing also serves as a center armrest in the front seat. The channel selector and other tuning controls are beneath the tube. The installation is purely experimental, and no word has come from Cadillac as to when —if ever—they expect to make it an available accessory.

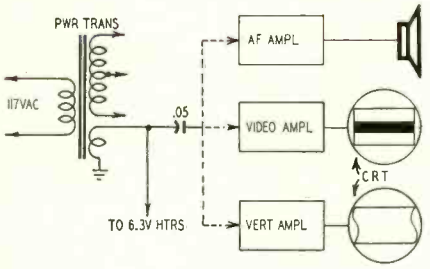
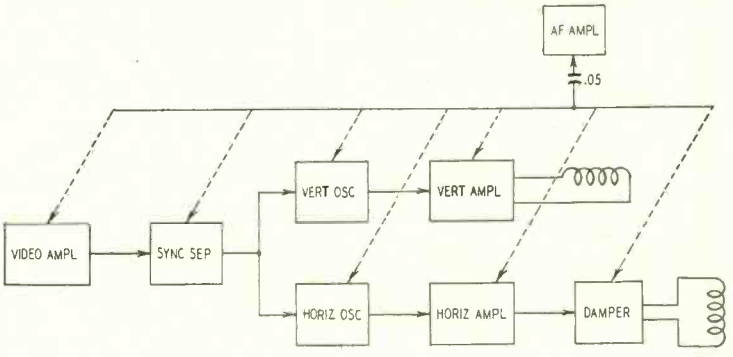


Fig. 1—Trouble-shooting by signal injection using the set's heater supply.

Fig. 2—Signal tracing in sync, video and deflection circuits using the set's audio system for useful indications.



WHEN servicing away from the bench, the technician usually carries only a minimum of test equipment. He can materially add to this equipment by putting his ears to work—whether they be of the tin or golden variety.

A surprisingly large portion of a TV receiver can be serviced by audio techniques. Every TV receiver contains an audio amplifier and almost all operate from a 60-cycle power line. Thus, the heater supply provides an excellent 60-cycle test signal for audio signal tracing. Being equal to the vertical sweep frequency, a voltage from the heater supply can be used to test the vertical sweep circuits. And let's not overlook the fact that the horizontal sweep frequency is also within the audio range.

Headphones are splendid for audio work. High-impedance units connected in series with a .05-μf capacitor are ideal for tracing a signal from the sound detector output to the loudspeaker voice coil. Thus, when there is no audio output or there is distortion resulting from a defect within the audio section of a receiver, the technician can start at the output of the detector and work toward the speaker, picking up a clear signal and tracing it to a point where it disappears or becomes distorted. This pretty much pinpoints the source of the trouble.

Where no signal is on the air or headphones are not available, the heater supply makes a good audio signal generator (Fig. 1). The strong 60-cycle 6.3-volt signal can be applied to the audio circuits by tieing one end of a test lead to the ungrounded side of the 6.3-volt heater supply through a .05-μf capacitor and using the other end as an audio test lead. In series-string heater circuits the 60-cycle voltage can be taken from the hot side of the first heater at the ground end of the string.

From here it becomes a simple matter of signal tracing. You can start either at the plate of the audio output tube and work toward the detector while listening for the signal at the loudspeaker, or inject the audio signal at the detector output and trace toward the speaker, using headphones. In either case, the signal will consist of the all-too-familiar 60-cycle hum.

Should there be no vertical sweep, the heater supply provides an excellent drive voltage for the vertical output tube. When injected into the grid circuit of this tube, provided the vertical output circuit and deflection coils are in good order, the screen will show a vertical sine-wave sweep. The sweep will, of course, be nonlinear. However it will indicate whether the primary source of trouble is lack of vertical oscillator output.

The 60-cycle supply also provides a good test voltage for the video amplifier in cases where a raster is present, but no video signal. In much the same manner as audio injection, the 60-cycle signal can be applied at the input to the picture tube (grid or cathode). If the input circuit to this tube is in good order, the raster should show a broad horizontal dark bar similar to the effect produced by heater-to-cathode leakage. From this point the test lead can be moved back toward the output of the video detector. Should a point be reached where the bar disappears, the trouble area is pinpointed.

If the audio section of a TV receiver is operating properly, we have a fine audio amplifier for testing (Fig. 2) the vertical and horizontal oscillators and output circuits, sync separators and video amplifiers. In each case the test consists of listening for the loud 60-cycle buzz and the shrill 15,750-cycle components of the signals in these circuits.

The horizontal sweep frequency cannot always be heard by technicians. However, by turning the horizontal hold control to its low-frequency side, the horizontal sweep frequency can be reduced enough to be fairly audible.

The better the high-frequency response of the amplifier, the easier it is to hear the horizontal sweep signal. In this case our "probe" consists of a test lead in series with a .05-μf capacitor, one end connected to the input of the audio amplifier and the other used to pick up signals from the various circuits.

When checking the vertical sweep circuits, a 60-cycle buzz will be heard if it is operating properly. To make sure that you are not hearing the incoming vertical sync pulses, short out the antenna terminals or remove one of the i.f. tubes. Varying the vertical hold control will cause a slight change in pitch when the signal is from the vertical oscillator. Having isolated the vertical sweep circuits from the incoming signal, you can check point to point from the output of the integrator to the plate circuit of the vertical output tube (watch the blocking-capacitor voltage rating—1,000-volt peak-to-peak signals are common in this circuit).

When checking the horizontal sweep circuit, place the probe at any point between the input to the horizontal oscillator and the screen grid of the horizontal output tube. The plate of this tube and the damper cannot be directly touched because of the very high pulse voltages present. However, sufficient pickup through stray capacitance can be obtained by placing the probe lead next to, or wrapping it around, the insulated leads of these circuits.

A properly operating sync separator will produce a strong 60-cycle buzz at the audio amplifier output; the same is true for the video amplifier. In either case, the 60-cycle buzz caused by the vertical sync pulses serves as a rough indication of proper operation.

These tests do not replace test equipment but, rather, act as temporary substitutes.

Focus control

I have a Stromberg-Carlson 21-inch TV receiver, model 622. The picture is

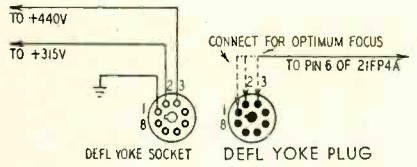


Fig. 3—Yoke connectors in Stromberg-Carlson 622 TV set. Connections to pins 1, 2 or 3 determine focusing.

not as sharp as I would like it and I want to try focusing it. The set uses a 21FP4-A with no means of adjusting the focus. Could you please tell me how this picture tube is focused?—J. H., Fort Wayne, Ind.

The 21FP4-A is a low-voltage electrostatic-focus picture tube and there are three fixed positions (Fig. 3) for varying the voltage on the focusing grid, pin 6.

The lead from pin 6 of the picture tube is connected to either pin 1, 2 or 3 of the deflection yoke plug. These pins are reserved specifically for providing three different potentials for the focusing grid. Pin 1 is at ground potential, pin 2 at approximately 315 volts and pin 3 at approximately 440 volts. Connect the focusing grid to the position on the plug of the deflection yoke that provides optimum focus.

A.g.c. filter

A set came in recently with a peculiar set of troubles. The vertical hold was very poor. Whenever it was adjusted, it would maintain sync for a few seconds and then start to barrel. However, the horizontal sync was pretty good. At times there was a slight jitter, but nothing worse.

On strong stations the top of the raster is very dark, almost blacked out. On weak stations, or when I disconnect the antenna, the trouble virtually disappears and the picture is normal. In addition the sound is very distorted but clears up considerably on weak channels. The set is a Du Mont model RA-312. I would appreciate any suggestions you might have. I have checked all i.f. tubes and all components in the sync separator and vertical oscillator circuits.—R. M., Roanoke, Va.

These symptoms indicate a defect in the a.g.c. line and, more particularly, poor a.g.c. filtering. Because of a.f.c. action it is common to find the horizontal sync more stable than the vertical. Check all resistors in the video i.f. a.g.c. line and replace all capacitors. This set has a convenient i.f. a.g.c. test point for checking this circuit. You should read approximately −6 volts, and an oscilloscope check will quickly indicate any lack of a.g.c. filtering.

Oscillator drift

I have a Tele-King model 210. After I tune in a channel, the picture is clear and the sound good for about 3 minutes. Then the picture starts to lose detail and the sound slowly fades. This continues until the picture almost disappears and the sound is barely heard. If I turn the fine-tuning control a little, picture and sound clear up. I have to repeat this fine-tuning adjustment three to five times before the picture and sound remain locked in. When I change channels, I have to repeat this process to a lesser extent. All tubes in the tuner and i.f. section have been replaced. I thought the oscillator tube in the tuner was the cause of the trouble, but apparently not. Could you please help?—J. M., Wickliffe, Ohio

As you suspect, the trouble is caused by a drift of the local oscillator tube in the tuner or one or more of the oscillator circuit's associated components. Since a slight change in the characteristics of the oscillator tube will often cause drift, it will be necessary for you to try a few tubes. If this does not help, check the components in the circuit. *Use exact replacements* because many components are temperature-compensated to minimize drift during warmup. Be especially carefully about placement of parts as distributed capacitances are often important. When replacing parts, always maintain original wiring layout.

Slow warmup

The warmup time in a Du Mont RA-103 is about ½ hour. After that time the picture stabilizes and is centered. However, during that half-hour there is considerable trouble. The picture crowds to the left leaving a 1-inch space at the right. During the warmup time the picture gradually moves back to center.

When the picture comes on, it has too much contrast, which can be corrected with the contrast control. At times the picture will black out. Increasing the contrast will bring it back on. Often picture sharpness is poor even with adjustment of the focus control. I'd appreciate some help with this.—C.N., Belleville, N. J.

If you have not checked the low-voltage power supply, do so. Determine whether there is a change of voltage output during the first half-hour. Low emission from the rectifier during warmup could cause the troubles you describe. If the power supply voltage is fairly stable and at full rated value during warmup time, the horizontal oscillator and horizontal output circuits should be checked for slow-heating tubes or other component parts that prevent proper linearity and full picture width.

It appears that some trouble exists in the contrast control or in the video output circuit. This would cause the intermittent contrast level which requires readjustment of the contrast control. In each of these circuits check all tubes and components. Replace any parts that measure beyond their tolerance limits.

Picture-tube flare

My problem deals with an Olympic television set model 755. I have changed the 16KP4 and am having trouble with neck shadows. The picture tube I removed was a Sheldon with a straight neck up to the flare. The replacement is an RCA and it has a slight hump before the flare. Thus, the deflection yoke will not fit against the flare. I've manipulated the focus coil and the ion-trap magnet, but to no avail. The best I could do was to have one corner shadowed about 1 inch. Please advise me if there is any way to eliminate these shadows or do I have to change the deflection yoke.—E.K., Lorain, Ohio.

You should have replaced the 16KP4 with an identically numbered tube or a 16QP4, 16RP4, 16TP4 or 16UP4. These tubes have a straight flare.

There is little that can be done to eliminate the corner shadow except to get the proper tube or to install a new horizontal output transformer and matching deflection yoke for the tube. If just the yoke is replaced, a mismatch will probably occur and you will have trouble with linearity and insufficient width.

Fuse failure

I have made three calls on an Arvin 379 chassis for a blown fuse. The fuse is a ¼-ampere slow-blow unit that feeds the horizontal output and damper circuits. Every test indicated normal operation. All tubes in this section were replaced and the values of the components were checked. I wanted to put a heavier fuse in this set, but didn't because I don't want to run the risk of permitting too much current flow and possibly seriously damaging other components. Do you think a slightly larger fuse will solve the problem or should the circuit be checked further? My calls were about a month apart.—D.K., Atlanta, Ga.

Since the fuse blowouts occur only once a month in presumably normal operation, chances are that there is no serious current drain. During the past year there has been a general trend toward changing these fuses to ⅜ ampere. This is because so many of the fuses blow, not because of excessive current drain, but due to the large a.c. component in the horizontal sweep circuit.

This causes fuses to open, while not actually being burnt. It does not occur on all sets because it takes certain settings of the drive, horizontal linearity and width control to create excessive a.c. components.

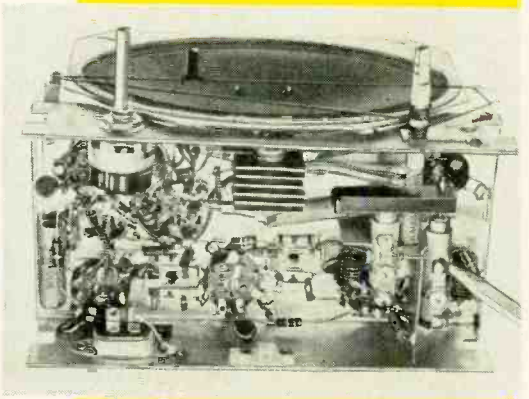
In most cases the trouble can be cured by connecting a 20-μf 400-volt electrolytic capacitor from the load side of the fuse to ground. This bypasses the a.c. component to ground and protects the fuse. Of course, a more inexpensive solution is to use a ⅜-ampere fuse. If the larger fuse continues to blow, you will have to carefully check all components and wiring in the horizontal output and damper circuits.

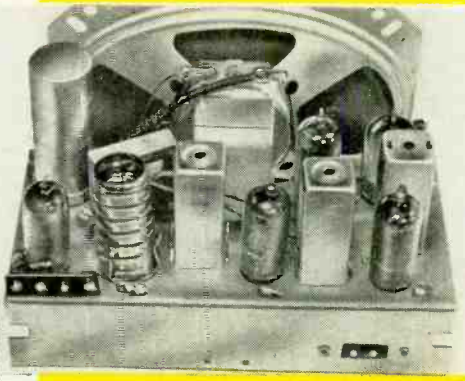
Using fuses larger than these would be extremely dangerous as it could lead to damage of major components in the sweep and output circuits. END

Coaxial Tuner in FM Receiver

Construction and application of a high-quality front end

By SEYMOUR NAPOLIN*





Underchassis view (above), rear-top view (right) and front view (below) show construction and size of the Granco 610 FM set.

FOR many years the front end or tuner of broadcast receivers has been designed around the ganged multiplate variable capacitor as the standard tuning element. The almost universal acceptance of the variable capacitor has for a long time discouraged the development of other tuning methods, despite its many obvious disadvantages such as:

1. Susceptibility to microphonics
2. Mechanical wiper contacts
3. Large physical size
4. High minimum capacitance
5. Temperature sensitivity

The recent trend toward increased use of v.h.f. and u.h.f. for broadcast purposes has resulted in extensive testing of all available tuning devices. The coaxial tuning principle has emerged from these investigations as one of the most efficient methods of tuning at very high and ultra high frequencies. Recently the coaxial tuning principle has been adapted to FM reception. A compact table model FM radio using it is described in this article.

Coaxial tuning

The basic tuning element of the coaxial tuner is a low-loss glass dielectric tube with cylindrical end sleeves, capacitance-coupled by a metallic plunger traveling within the tube. The glass tube is made with extremely close tolerances. These tolerances can be maintained only in glass since it is possible to utilize centerless grinding techniques as well as precise heat-shrinking on accurate mandrels. The cylindical end sleeves serve as the two plates of a capacitor. Thus minimum capacitance between the two end plates is extremely small since they are coupled only at the edges which are spaced apart on the glass dielectric tube. The plunger, as it travels within the glass

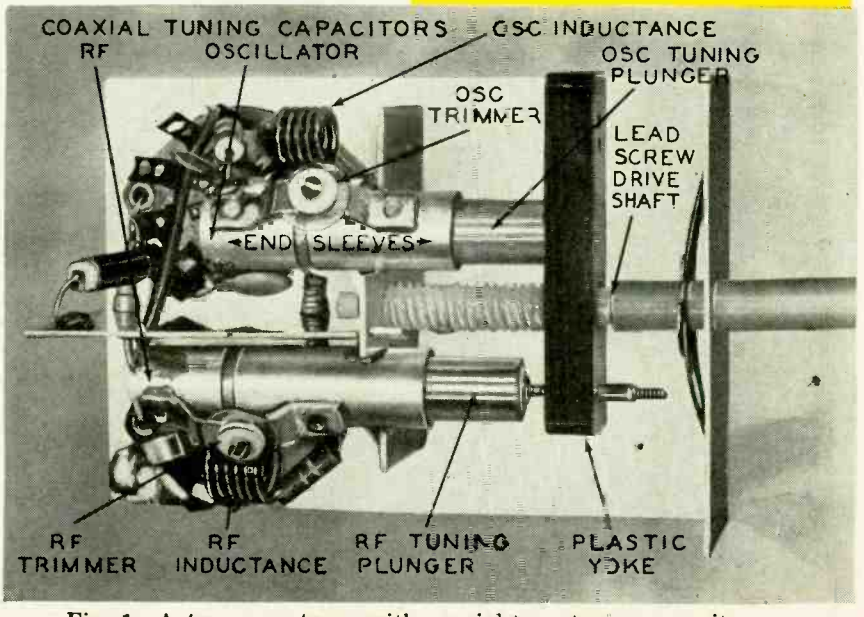


Fig. 1—A two-gang tuner with coaxial-type tuning capacitors.

* Vice president, Granco Products, Inc.

tube, serves as a transfer medium between the two end plates and increases the capacitance coupling as it engages more and more of the surface of the two end sleeves. The capacitance is thus varied smoothly over a wide range without any physical contact being made to either of the capacitor plates.

The range of capacitance change is controlled by the area of the capacitor plates and the thickness of the glass dielectric tube. The glass used has practically a zero temperature coefficient, resulting in oscillator frequency stability of better than 10 kc over the entire FM band. By making the metallic plunger fit precisely within the dielectric tube, permitting no side play, microphonics have been completely eliminated.

A lead-screw tuner drive provides sufficient vernier control (five complete turns tune the entire FM band) with no trace of annoying backlash. This is a positive, direct drive with the tuning shaft terminating directly in the tuning knob. No additional string, gear or pulley drives are used, completely eliminating the backlash problem normally found in such drives. This results in smooth tuning and permits easy selection of closely spaced stations.

Any number of these tuning elements may be ganged by parallel mounting on a metal base plate. The plungers are fastened to a plastic yoke, driven by the lead screw. Since plastic is used for both the lead screw and the yoke, frictional noises are eliminated completely. A two-gang version of this tuner is shown in Fig. 1. Note the small physical size and compact structure which permit bottom chassis mounting with extremely short lead connections to tube sockets. An accurate three-point tracking method is provided—trimmer capacitors to adjust the high-frequency end, tuning plunger positioning for the middle frequency and inductance adjustment for the low-frequency end.

The tuner uses a 6BA6 r.f. amplifier and a 12AT7 oscillator-mixer. Because of the extremely low-loss dielectric of the tuning elements, unusually high gain and oscillator stability are possible. The overall r.f. gain of this tuner is greater than 100 throughout the band. The high effective circuit Q made possible by the low-loss dielectric, and low radiation losses due to the small physical size of the oscillator tuning circuit elements, make the stability of this oscillator with line voltage change considerably better than that of conventional oscillator circuitry. Oscillator drift due to temperature effects is also extremely small, resulting in an oscillator stability equal if not superior to that of tuners with elaborate a.f.c. circuits. The net effect to the listener is one of no noticeable drift, with none of the strong-station pulling and rubbery feel of automatic frequency control.

FM receiver

The development of FM coaxial tuning has made possible the design of an FM receiver comparable in both size and price to AM receivers, without reducing the high-quality performance capabilities of FM. The growth of FM has been seriously hampered for a long time because of the large price gap between AM and FM receivers. One of the major objectives in the development of coaxial tuning for FM was to close this gap.

The schematic diagram of the Granco model 610 FM radio using coaxial tuning is shown in Fig. 2. This is a complete six-tube receiver with self-contained power supply, audio amplifier and loudspeaker. The unit is housed in a compact plastic cabinet no larger than an average AM radio. Sensitivity of better than 5 microvolts for 20-db quieting assures excellent performance in all FM reception areas with a built-in antenna. The audio amplifier with a negative feedback loop of over 10 db has a flat response from 70 to 15,000 cycles, with a maximum power output of 2 watts. Hum and noise level is more than 70 db below maximum output. A special 6-inch oval loudspeaker makes the front of the cabinet virtually "all speaker" (see photos) and results in a tonal reproduction range and a remarkable sensation of presence. The tuner, i.f. and detector response curves have been designed to suppress almost completely spurious sideband peaks, resulting in a "tuning feel" similar to that of an AM radio.

A ratio detector is used rather than a limiter discriminator to avoid objectionable interstation noise and harsh "breakouts" on weak signals. The two-stage audio amplifier is completely enclosed by a negative feedback loop from the voice coil to the input grid. Due to the shunt effect of the detector circuit at maximum and near maximum settings of the volume control, this negative feedback is considerably reduced, resulting in maximum audio gain for weak or low-deviation signals. Provision is made for connecting either the built-in line cord antenna or an external antenna. The excellent regulation of the selenium rectifier power supply makes possible a considerable increase in undistorted audio power. END

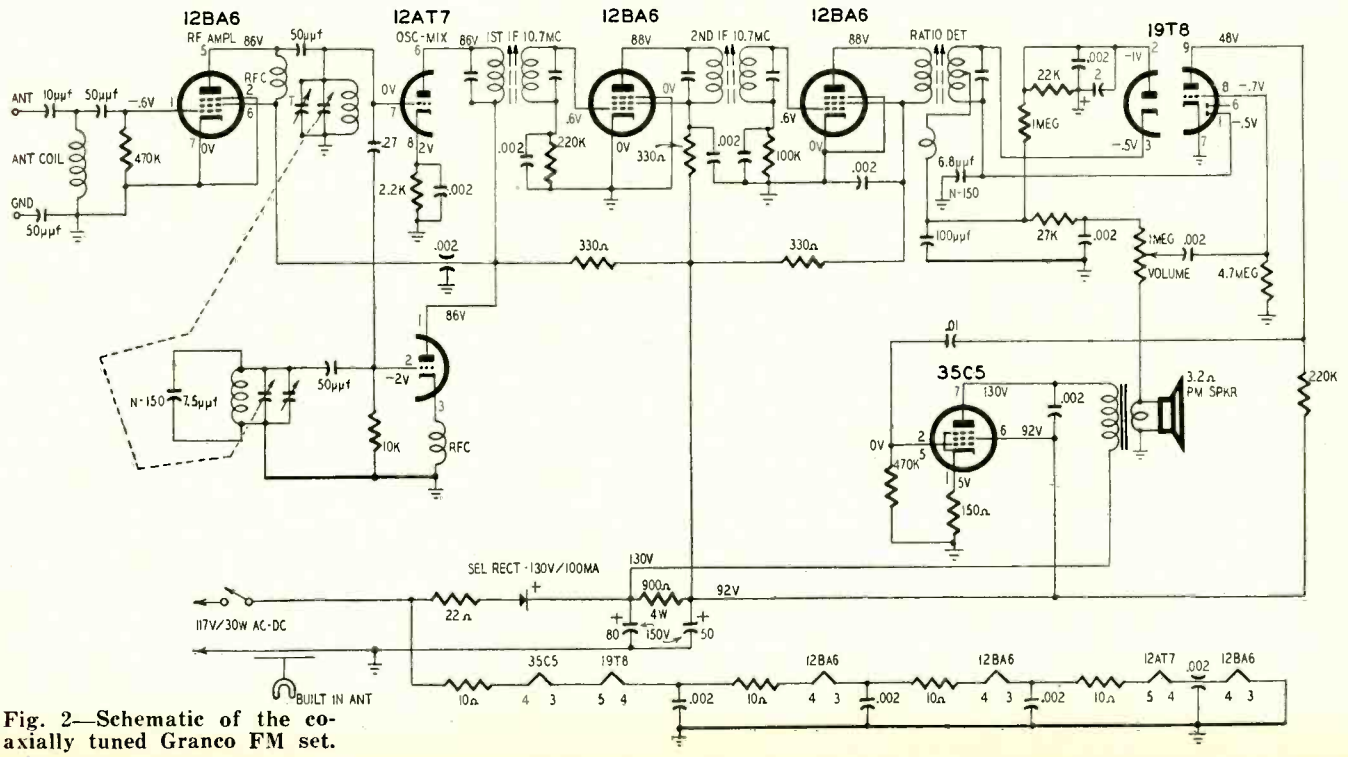


Fig. 2—Schematic of the coaxially tuned Granco FM set.

NEW LIGHT AMPLIFIERS

Interesting equipment recently developed for reproducing and controlling light.

By SOL HELLER

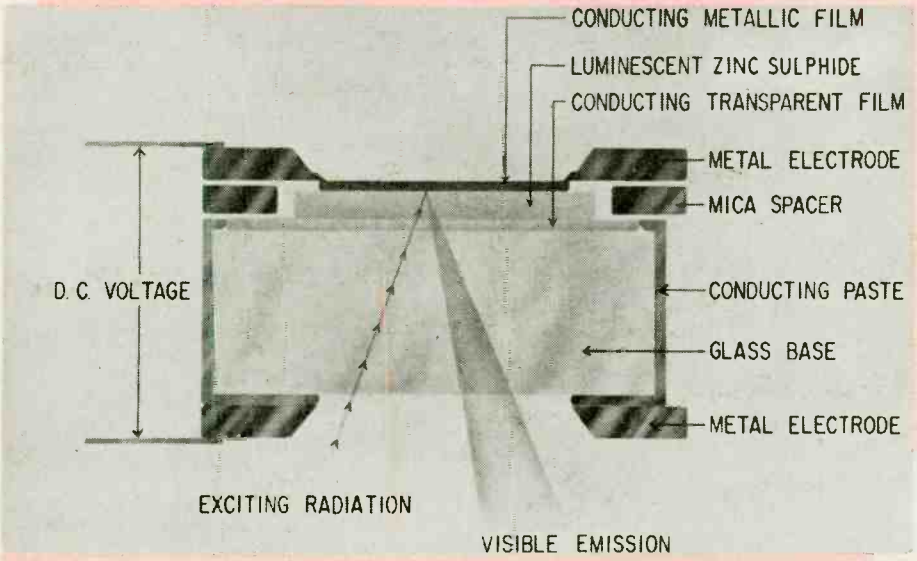


Fig. 1—Secondary electron emission causes direct amplification of light.

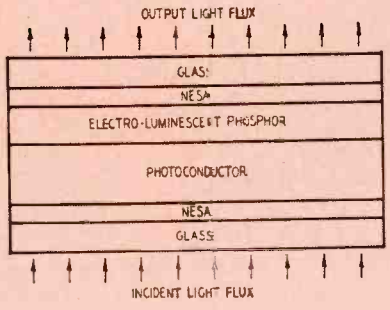


Fig. 2—A photoconductive amplifier.

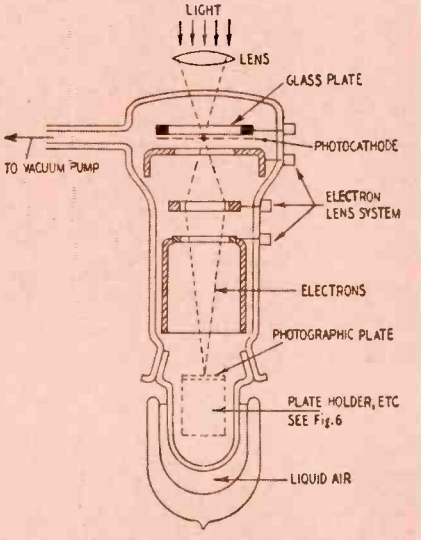


Fig. 4—The French electronic camera.

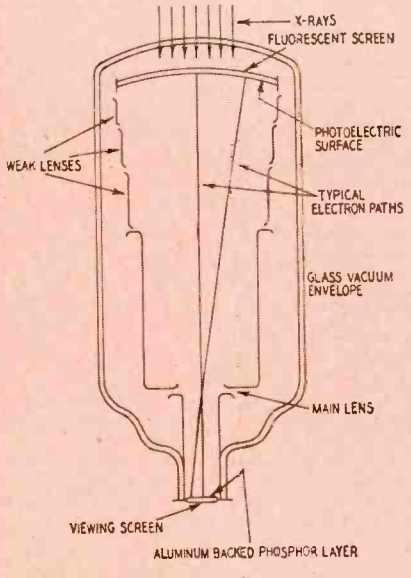


Fig. 3—Westinghouse image magnifier.

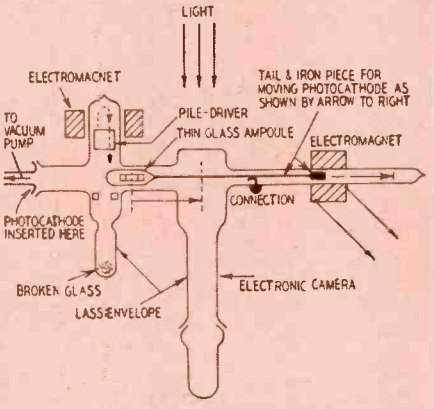


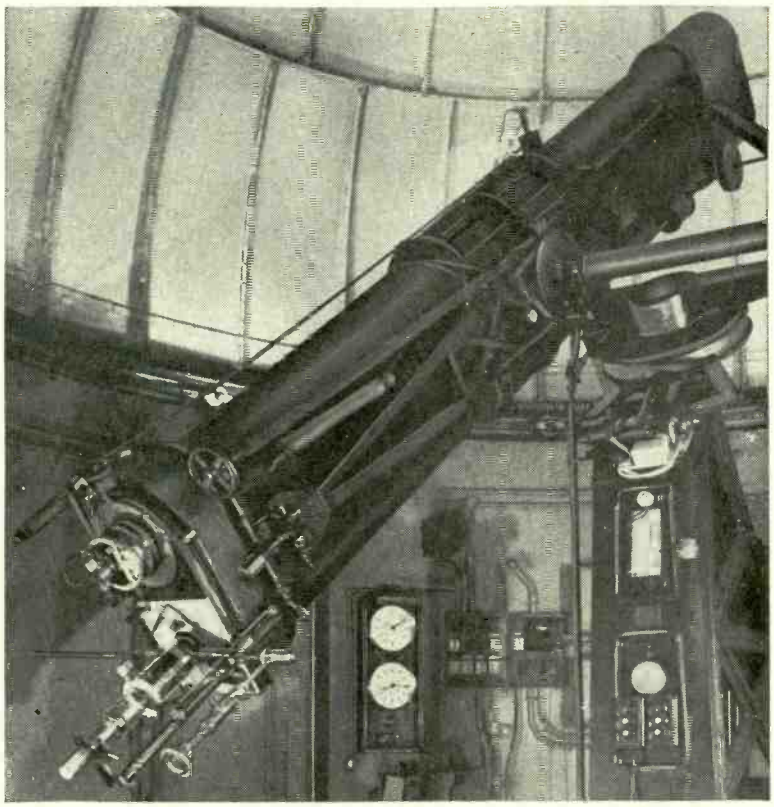
Fig. 5—Detail shows how photocathode is inserted in the electronic camera.

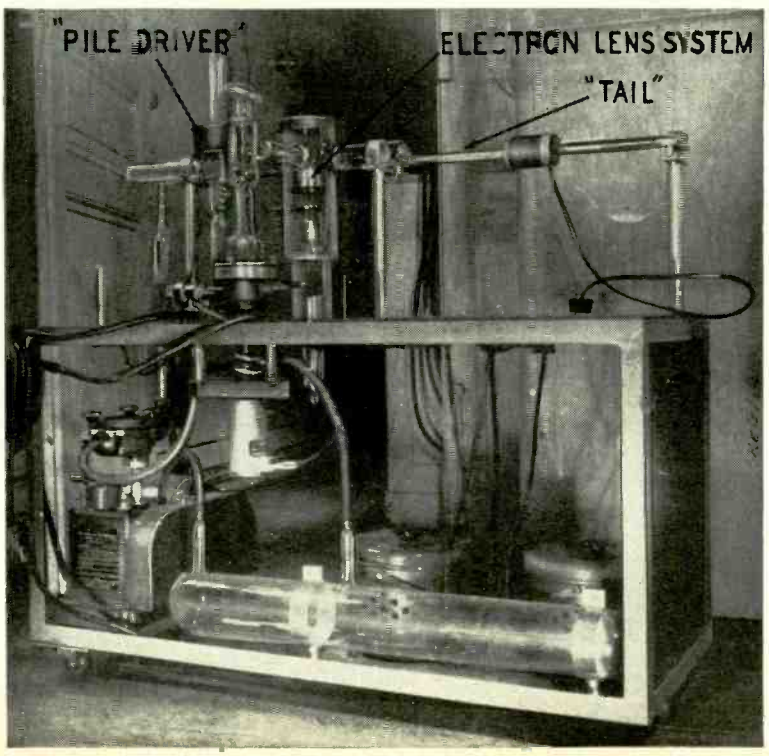
DIRECT amplification of light is arousing considerable interest these days. The development of such amplifiers has been ranked in significance with the invention of the three-element vacuum tube. Light amplifiers may have great importance in television, X-ray devices, astronomy and other applications. Picture-on-wall television has been predicted for the not-too-distant future.

General Electric's Research Laboratory in Schenectady, N. Y., recently demonstrated a light amplifier which achieves amplification in a simple phosphor film. It was described briefly on page 6 of the February, 1955, issue of RADIO-ELECTRONICS. A d.c. voltage of 100 is applied to a zinc sulfide layer which is exposed to X-rays or ultra-violet light. (See Fig. 1.) The resultant electric field around the sulfide layer increases its light output. For every photon of ultra-violet light striking the layer, 10 or more visible photons are emitted. The single phosphor layer thus acts as an image-intensifying screen, providing an amplification of 10.

The phosphor's emission when no light strikes it is negligible. The magnitude of its *electroluminescence*, or light output when exposed to an electric field, depends on the intensity of the light that strikes it. Light from the brightest areas of an image is amplified most; light from the darkest portions is amplified least. The result is that the contrast relations in the amplified image remain virtually unchanged (see photo).

Engineers at the Capehart-Farnsworth Co. recently described a light amplifier which uses ordinary light, instead of X-rays or ultra-violet rays. The unit (Fig. 2) contains two glass plates. Their inside surfaces have been





Top—Left—the fully amplified image; right—the image with low amplification.

Center—The French electronic camera mounted on large telescope.

Bottom—All the details of the electronic telescope camera can be seen in photograph.

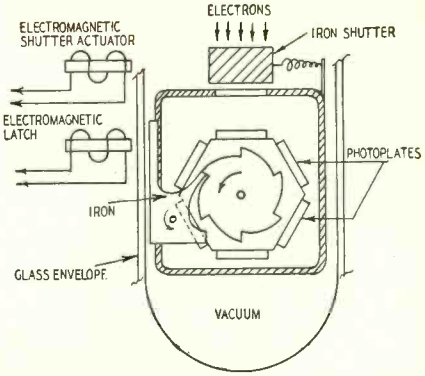


Fig. 6—Position of the plates. One photocathode makes several exposures.

made conductive by coating them with a transparent electroconductive layer called a Nesa. Between these coatings an electroluminescent phosphor and a photoconductive layer are placed. The phosphor luminesces if a strong alternating electric field is developed between its two surfaces. Such a field is produced by the application to the layers of Nesa of 600 to 800 volts, at a frequency between 60 and 3,000 cycles.

The Nesa coatings make it possible to apply a voltage between the layers of glass, permitting the development of the required electric field between them.

The applied voltage divides between the phosphor and the photoconductor. When light is not coming in, the impedance of the photoconductor is high. Most of the applied voltage is developed across it in consequence, leaving very little voltage for the phosphor and preventing luminescence. When light strikes any portion of the photoconductor, the impedance of that area goes down, permitting the phosphor to luminesce in proportion to the voltage reaching it.

The best value of intensification that has been obtained with the Capehart light amplifier is approximately 24.

Several years ago Westinghouse developed an image amplifier for use as an "X-ray telescope" (RADIO-ELECTRONICS, August, 1948). This device permits much more effective fluoroscopic examinations. Images of the internal organs of the patient under test are intensified 200 times or more.

Better perception of detail could also be obtained by increasing X-ray radiation; but since such radiation is limited by safety considerations, such a method is not feasible.

The light is amplified *after* the X-rays have passed through the patient's body. They strike a fluoroscopic screen in the special tube used as the amplifier (see Fig. 3), releasing electrons from a photoelectric surface on the screen.

These electrons are accelerated by a 30-kv potential and strike a second fluorescent screen hard enough to release much more light than the first screen produced. Note that this is a vacuum-tube light amplifier, not a solid-state one, like the preceding units.

A new electronic camera recently developed in France for telescopic photography uses an amplifier somewhat resembling the Westinghouse image amplifier. It is expected to reduce to about 4 minutes exposure times that are now as long as 6 to 8 hours. A description of it was sent to RADIO-ELECTRONICS by Mr. Bonhomme, editor of the French magazine *Télévision*, and the following is from his pen:

A French electronic telescope

The French equipment does not operate by multiplying electrons, but by speeding up electrons emitted when light strikes a photocathode. It was conceived in 1934 by Professor Lallemand and an early model was constructed in 1936 at Strasbourg. Interrupted by war, work was resumed in 1945, with the collaboration of Maurice Duchesne, and a second camera put into action in 1950. Several are now under construction.

The fundamental principles

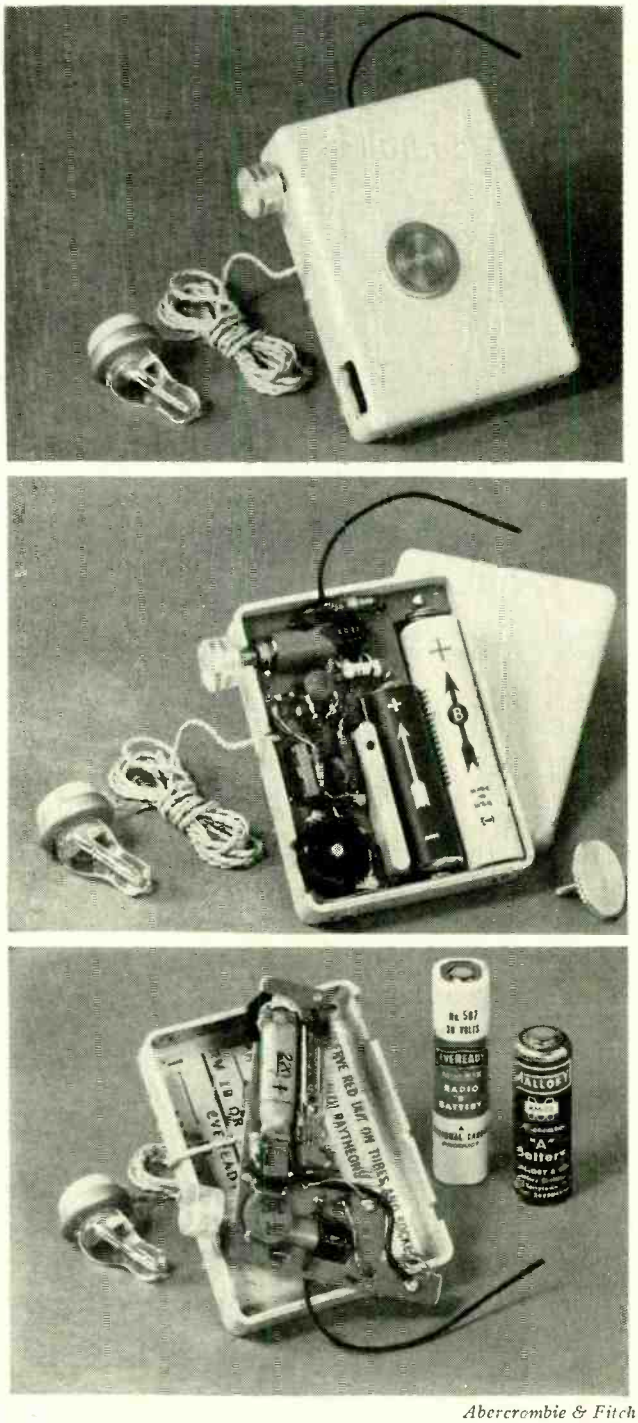
Fig. 4 is a simplified cross-section of the camera. Light is focused by an optical lens to form an image on the photocathode. Under the bombardment of photons, it emits electrons which are accelerated toward the photographic plate by a potential of 40,000 volts in the electron lens system seen in the figure. The electron lens forms a second image—electronic this time—on the sensitive surface of a photographic plate.

Here is the secret of the French electronic camera—it requires no reconversion of electrons to light. The electrons, having acquired great kinetic energy, impress the photographic emulsion directly. Light amplification of 100 times has been obtained and much better figures are expected in the near future.

Construction and operation

If the principle is relatively simple, actual construction is difficult. One problem is that the photocathode must be made in a vacuum and remain in one till it is used. But air must be admitted into the tube when the plates are introduced. That problem was solved as indicated in Fig. 5. The photocathode is a glass disc with metallized edges. On it is deposited—in a vacuum—a thin coat of cesium and antimony volatilized by r.f. heating. This process is performed in an ampoule of very thin glass (to be broken later). When the photocathode is formed, the ampoule is sealed and—attached to a long "tail" of magnetic material—placed in the camera tube in the position shown in the figure.

MINISCULE FM RECEIVER



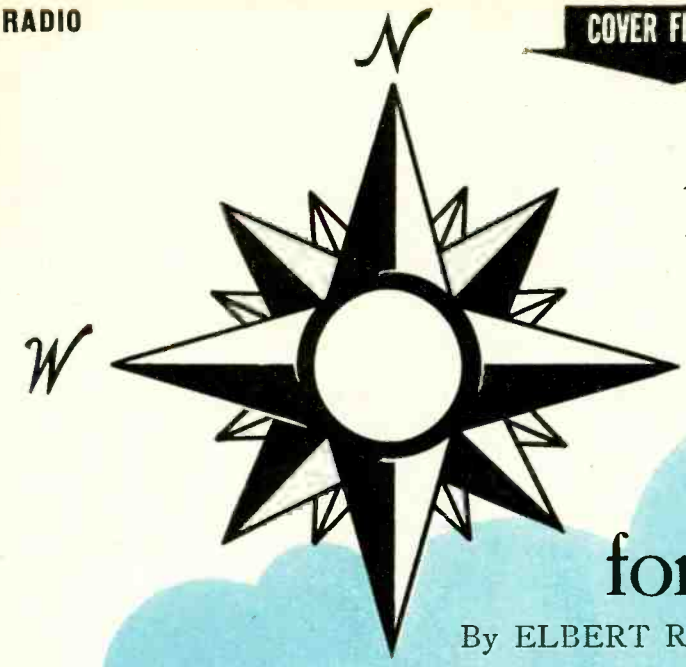
A recent development in the pocket-size radio field is this little FM receiver. Designed by Richard Florac, who developed a number of the receivers used in radiopaging systems, this little set uses two tubes and a 3-inch antenna. Results are surprisingly good, even in city surroundings, and when tried on the second floor of a building in a suburban area brought in several FM stations from considerable distances.

Abercrombie & Fitch

The photocathode is now positioned under a sort of little electric pile driver—an iron cylinder held up by an electromagnet. The camera is closed and pumped to a high vacuum. Then the current to the pile-driver magnet is cut and the iron cylinder falls, breaking the ampoule. A second magnet draws the photocathode into its proper position.

To permit several exposures with one photocathode, six plates are mounted around a shaft which is caused by a spring to turn in the direction of the arrow. (See Fig. 6.) An external electromagnet controls an escapement, permitting a 60° advance each time it is stepped. Another electromagnet operates a shutter, exposing each plate as desired. As a further precaution against "poisoning" the photocathode with ions released from the emulsion by electronic bombardment, the whole lower portion of the camera is refrigerated with liquid air. This maintains it at an extremely low temperature. END

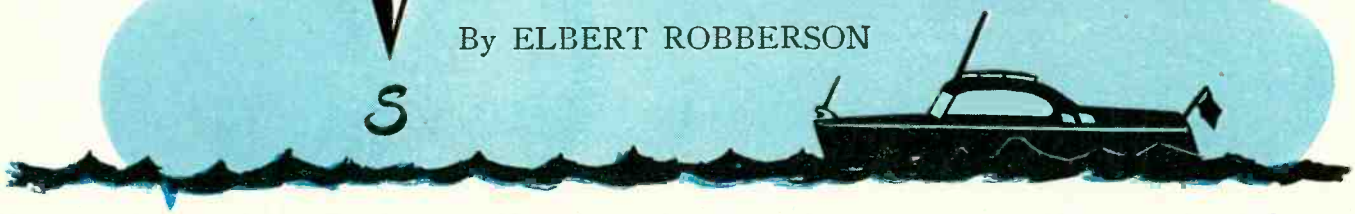
COVER FEATURE



An extremely useful marine instrument for small-boat owners

& DIRECTION FINDER for SMALL CRAFT

By ELBERT ROBBERSON



BOATING is the country's most rapidly growing sport, with some five million people due to go cruising this year. Some of them are going to get lost in the fog. To find their way back to port they will need a radio direction finder. No wonder that anyone who sets sail on anything deeper than a pond in a pasture wants one of these electronic "seeing-eyes."

But direction finders are expensive and, until recently, complicated and cumbersome affairs with a loop antenna, slip rings and a dozen confusing controls. However, by using the recently developed ferrite type antenna, radio-direction-finder design has been greatly simplified. You can build one and use it yourself or give it to a cruising friend, thus insuring yourself of a boating trip anytime you want. This model has been designed with the simplest of construction and can be made of surplus and junkbox parts. But it will give bearings as good as the fanciest job afloat.

There is nothing complicated about radio direction finding. All you do is to use the figure-eight response pattern of a loop antenna to determine a "line of position." Fig. 1 shows the pattern of both the old and new loops.

Contrary to communications-antenna operation, where the line of maximum response is used, the "null" or line of "no signal" is used in direction finding. It is sharper and easier to detect by ear than the center of the broad-nosed maximum-response part of the curve.

Adding a loop antenna to a radio receiver is all that is required for a rudimentary direction finder. Include a means for reading the vessel's compass heading and angular displacement of the transmitting station, and you have a full-fledged direction finder. In a compact design it is not necessary to rotate the loop. The entire set can be swiveled on a degree-calibrated rotary platform (see photos) to find the null line. I have used this method for a number of years with direction finders having both conventional and ferrite antennas, and at least one "old-line" manufacturer has recently come out with a commercial model using the principle.

Radio-beacon stations are tuned in conventionally, and the degree-marked compass rose (seen on the base) is set to the same heading as the boat's steering compass. The equipment is then rotated until the signal fades out. On this null setting, the station will have a compass bearing as indicated by the arrow under the tuning knob. This bearing line can be laid out, running through the transmitting station, on a chart to establish a line of position.

A similar bearing taken on a second station will provide another line of position. The point where the lines intersect is the boat's position or a "fix." Using this method there will be no trouble from reciprocal (two-way) bearings due to the bidirectional characteristic of loop reception.

Construction

The carpentry work requires nothing more complicated than a saw, drill and some sandpaper. The detailed plans of Figs. 2 and 3 and the photographs show the layout.

The base and rotating platform are made of ⅝-inch plywood, cut square and well sanded. Bore the holes accurately. Although a conventional brace and bit may be used, the newer high-speed flat bits make a neater hole. In any case, it is important that the bottoms of the 1-inch holes be finished off square and smooth, using a chisel if necessary.

Install rubber feet on the four corners of the bottom piece, then proceed with the assembly as shown in the photographs.

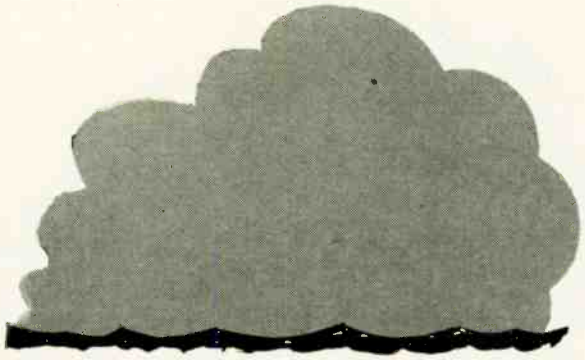
The plastic rose can be obtained from Government surplus or marine-hardware outlets. The center hole is ordinarily about ⅜ inch. With machine tools, this may be enlarged to a free fit on the Bakelite disc by cutting on a lathe. Other ways of making this hole are with a fly-cutter, a "hole saw" or a hand-operated coping saw and a smooth half-round file. The turning platform does not rest on the plastic compass rose but bears on the ⅛-inch Bakelite disc. This is important, because it must be possible to rotate the rose and the platform independently without any drag between them.

The final result is a base and rotary platform which may be stained, varnished or left "bright." The assembly should be tightened just enough to prevent rocking of the platform, but must turn freely.

In fastening the cabinet use marine or waterproof glue—made by mixing a powder with a small amount of cold water—and only enough small brads to keep the parts aligned until they set.

In finishing the cabinet do not use paint having metallic pigment, since there is some possibility that it might affect loop operation. Use a stain, shellac or varnish.

Cut the metal panel from 1/16-inch aluminum with tin shears or a metal-cutting coping-saw blade. File and sand the edges smooth and drill the holes for the jack and the controls and for securing to base. If the finish of the metal has been damaged by handling or toolwork, a fair satin finish may be



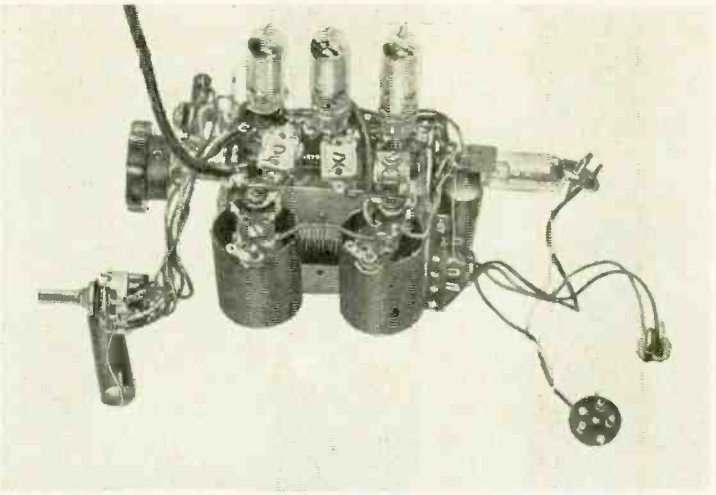
restored by boiling the panel in a strong solution of *Oakite* or, if you are very careful not to spill any or get into the fumes, a solution of household lye. Afterward, wash the panel in water and put on a coat of clear lacquer to prevent further marking.

Fig. 4 shows the schematic diagram of the direction finder. A minimum number of parts are used and the circuit is straightforward and conventional.

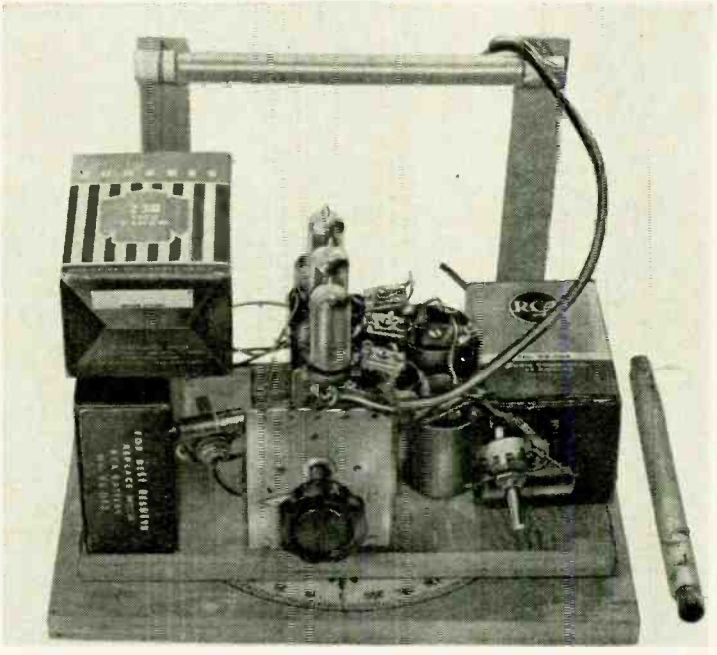
As a matter of convenience, the audio amplifier can be coupled to the detector with a printed circuit instead of the separate resistors and capacitor shown on the diagram. In this case, the Centralab PC-71 *Couplate* can be used in place of C1, R1 and R2.

The most important single component is the loop. This is wound on a broadcast-band ferrite core from which the original winding is removed. The core shown was obtained from surplus stock and measures ½ inch in diameter and 8 inches in length. The winding consists of 150 turns of No. 24 polyethylene-insulated solid copper wire, closewound with the ends secured by a wrapping of Scotch tape. Other size forms may be used, but will require some experimenting in the number of turns and wire size for proper frequency coverage. The required inductance is 1.3 millihenries, so the maximum shunt capacitance available in the circuit will resonate the loop at about 220 kc.

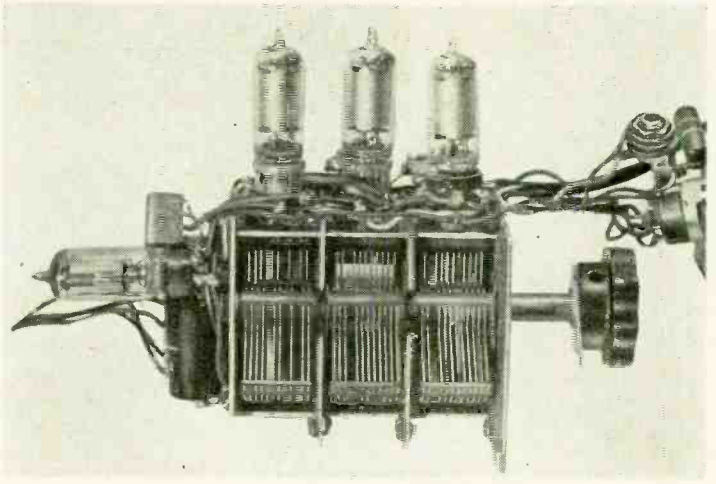
A unique form of mechanical construction is used in that the frame of the tuning capacitor is the chassis on which all other parts are mounted. This eliminates much of the troublesome metal work otherwise required and takes the fewest tools. Some old three-gang broadcast-radio tuning capacitors



View of chassis shows trimmers.



Unit before installation.



The ganged tuning capacitor.

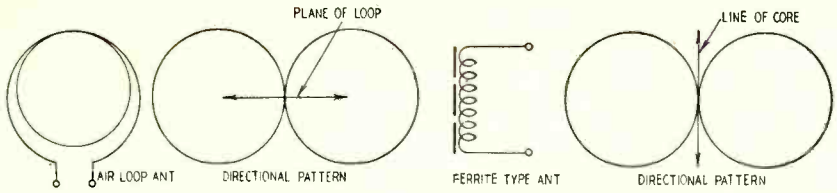


Fig. 1—The air loop and ferrite antennas, and their directional patterns.

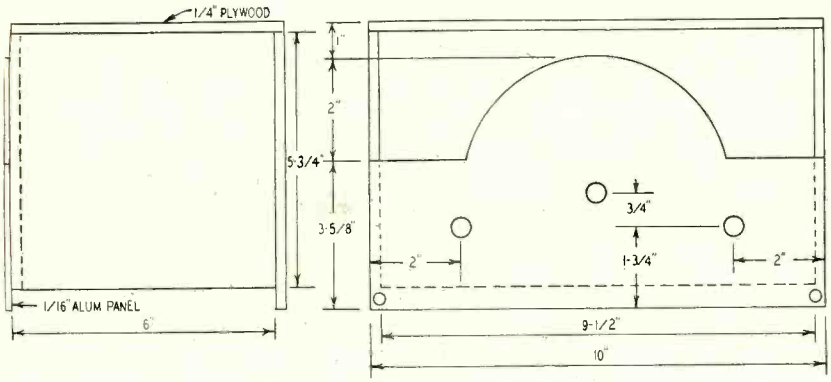
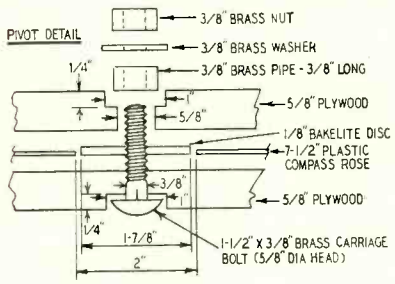


Fig. 2—Cabinet and panel layout.

have enough spare room and enough extra holes sprinkled about the frame to mount everything without any drilling or cutting, except possibly the tapping of some of the holes. Of course, a small aluminum shelf or chassis secured to the tuning capacitor could also be used. Tube sockets and r.f. transformers could then be mounted in the conventional way.

To make the set without a conventional chassis, as the author did, follow the plan shown in Fig. 5. The tube sockets are fastened to tapped holes in the capacitor frame by 6-32 flathead brass machine screws, and held off the proper distance by a simple ½-inch spacer cut from aluminum or copper tubing. Tube sockets with an adequate center hole must be used. The 6-32 screw heads may be filed down if necessary to clear the tube base and pins.

Attach a six-terminal strip to the rear of the capacitor and the r.f. transformers to the blank side, using small aluminum angle brackets for fastening. The chassis is now ready for wiring.



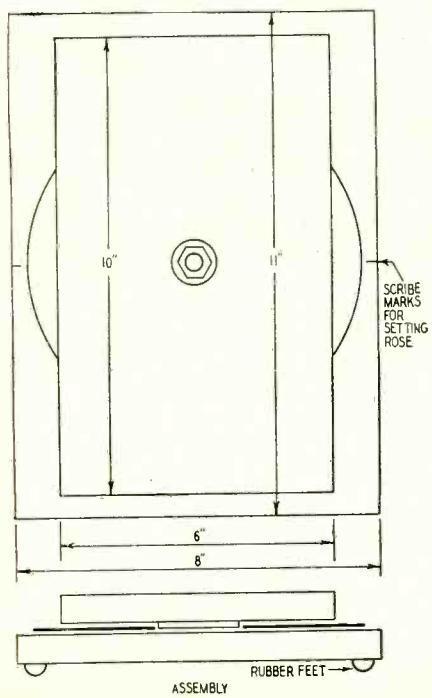


Fig. 3—The platform and base layout.

Wiring and adjustment

Make up battery cables with plugs and connect them to the indicated terminals. The fourth terminal on the strip is used as a tie point for C2.

The phone jack and sensitivity controls are made as subassemblies, held temporarily by their cables. The two r.f. transformers are wired into the circuit with the shortest possible leads. Isolate the input from the output wires.

The filament circuit is grounded on one side, so put jumpers to ground on pin 1 or 5 of the tube sockets. The A plus side is wired from the third terminal of the strip to the on–off switch, then from socket to socket on the pin-7 terminals.

Before the equipment is installed in the case it should be aligned. Connect the ferrite type antenna to the first tuning-capacitor stator and input-tube grid with an 8-inch length of RG/59-U or similar cable. Set the tuning capacitor at midpoint and tune the signal generator (or grid dip oscillator) to 350 kc. Couple the generator to the primary of the detector transformer with a 100-$\mu\mu$f capacitor and adjust the detector trimmer capacitors for maximum-signal output.

Couple the generator to the first r.f. transformer primary and repeat the tuning operation on this stage.

To couple into the first stage, connect the signal-generator output to a one-turn open loop about a foot in diameter and suspend it near the direction-finder loop. The generator loop can easily be made from a shielded lead by using a short clip lead, clipping the hot generator connection back to the grounding

Parts for direction finder

Resistors: 1—330, 1—33,000, 1—220,000, 1—470,000; 1—3.3 megohms, ½ watt; 1—50,000-ohm potentiometer (with switch).

Capacitors: 1—250 $\mu\mu$f, 2—.002 μf, 1—.01 μf, 1—0.25 μf, 1—1 μf; 3—365-$\mu\mu$f, variable, with trimmer, ganged.

Miscellaneous: 3—1U4; 1—1S4; 1—phone jack; 1—loop antenna or ferrite type antenna; 2—r.f. transformers, 140–425 kc (J. W. Miller X-320-RF or equivalent); 1—d.p.s.t. switch (on sensitivity control); 1—battery, 1.5 volts (RCA VS-004 or equivalent); 2—batteries, 45 volts (Burgess Z-30 or equivalent); 4—tube sockets; 1—4-terminal strip; 2—battery plugs for 45-volt battery; 1—battery plug for 1.5-volt battery.

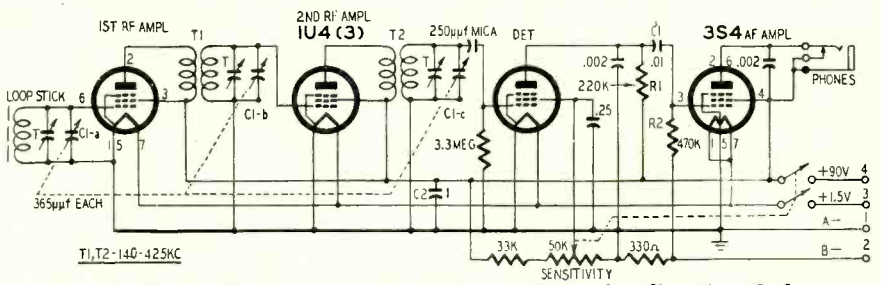


Fig. 4—Schematic diagram and values of the radio direction finder.

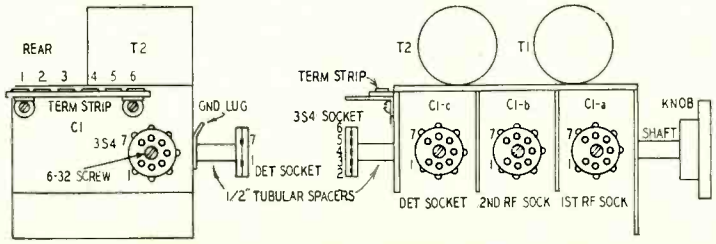


Fig. 5—Diagram shows mechanical layout of the tuning capacitor chassis.

shield. Then tune the loop-circuit trimmer.

Make sure the loop circuit is on the nose. One of the other stages may be slightly off without any more harmful effect than slight loss of sensitivity or selectivity, but the loop circuit being off-frequency can lead to undesirable antenna effect, resulting in poor signal nulls and possible erratic bearings.

The marine-beacon band lies between 280 and 314 kc, so concentrate on peaking this portion of the tuning range. If tracking falls off, tune so the poor spots fall outside this band, where the effect will be unimportant.

Oscillation may occur with the sensitivity control fully advanced. This can be cured by dressing all leads carrying r.f. current, by using bypass capacitors at the screen of the r.f. amplifiers or by placing a shield between stages. As a final resort, a decoupling resistor and capacitor in the B plus lead to one or more of the r.f. stages should be tried.

Some builders may desire enough regeneration in the set to give oscillations at maximum sensitivity to permit reception of CW (the long-wave ship-telegraph stations will be within the frequency range of the equipment) and help locate weak stations. Bunching a couple of grid and plate leads should be sufficient to give the desired feedback.

After tuning, the equipment can be inserted in the cabinet from the rear, the metal panel installed and the assemblies secured together by the shaft-collar nuts. Since the metal panel is grounded, insulating washers must be used with the phone jack.

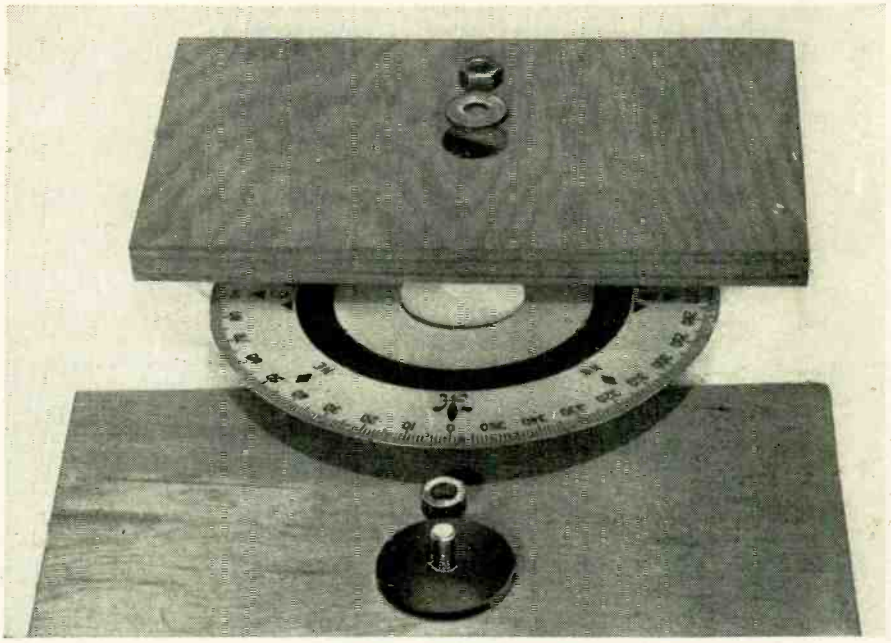
The metal panel will project ⅝ inch below the front of the cabinet. This is normal. Set the assembly on the base and fasten the two together with screws through the bottom corner holes of the panel.

Place the batteries in the cabinet. The loop should then be mounted inside the top of the cabinet at the rear by a small fiber strap at each end. Arrange the loop and its insulated fastening so the ferrite type antenna is not near any metal (this will lower its efficiency) and is securely held in line with the rear of the cabinet. Maintenance of this alignment is important to bearing accuracy.

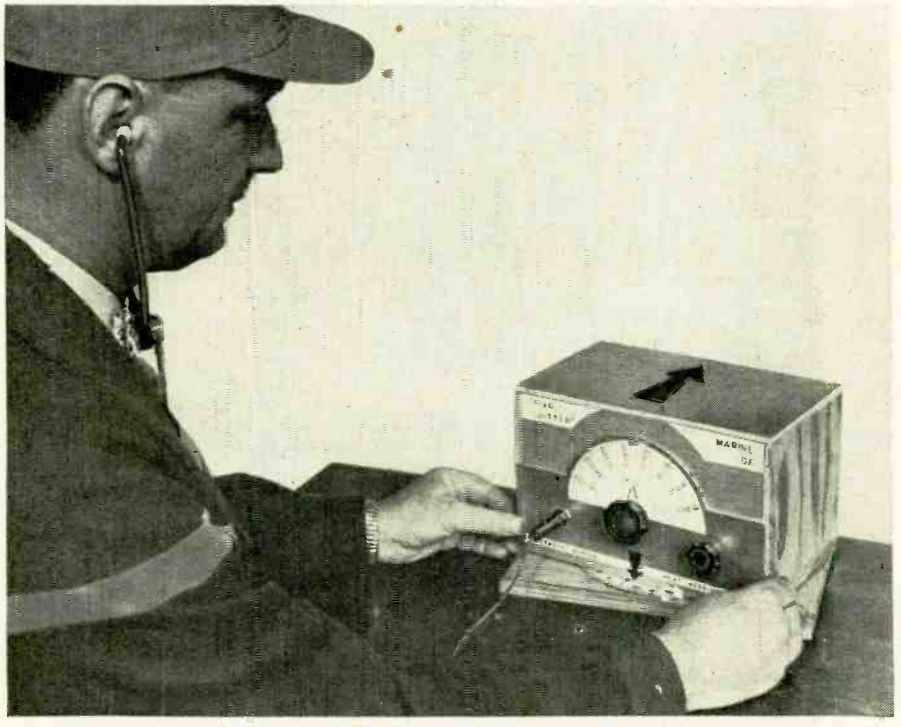
The back cover can now be put on with small screws into both the cabinet ends and the base board. Install the knobs and the equipment is ready for calibration.

Directly below the center of the dial, cement a cardboard or plastic arrow for the bearing indicator. Above the tuning knob, cement a plastic or cardboard scale, and also any desired ornamentation or identification.

Calibration consists simply of finding and marking the dial locations of the different key frequencies within range of the set. Use of a lettering guide will result in a professional-looking dial. A coat of clear lacquer will preserve the markings.



Assembling the direction-finder base. Bolt and Bakelite disc are in position.



The completed radio direction finder—it must turn freely on the disc.

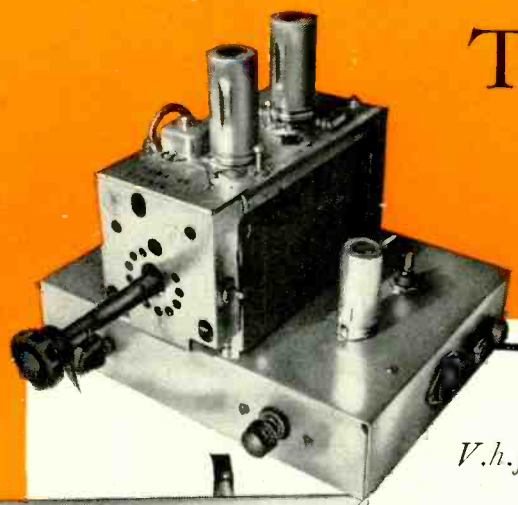
The U. S. Coast Guard issues free charts of both coasts and the Great Lakes, giving the location, frequencies and operation schedule of all marine-beacon stations. Study these charts to know when which stations may be picked up.

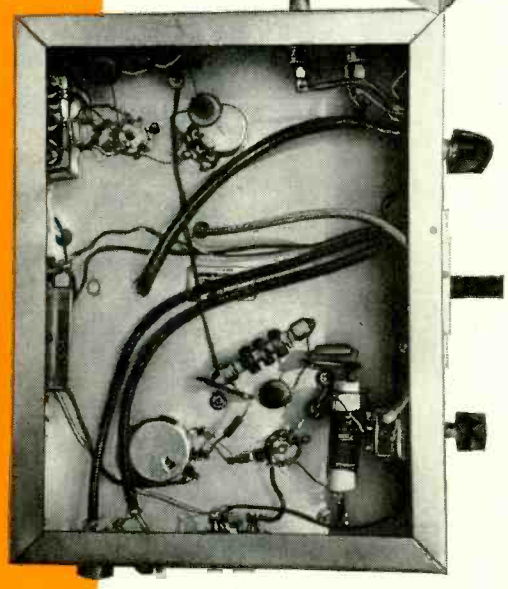
As you tune over the band, a number of other stations will be heard, most of them transmitting two-tone A-N code signals (dot-dash or dash-dot, depending upon your location). These are airways-range signals which may be used for navigation and to obtain voice flying-weather information.

When the equipment is used aboard a boat, it is necessary to line up the base, either fore and aft or at right angles to the keel, with the beam. Tune in a station and turn the direction finder until you find the null. Through the center line of the direction finder runs the line of the station. Fair weather or foul, if you run down this line, you'll get to the station. Or, with another bearing on a different station, the crossing of the lines on the chart will show exactly where you are.

You don't need to get lost with a radio direction finder. END

TV Sound in Your CAR





V.h.f. front end and simple circuit provide audio for mobile use

By BRUCE MORRISSETTE

Above, the complete TV sound tuner chassis. Left, Underchassis arrangement — few parts permit simple layout.

THE nation's approximately 60,000,000 cars, with their radios, constitute a sort of last frontier for television. Technical difficulties and the danger of distracting the driver have effectively sealed off this "captive audience" to AM broadcasts. But given an opportunity to listen to TV *sound* in their cars, most drivers will follow the sound portions of their favorite TV programs and in preference to AM radio broadcasts. Two familiar morning shows of NBC and CBS, for example, provide superior entertainment while driving to work. Children will listen with fascinated attention not only to Howdy Doody and Captain Video, but even to the soundtrack of cowboy movies. For the coming generation, TV sound in the car is a natural.

Using one of several v.h.f. television tuners currently available at bargain prices, an inexpensive but excellent TV sound receiver (see photo) can be built. Using the power supply, audio system and antenna of the car radio, this TV sound tuner enables the driver to switch back and forth from AM to TV and to change TV channels with the flick of a wrist. The chassis is installed, with tubes pointing down, under the car radio box and fastened to it by spade lugs or brackets.

Circuit and Construction

In theory any v.h.f. tuner may be used for the sound receiver, but in practice it is advisable to pick one with the following characteristics: Well shielded, it should be physically arranged so that it can be mounted on the chassis easily. It should have individually adjustable channel tuning slugs accessible from the front, so that each may be aligned separately for switch tuning (no one wants to bother with fine tuning while driving). It should have a 6-volt filament heater system (no series heaters, unless you have a 12-volt car battery). It should have a low-impedance, shielded output coupling link—which means that the mixer tube must have a transformer in its plate circuit. Check this item carefully since many tuners depend on an impedance not mounted on the tuner but located in the first i.f. stage. If you want to use such a tuner, you will have to install your own output transformer (such as the Miller No. 6215 for 41 mc). Lastly, if you wish to follow the exact specifications of the detector described in this article, the tuner should be designed for a 41.25-mc sound i.f. If you wish to use a tuner in the 22-mc range, you will have to experiment with increased turns on the detector tuning coil until it covers the desired lower frequency.

The RCA KRK22A tuner, purchased from a mail-order house complete with tubes for $5.95, answers all these requirements. It is a "hot" tuner with a cascode input stage, high gain, low noise and excellent oscillator stability. To prepare it for use, remove the elevator transformer which protrudes from the back, opening the tuner cover to unsolder its output wire from a switch point. This point becomes the antenna input for our circuit. Solder a length of RG-59/U to this point and bring it down through the bottom tuner cover (drill a hole) and through the chassis to connect to the function switch antenna section. Double the i.f. output shielded wire back through one of the holes in the side of the tuner cover, and bring it down likewise through holes in the bottom of the tuner and top of the chassis.

Secure the tuner to the chassis by three mounting holes already provided for self-tapping screws. The heater, B plus and a.g.c. terminals on the back of the tuner are easily recognizable; if in doubt, check the circuit. (Rider's TV Manual, Volume 12, page 49, has a full schematic of the KRK22A.) Ground the green a.g.c. wire and bring the heater and B plus wires from the tuner down through a hole in the top of the chassis (use a grommet) to the appropriate tie points below.

Fig. 1 shows the circuit of the detector and audio amplifier stages which are built on the 9 x 7 x 2-inch aluminum chassis to which the tuner is bolted. The shielded i.f. output cable from the tuner is brought to a two-turn coupling link spaced about ½ inch from the grid end of the detector tuning coil. This coil is wound with 26 turns of No. 20 enameled wire on any ½ inch diameter form, in this case a short length of rubber hose found in the junkbox. A miniature 1- to 5-$\mu\mu$f variable capacitor mounted ahead of the tuning coil on the

front lip of the chassis permits setting the detector frequency to exactly 41.25 mc. Ordinarily this setting is not changed once it has been properly made.

The detector works on the principle of regenerative slope detection of the FM audio TV carrier, and sound quality is a function of correct slope tuning. A few minutes' experience will teach you all about such tuning and develop your judgment of audio fidelity, which at the best setting is really excellent. Since the 250,000-ohm potentiometer in the 6C4 plate circuit determines the amount of regeneration, and hence the audio quality, it must be carefully set. The best position is a few volts above the point where there is no regeneration. Set it while listening to the hiss on a vacant channel. When a program is tuned in, the hiss will disappear. The closer the regeneration is set to the threshold level, the greater the amplification; but motion of the car will cause a swishing variation in volume if the detector is left in too sensitive a condition. At the right point, a.v.c. action will hold the sound level practically constant.

Once set, the regeneration control need not be touched; hence it is located on top of the chassis behind the 6C4. Incidentally, since the regenerative detector is not coupled to the antenna and works in an enclosed metal box (when the TV sound chassis is attached to the car radio), there is no reradiation and absolutely no interference problem.

Audio is taken from the plate circuit of the detector and amplified by a 6AK5 pentode amplifier with a 250,000-ohm volume control in the grid circuit. This control, mounted on top of the chassis, permits setting the TV sound output of the tuner so that programs have the same average volume level as local AM broadcasts.

A three-pole two-position rotary AM-TV switch mounted on the front panel transfers power, audio and antenna to the correct points for broadcast or television sound. The power plug (Fig. 2) is inserted into the five-prong socket (see photo) located next to the microphone type audio connectors. (This arrangement may cause a shock or a short circuit if the plug comes loose while the receiver is turned on. Avoid this by using a female connector on the end of the power cable and a male connector on the TV sound tuner chassis.—*Editor*) One of these (J3) receives the detector output from the car radio; the other (J4) feeds audio from the tuner chassis to the radio audio amplifier. The regular car antenna (which functions surprisingly well on TV) plugs into J1. A short shielded jumper fitted with the correct plugs connects from J2 to the radio antenna input socket. When the switch is turned to TV, plate power is applied to the TV chassis, while audio from the 6AK5 is fed to the radio amplifier, and the antenna is connected to the TV tuner. Heaters are left on standby (lighted) whenever the car radio is on, assuring instant TV sound when the AM-TV switch is thrown to TV.

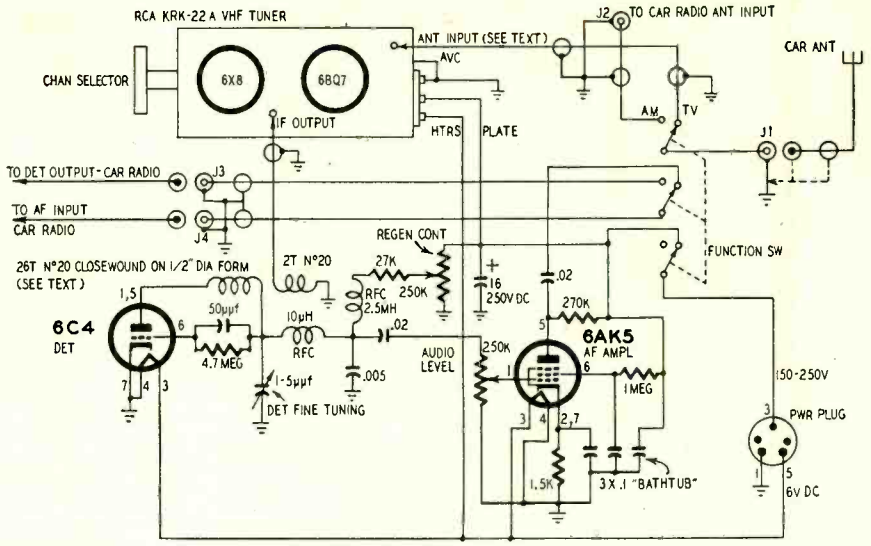


Fig. 1—Diagram shows schematic of detector and audio amplifier stages.

Figs. 2 and 3 show the simple connections made inside the radio to prepare it for use with the TV sound tuner. Most modern car receivers are not too difficult to remove, and it is not necessary to consult a schematic of the circuit to locate the points on the diagrams. Unsolder the connection to the high (maximum clockwise) side of the car volume control, and connect and bring out the shielded microphone cable as indicated, drilling holes if necessary. The power-supply plug has three wires braided together: one grounded, one connected to the live side of the battery at a convenient tube socket and the third soldered to a convenient B plus point, preferably near the output of the power-supply filter. Look for red wires carrying B plus and trace out a likely looking point or measure it with a d.c. voltmeter. Any voltage over 100 will do—most car radios supply between 150 and 200 volts at the output filter capacitor.

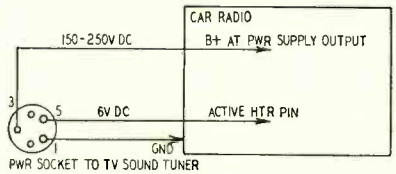


Fig. 2—The power plug connections.

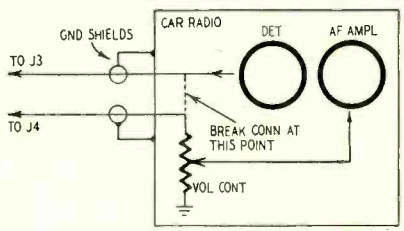


Fig. 3—Diagram shows method of bringing out shielded leads to TV tuner.

Testing and adjustment

If a bench power supply is available, test and adjust the TV sound chassis indoors. This will allow you to adjust the regeneration, detector fine tuning and TV channel oscillator screws to near optimum position conveniently. A 3-foot length of wire inserted in J1 will serve as a temporary antenna and any audio amplifier connected to J4 will reproduce the sound. Spend a little time investigating the various settings of the regeneration and detector fine-tuning controls. The fine-tuning shaft of the KRK22A may be used, though when the tuner is installed in the car you will want the TV channels to snap into tune. So set the tuner fine-tuning shaft to mid-position and adjust all channel slugs correctly.

Mount the chassis under the car radio, or elsewhere if space does not permit. If spade lugs are installed on the bottom of the radio to fit the edges of the tuner chassis exactly, self-tapping screws may be inserted, giving a very convenient assembly. Connect power, audio and antenna leads, turn on the radio and switch the tuner to TV. Touch up the various controls while the car is parked—inside the garage, if you like. Switch from TV to AM and set the 6AK5 volume control to give equal sound from broadcast and television stations. Try all the channels functioning in your vicinity and touch up the channel slugs so that each is in tune as you turn the selector shaft. Antenna length may be changed to favor any weak station. Then try driving around with the TV sound playing. Listen for any swishing and correct it by backing the regeneration control off a little. Adjust audio quality with the fine-tuning capacitor. END

Parts for TV sound tuner

Resistors: 1—1,500, 1—27,000, 1—270,000, 1—megohm, 1—4.7 megohms, ½ watt; 2—250,000-ohm potentiometers.

Capacitors: 1—50 µµf, 1—.005 µf, 2—.02 µf, 1—0.1-0.1-0.1 µf (bathtub type); 1—16 µf, 250 volts, electrolytic; 1—1-5 µµf, variable.

Miscellaneous: 1—6C4; 1—shield and socket for 6C4; 1—6AK5; 1—socket and shield for 6AK5; 1—coil, detector plate (see text); 1—coil, i.f. output (see text); 1—coil, 10 µh; 1—coil, 2.5 mh; 1—power socket and plug; 1—3-position double-pole rotary switch; 1—tuner (see text); 1—length of RG-59/U cable; 1—chassis; 2—microphone type jacks; 2—jacks for antenna inputs.

REMOTE-CONTROLLED GARAGE DOORS

A new field opens for the service technician; circuitry and installation of Perma-Power RC-101

By ROBERT F. SCOTT
TECHNICAL EDITOR

REMOTE-controlled garage door operators have become increasingly popular during the building boom of the last few years. They are now included as standard equipment along with refrigerators, washers, dryers and other modern conveniences in many new housing developments. There are a number of methods of controlling these door-operating mechanisms from remote points. Some are controlled electrically; others use electronic controls. The ambitious service technician would be well advised to familiarize himself with the different types and consider their installation and maintenance as an added source of income.

The nonelectronic type of remote controls generally consists of a key-operated switch mounted on a post alongside the driveway; the garage door can be opened or closed without leaving the car. A second kind uses a service-station type pressure switch that operates when the car passes over an airtight hose across the driveway. The hose method has several disadvantages. It requires frequent replacement because of wear and deterioration through constant exposure to the weather. Too, it is a visible invitation to prowlers and thieves and is an "attractive nuisance" to playful children who enjoy watching the door open and close as they jump on the hose.

Electronic systems include those operated by electric eyes, ultrasonic signals, induction currents and radio. Photoelectric systems are of two types. One operates when the car's headlamps shine on a photoelectric tube; the other operates by breaking a light beam falling on a phototube. Photoelectric systems are also invitations to children and prowlers.

Ultrasonic systems use a high-frequency tone above the limit of human audibility. These are often falsely triggered by ultrasonic noises from "silent" dog whistles, high-speed planes, fire and emergency sirens, and even the jangling of a bunch of keys.

The induction system uses induction currents with a receiver loop buried in the driveway and a similar transmitting loop suspended below the car. For successful operation, the car must be positioned so the transmitting loop is within a few feet of or directly over the buried loop.

Installing this system under a surfaced driveway can be expensive. Similarly, any defect in the pickup loop or its connecting cable can be troublesome for the technician and expensive for the owner.

Radio-controlled types are the most attractive to the prospective customer and are easiest to install and maintain. Several such systems on the market operate in the upper end of the v.h.f. TV band—usually between channels 10 and 13. These can cause considerable trouble for the distributor and service

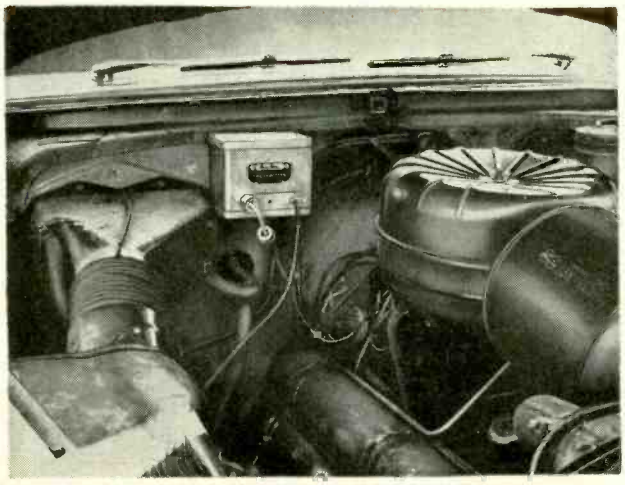


Fig. 1—Transmitter mounted in car.

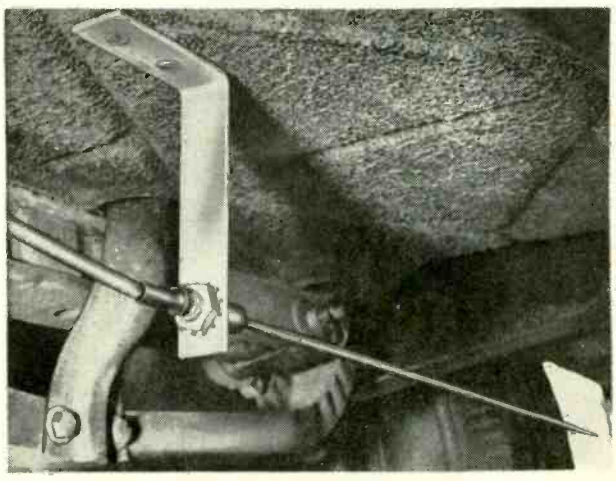
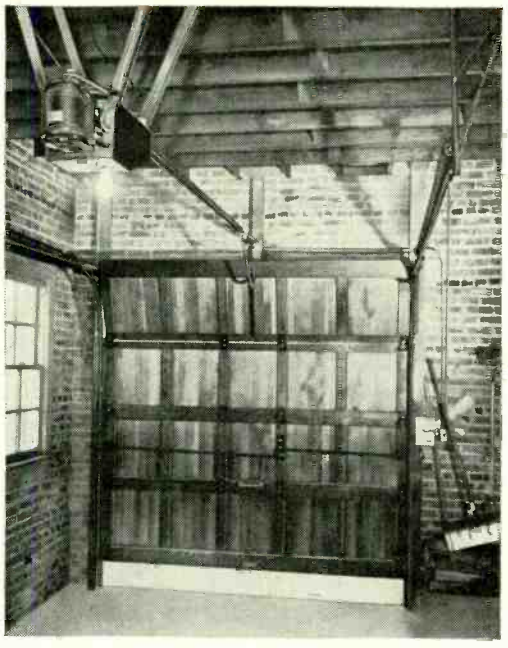
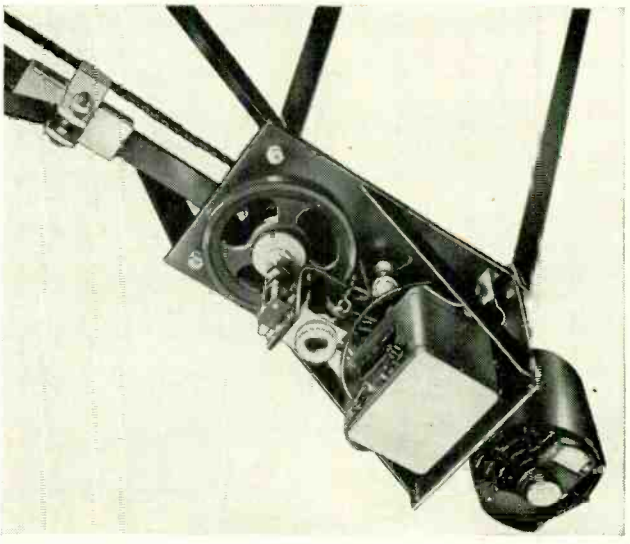


Fig. 2—Transmitter antenna mounting.



Left, completed installation of operator in garage.

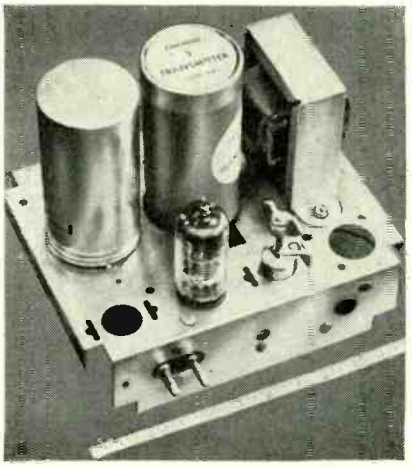


Above, Receiving unit is installed in the operator.

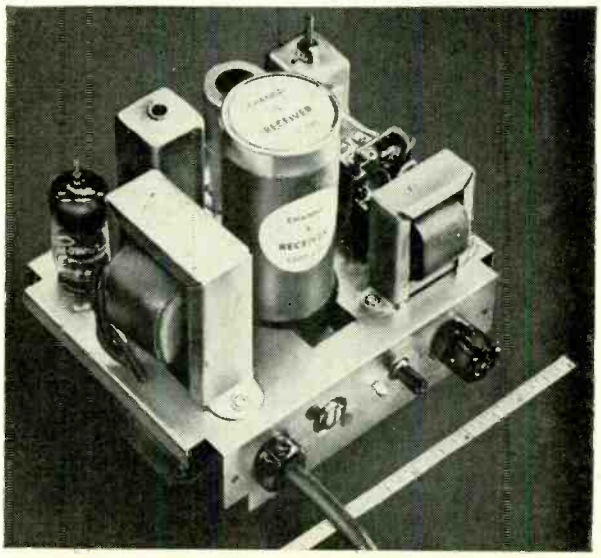
technician. The radiation from super-regenerative receivers is a continuous source of interference to TV and other services adjacent to its operating frequency. Too, because of the high operating frequency, it is difficult to limit the transmitter's output and receiver radiation to the point where there is no interference and the equipment operates legally under the "low-power rules" of the FCC.

One of the circuits avoiding the above disadvantages, the new Perma-Power model RC-101 remote control unit is a radio-controlled type operating in the 27.255-mc class-C Citizens band channel assigned specifically for remote control work. This frequency is approved for radio-controlled garage-door operators by the FCC and its Canadian counterpart.

The RC-101 consists of a one-tube crystal-controlled tone-modulated transmitter with a 16-inch whip antenna and a two-tube receiver. The transmitter operates from the storage battery in the automobile. The receiver is installed in the garage close to the operator (motor) and operates from 117-volt a.c. lines.



Left, top view of the RC-101 transmitter chassis.



Right, top view of the RC-101 receiver chassis.

Transmitter circuit

The transmitter is usually mounted in the engine compartment against the firewall (Fig. 1) and the antenna on an L bracket fastened to the underside of the gravel pan between the radiator and grille (Fig. 2). The heater circuit of the transmitter tube is wired through the car's ignition switch so the transmitter is ready for instant use whenever the engine is running. The transmitter is turned on to operate the garage door by pressing a push switch on the dashboard.

The transmitter circuit is shown in

Fig. 3. The r.f. section consists of the pentode section of the 6U8 connected as a crystal-controlled oscillator operating on 27.255 mc with an accuracy of ±.04%.

The tone generator and modulator is a modified Hartley oscillator using the triode section of the 6U8. The output of the a.f. generator modulates the screen grid of the crystal-controlled oscillator. Since several RC-101 units may be installed within operating range of each other—100 to 300 feet—one unit may operate the door of another. This can be prevented by changing the modulation frequency of the offending unit. Ten modulating frequencies with a ratio of 1 to 1.25 are available between 600 and 4,700 cycles. The frequency of the modulating tone is controlled by plug-in L-C networks numbered 1 to 10. The frequencies are 600, 750, 950, 1,200, 1,500, 1,900, 2,400, 3,000, 3,750 and 4,700 cycles, respectively.

In two-door garages, individual doors can be controlled by separate transmitters, each with its own modulating frequency.

A novel feature of the transmitter is a neon-lamp tuning indicator connected to the hot (plate) end of the transmitter coil. The brightest glow corresponds to maximum output and maximum r.f. voltage in the tank circuit.

In this and similar grid-plate oscillators, the best keying (on–off) characteristic is obtained when the plate tank is tuned to a frequency slightly higher than the crystal frequency. This slight detuning of the plate circuit reduces the available output. When the transmitter is turned on, the tank circuit is automatically tuned closer to resonance and output is increased by the ingenious use of the neon lamp: The stray capacitance of the lamp is lowest when it is dark and increases when it is ignited. When the transmitter is first keyed on, the tank is tuned slightly above resonance. During the period when oscillations are building up, the r.f. voltage at the plate is too low to ignite the lamp. As soon as oscillations reach full strength—a matter of a few microseconds—the lamp strikes and its stray capacitance drops to retune the tank automatically toward resonance and maximum output. Thus, maximum output and reliable starting can be obtained simply by adjusting the plate trimmer capacitor for maximum brilliance in the neon indicator.

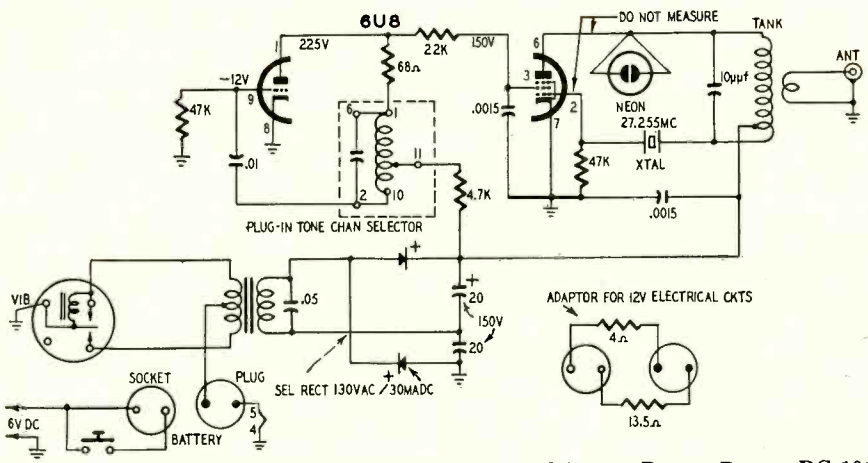


Fig. 3—Schematic diagram of the transmitter used in the Perma-Power RC-101.

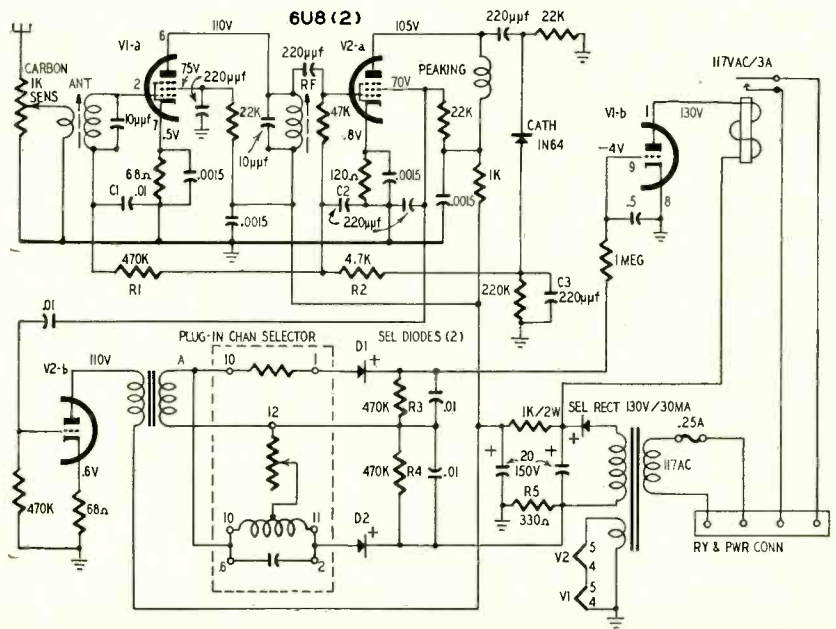


Fig. 4—Schematic diagram of the receiver used in the Perma-Power RC-101.

The receiver

The signal from the transmitter is picked up on a simple 8-foot antenna and fed to a two-tube receiver (Fig. 4) using two 6U8's, a 1N64 germanium diode, a pair of miniature selenium diodes and a half-wave selenium rectifier in an a.c. type power supply. The incoming signal is amplified by the cascade-connected pentode sections of the 6U8's and then fed to the 1N64 detector. The audio output of the detector is fed back to the control grid of V2-a through R2. By reflexing, V2-a now operates as a triode a.f. amplifier with its screen grid serving as the triode plate. The 22,000-ohm screen dropping resistor serves as the triode plate load.

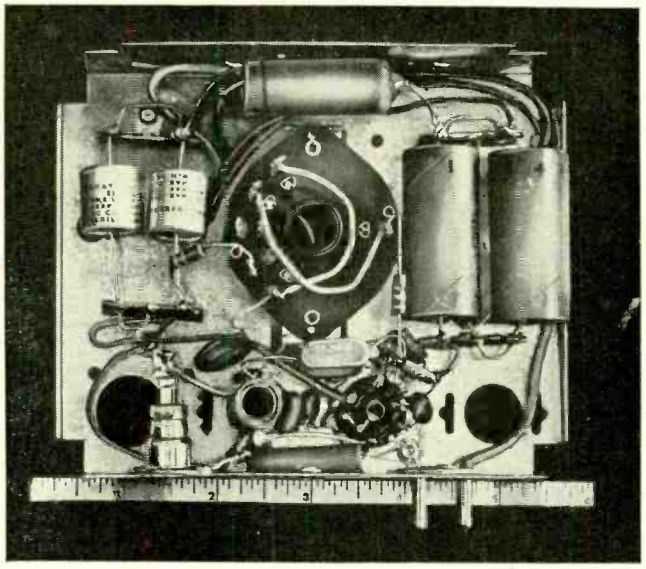
The output of the reflexed first a.f. amplifier is fed into triode V2-b. The output of this stage is transformer-coupled to a plug-in audio channel selector network and a pair of selenium rectifiers used as decoders or demodulators. The decoder develops a control voltage that varies the plate current of V1-b and opens and closes the relay in its plate circuit. Plate current flow through R5 develops a negative bias voltage that is applied to the grid of V1-b through R4 and R3. In the absence of a tone of the correct frequency, this bias cuts off V1-b and its relay contacts are open.

The signal developed at point A on the secondary of the a.f. transformer splits into two paths. One path is through a resistor to diode D1 where it develops a voltage drop across R3. The voltage across R3 bucks the fixed bias applied to the grid of V1-b. The other path is to D2 through a notch type (rejection) filter tuned to the frequency of one of the tone channels. D2 develops a voltage across R4 that opposes that across R3.

A signal whose frequency differs from that of the tone filter suffers little or no attenuation so the voltages applied to D1 and D2 will be approximately equal and the net voltage across R3 and R4 will be zero or slightly negative. Since the voltage is in series with the fixed bias, V1-b remains cut off and the relay stays open.

When the incoming tone signal is the same as that of the channel selector, the voltage applied to D2 is sharply attenuated by the notch filter. The net voltage across R3 and R4 is now positive so it cancels the fixed bias on V1-b and causes the relay to operate.

The detector (1N64) output is also used as a.v.c. voltage for the r.f. input stage V1-a. R2 and C2 provide r.f. decoupling and R1-C1 forms an audio



Underchassis view of the Perma-Power transmitting unit.

filter to prevent the receiver's gain from varying at an audio rate.

To prevent operation of the door by possible interference in the form of momentary heterodynes and squeals that may trip the relay, a time-delay circuit (1-megohm resistor and 0.5-μf capacitor) is inserted in the grid circuit of V1-b.

Door mechanism

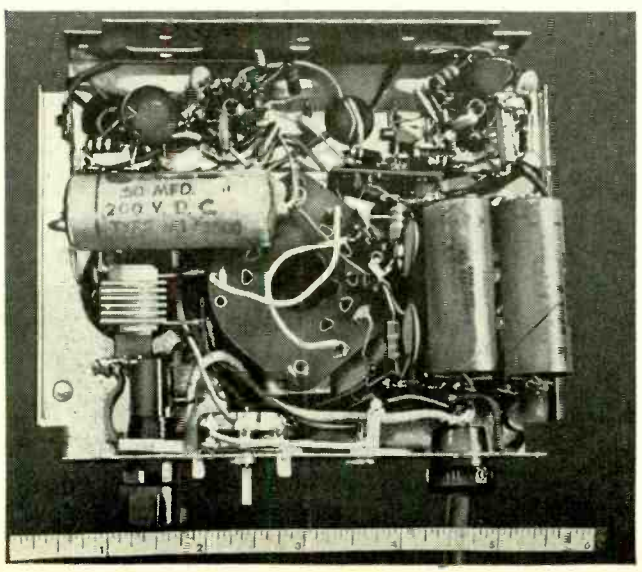
The door-operating mechanism of the Perma-Power unit handles all standard residential type overhead garage doors. It is operated by a ⅓-h.p. reversible 115-volt 60-cycle a.c. motor through a friction clutch and a chain-and-sprocket arrangement and is suspended from the ceiling beams in the garage.

The chain is fastened to a carriage that slides along an I beam fastened between the operator and the wall above the doors (see photos). The carriage connects to the door through a lifting arm. When the motor operates, it drives the chain that pushes or pulls the carriage to close or open the door.

The motor is interlocked through relays and switches so it automatically turns in the right direction—opens the door if it is closed and closes it if open—and then stops with the door fully closed or wide open. The friction clutch slips when the door meets an obstruction. This is important when someone may inadvertently try to close the door when a child or pet is playing beneath it or the car is standing half out of the garage.

The unit is also supplied with a manually operated pushbutton control that permits operating the door from inside the house or some other remote point.

The field of remote-controlled garage doors promises to be a profitable addition to the service technician's business. It is a field that is constantly growing and winning acceptance. As in most work of this type, installation speed and techniques come with experience. The tremendous and continued growth of new homes since the war provides a long-range program for the service technician, both in installation and maintenance. END



Compact receiver chassis requires tight wiring.

AIRCRAFT REPAIR

THIS service experience was encountered while trouble-shooting an aircraft transmitter-receiver unit. A new radio communications unit was installed in a customer's light aircraft—ground tests proved the installation airworthy and complete.

Three days later the owner returned with a complaint of radio failure in flight. The unit was removed, placed on the bench, and a defective input filter capacitor located. A 525-volt capacitor was installed to replace the defective 475-volt unit. The set performed normally on the bench for several hours and was reinstalled in the aircraft.

After a local flight of approximately 2 hours, the pilot returned, reporting the equipment again inoperative. The input filter capacitor had failed a second time.

The defective capacitor was replaced and an oscilloscope connected across it to observe the waveform and voltage amplitude at this point. No abnormal conditions could be found.

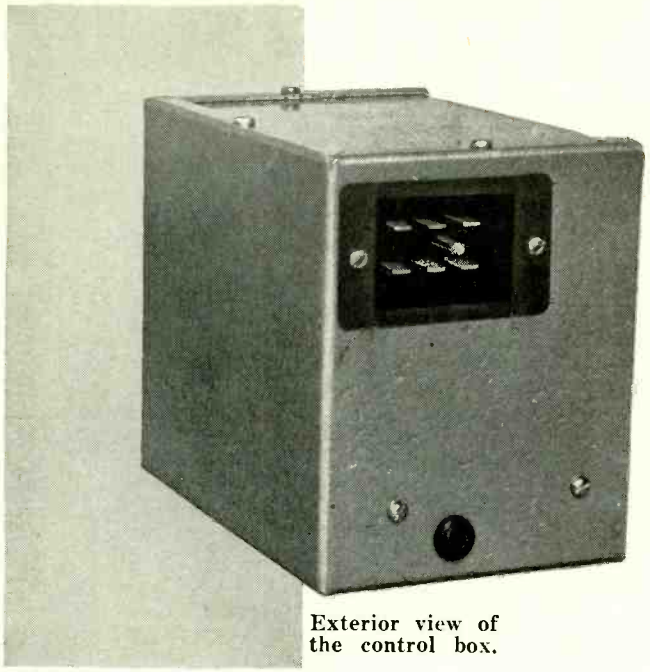
The unit was reinstalled in the aircraft. I accompanied the pilot on a flight, with a voltmeter connected to the set's power-input terminals to determine if in flight the aircraft's generator voltage was excessive. Input voltage to the equipment was found normal. The equipment performed satisfactorily for approximately 2 hours, after which it suddenly failed with the characteristic odor of a blown filter capacitor.

On the bench, particular attention was given to a solder lug riveted to the aluminum chassis, which served as a ground and negative return for the primary of the power transformer. Although this lug was apparently tight, a check with a dye penetrant proved the lug loose enough for the dye to pass through the rivet hole, past the body of the rivet. A ground lug was mounted to the chassis, adjacent to the suspected lug, with a jumper wire connecting both. To insure a positive connection to chassis at this point, the new lug was mounted with a self-tapping sheet-metal screw.

Bench operation and subsequent flights with the equipment mounted in the aircraft proved this to be an effective repair.

Apparently in flight, with the equipment subjected to vibration, continuity of the power transformer primary circuit through the chassis ground at the loose lug was intermittent. This circuit is inductive and the current comparatively high, so radical changes in resistance caused high transient voltages in both the primary and secondary of the power transformer. These transients, or spikes, in the transformer secondary were applied to the input filter capacitor. After a few hours of operation in flight, the capacitor would break down due to temperature rise.

—R. K. Schaefer



Exterior view of the control box.

TRANSISTOR AUTO LIGHT CONTROL

By EDWIN BOHR

THIS transistor light control box will take your automobile one more step toward complete automation. It automatically operates the headlight, dash and running lights, turning them off and on as required by light and driving conditions.

A self-generating photocell and CK722 transistor, together with a simple relay circuit, do all the necessary *thinking* and switching. Except for unusual circumstances, the driver will never need to touch the manual light switch.

The circuit is practical. It has been used and tested for more than a year. Three of these control units were built using the same basic design and each has operated completely satisfactorily.

Automobile electronic controls have faced two serious problems: the unreliability and the monstrous power requirements of the vacuum tube. In most cases, the power supply for vacuum tubes is more complicated than the control circuit! And power supplies contain vibrators and other components subject to rapid deterioration. Also, electronic power supplies are extremely inefficient. Only a fraction of the energy consumed reaches the control circuit as useful power.

In contrast, the transistor can operate directly from a car's 6-volt electrical system. The battery drain is in the order of milliamperes; there is no heavy filament drain to run the battery down and the transistor will probably outlast the automobile and remain completely troublefree.

These advantages of the transistor are put to work in the auto light control by a simple, reliable, electrical circuit (Fig. 1). In addition, the small size of the transistor permits very compact construction.

A self-generating type photocell supplies a d.c. output that is proportional to the light it receives. The output is amplified by a grounded-emitter CK722 transistor stage. The CK722 amplifies the output of the photocell sufficiently to operate two control relays (RY1 and RY3) in the collector circuit of the transistor. These relays are identical physically. However, one (RY1) is made less sensitive by connecting it to the collector through a series resistance. Because of this, the relay with the series resistance will pass less current and remain open with larger amounts of light pickup from the photocell than will the other.

With no light on the photocell, RY1 and RY3 are open. A small amount of light closes only the sensitive relay, while large amounts of light close both control relays and holds the lights off.

As long as both control relays are closed (armature pulled in) RY4 and RY2 are not energized and all automobile lights are off. When twilight approaches, there is not enough current to keep RY1 closed. When it opens, RY1 closes the 6-volt power relay RY2, which switches on the dash, tail and parking lights. As it becomes even darker, RY3 opens, closing the headlight contacts on RY4.

Notice the parking light current must pass through both RY4 and RY2. Since the dash and taillight current flows only through RY2, these lights remain on whenever *either* the parking lights or headlights are on. The parking lights turn off when the headlights come on.

For example, the 6-volt power runs

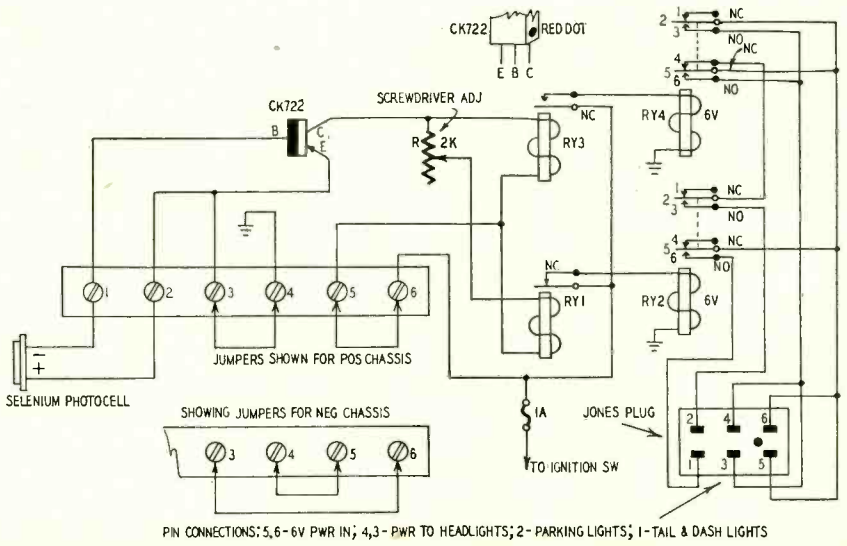
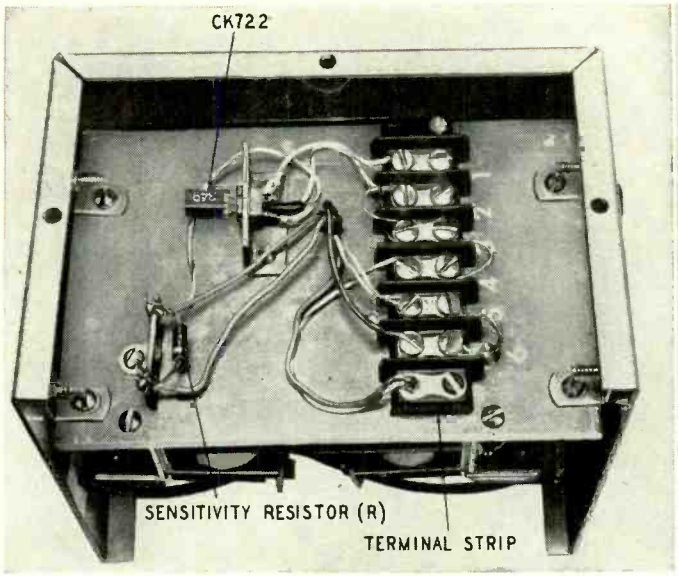
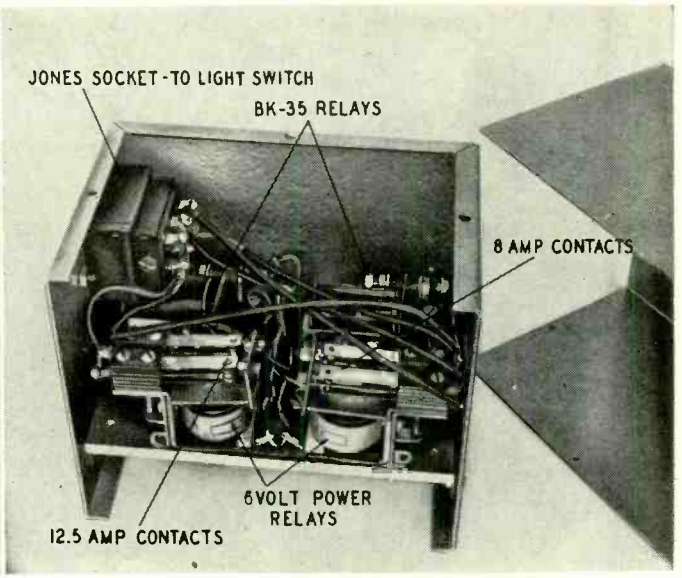


Fig. 1—Schematic shows all wiring for the transistor auto light control.



Underchassis view of the light control. The CK722 transistor is neatly mounted, and the terminal strip wiring is simple.



Topside view shows socket and relays. The wiring is a bit more complex, and all components must be mounted carefully.

from the Jones plug to contacts 2 and 5 of RY4. Relay RY4 is operated by the more sensitive of the two control relays. When RY4 is not energized, the 6-volt power can flow only to contact 4 and down to contact 2 on RY2. If RY2 is also unenergized, there is no possible path for the current to follow and all lights are off. But, if the photocell current drops, RY2 will close contacts 2 and 3 and allow current to flow to the parking lights. At the same time, contacts 5 and 6 also close and operate the dash light and taillights.

An even further reduction in photocell output energizes RY4, in addition to RY2, to operate the headlights as contacts 2–3 and 5–6 of RY4 close. This also opens contacts 4–5 of RY4, turning off the parking lights.

The ignition switch controls the current for the transistor and the 6-volt power relays. In this way, the lights cannot be accidentally turned on when the engine is not running.

The wiring from the auto light control box to the car's electrical system is simple. The control box switches are connected in parallel with the manual light control.

Circuit components

The amount of current available from the selenium self-generating photocell is proportional to the area of the light-sensitive opening. With moderate illumination, some cells deliver 0.5 ma or more into a load of approximately 100 ohms.

Selenium photocells are rugged. They are relatively immune to vibration, heat and electrical fatigue. And, unlike some vacuum phototubes, they are not damaged by extreme overillumination. The sensitivity of certain selenium photocells even improves slightly with age. Both the transistor and selenium cell have lives that, for practical purposes, are almost infinite.

The cell for our application should have an area of 2 square inches or more. Smaller cells may be paralleled to give the necessary area.

Special, low-resistance, meter-movement relays are available that will operate directly from the selenium photocell, but relays of this type are very expensive and delicate. Fortunately, one stage of transistor amplification provides enough gain to bridge the power gap between the most sensitive conventional relay and the selenium photocell.

Only the grounded-emitter operation of junction transistors gives an output or collector current greater than the input or control current. The current gain to be expected is given in the collector characteristics (Fig. 2). These are curves published by Raytheon as typical for the CK722. If the reader is familiar with these, he can make intelligent substitutions or modifications of the circuit.

To use the curves, locate the collector-to-emitter voltage, which, for most automobiles, will be 6 or perhaps 12 for some of the newer models. This voltage is plotted along the lower edge of the graph.

If we follow this 6-volt point vertically, we find it intercepts curves drawn for nine values of constant base current—from 0 to 400 microamperes. For example, with 6 volts on the collector and a base current of 100 microamperes, a collector current of 1.6 ma results.

In practice the collector will not be connected directly to the supply voltage—the relay coils will be in series with it.

The relay coils have a voltage drop across their terminals when current flows through the windings. The actual collector voltage is the supply voltage minus the drop across the relay coils. With bright light, the current is almost entirely limited by the coil resistance. Thus the load imposes a limitation on the collector current.

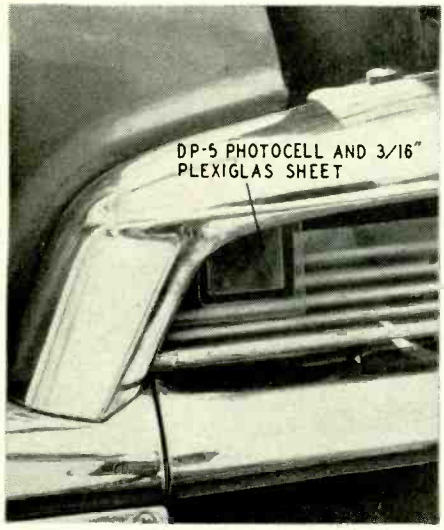
We can predict what will happen when a particular relay and transistor are connected together by drawing on the transistor curves a line representing the change in operating conditions caused by the relay coil.

Two 12,000-ohm BK-35 relays, in parallel, are used in the present auto light control. Together they represent 6,000 ohms in series with the collector.

To draw a relay line for 6,000 ohms resistance, we mark two dots on the graph representing circuit conditions with maximum and minimum current through the coil. The line is constructed by connecting the points with a straightedge. The first point to mark is the collector-to-emitter voltage with zero collector current. Since the drop across the coils is zero with zero current flowing, the first point is 6 volts–0 ma. Maximum current flows with the full 6 volts across the relay. This means the drop across the transistor must be zero. So, the second point is at 0 volt–1 ma. This current at collector voltage zero is obtained by dividing the supply voltage by the coil resistance.

Because the collector voltage, for changing values of relay current, runs along the relay load line, we find the collector current from the intersection of the base current curves and the load line. The collector and relay currents are the same.

Remember a base current of 100 microamperes produced a collector current of 1.6 ma without the relay. Now look at the graph. The 100-μa base current line and relay load line inter-



Photocell is mounted in the grille, with a protective Plexiglas sheet.

sect at just a little less than 1 ma. Notice, also, that it is impossible for more than 1 ma of relay current to flow. This means the circuit is saturated at light levels above about 100 μa, while amplification is more linear below this level.

These computations were based on a nominal 6-volt supply. Actually, the supply voltage will run around 6.5. This gives a safety value of amplification greater than the value derived from 6 volts.

To operate the various automobile lights at appropriate light levels, we know 2 square inches of cell surface are necessary. Also, 100 μa from this area should hold open both relay contacts, turning all car lights off. For 6,000 ohms of relay resistance, this means each relay must close on about 0.5 ma. The BK-35 relays operate on this amount of current. Other relays such as the Sigma 4F 8,000-ohm relay are easily adjusted to operate on 0.5 ma.

Another load line for the Sigma 4F has been drawn in Fig. 2. Notice the lower resistance of this relay permits higher current gain at the 100-μa base current intersection.

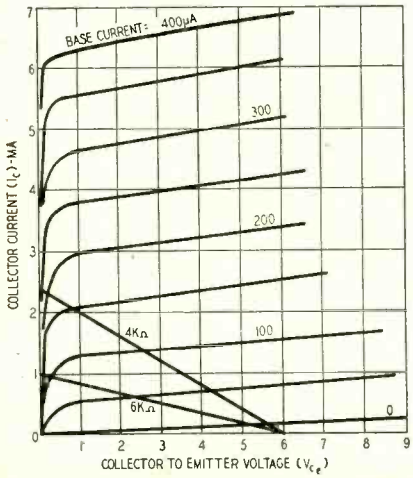


Fig. 2—Characteristics for the CK722.

As a rule of thumb, any relay that can be adjusted to close on 0.5 ma is suitable. To adjust high-resistance relays, say from 8,000 to 12,000 ohms, apply approximately 5 volts to the coil and adjust spring tension until the contacts close. The two relays should be identical. If the relays and coil resistances are dissimiliar, it may be difficult to adjust their closures for proper operation of the parking and headlights.

The BK-35's, made by GM Laboratories and obtained as surplus, are single-throw, normally open relays. For our purpose, the contacts must close when the current is removed from the coil. To do this, the contact and gap-adjusting screws must be swapped, since only one of them has a silver contact. Also, the armature must be turned over to turn the silver contact face in the opposite direction.

Construction

The unit shown in the pictures is mounted in a 4 x 5 x 6-inch aluminum case. However, another model was placed in a smaller 3 x 4 x 5-inch steel case. There was not enough room in it for the Jones plug and a screw terminal strip had to be used in its place. The unit used in the model shown in the photographs is a high-current, 400-series Jones plug.

Parts for auto light control

1—2,000-ohm potentiometer (see text); 2—relays, BK-35 (12,000 ohms) or Sigma 4F (8,000 ohms), (must close on 0.5 ma); 2—relays, 6 volts d.c., Guardian 200 series (one should have 12.5-ampere contact assembly; other an 8-ampere); 1—CK722 transistor and socket; 1—photocell, selenium, DP-5 (International Rectifier Corp.) or equivalent (see text); 1—Jones socket and plug; 1—screw terminal strip; 1—fuse, 1 ampere, and holder; 1—2-foot length of shield braid; 1—aluminum cabinet.

All construction should be rigid and free from vibration. Lock washers must be used and nuts and bolts tightened securely. The relay armatures of the sensitive control relays should move in a horizontal plane free from gravitational pull or up-and-down vibrations.

Relays RY2 and RY4 are the Guardian Universal 200 series. Six-volt coils are used. The contacts for RY4 must be the 12.5-ampere type—the contacts for RY2 may be the smaller 8-ampere variety. Any 6-volt relays capable of handling this much or more current will be O.K. if they do not pull too much current for the sensitive-relay contacts to handle. A 12-volt electrical system, of course, will require 12-volt coils.

Wiring from the Jones socket to the power relays must be flexible yet able to carry large currents. The braid from shielded grid wire—insulated with plastic spaghetti—is ideal for this purpose.

The leads from the photocell enter the case through a grommeted hole and connect to a terminal strip (Fig. 1). For the CK722 to operate at all, the negative pole of the self-generating photocell must connect to terminal 1. Do not use the automobile chassis as a return for the photocell. Run a twisted pair directly from the photocell to the proper terminals.

The jumpers from terminal 3 to 4 and from 5 to 6 are for positive-chassis electrical systems. Join 3 to 6 and 4 to 5 for automobiles with the negative battery terminal grounded. A fused lead connects the power to the control unit from the ignition switch. A 1-ampere fuse is used.

The sensitivity resistor in series with RY1 may be a 2,000-ohm variable potentiometer or a fixed value of resistance determined by experiment. It is possble to make one of the relays less sensitive by increasing its spring tension, but I recommend the series-resistor method.

Wiring from the Jones plug to the manual light switch should be at least as large as the existing wiring. Wires carrying 6-volt power to the switch and from the switch to the headlights are heaviest. Most automobiles have the dash light and taillights on one circuit and the headlights and parking lights on two others. Except for the sprained back and bruised knuckles acquired by getting at the manual switch under the dash, it is a simple matter to parallel the automatic contacts with the manual switch.

The photocell can be mounted on the back of the rear-view mirror, facing through the windshield. Or it may be placed in the radiator grillwork. Any reasonably protected location admitting full outdoor illumination is satisfactory. It can even be placed on the ledge between the rear seat and rear window and the wires run under the floor mats.

Unmounted photocells, such as those sold surplus, should be mounted in a protected container. Two of these cells paralleled and sealed in a phono-cartridge container were used with one of the control units.

The photocell in the photographs is a type DP-5 made by International Rectifier Corp. Hermetically sealed, it has 2.25 square inches of active surface. The output current is 600 microamperes at 100 foot-candles of illumination and the spectral sensitivity corresponds very closely to that of the human eye. The price of this cell, a deluxe model, is about $18. Other photocells can be purchased new, with the same output, for about $4. Surplus self-generating cells are even cheaper—some sell for less than $1.

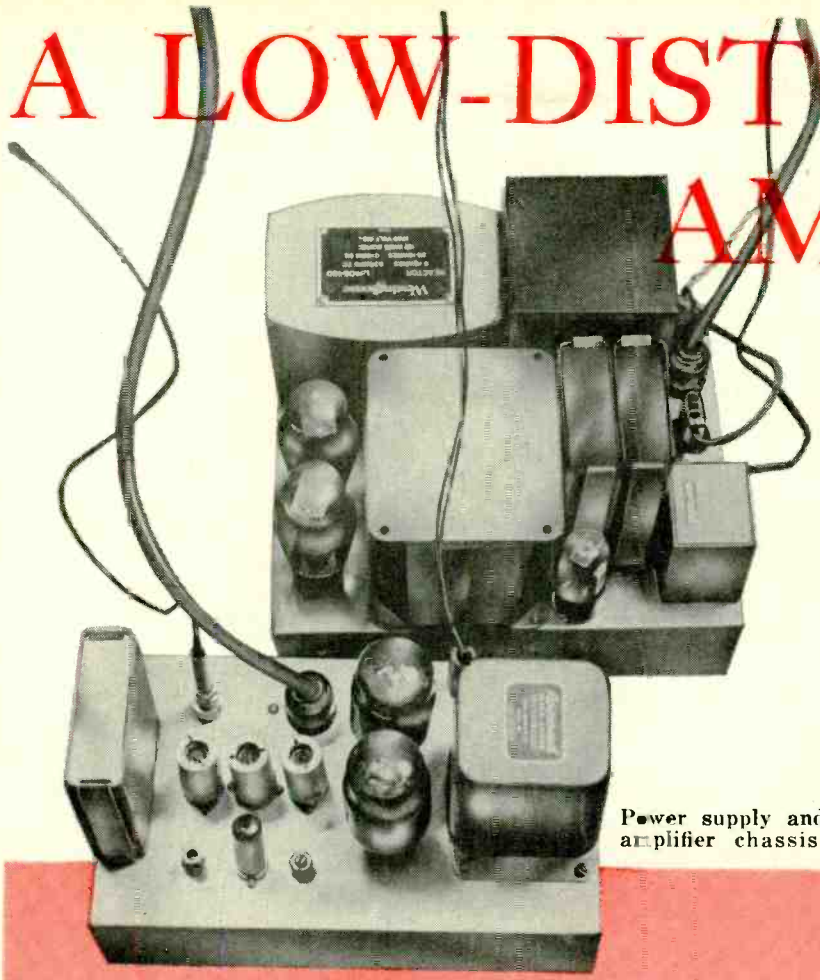
The success of the unit depends largely upon the photocell and the sensitive control relays. If components other than the recommended ones are used, they should be tested in a breadboard layout before final construction is begun.

The use of this circuit is not necessarily limited to automobiles. It could be used in fixed locations to operate such devices as electric signs and yard lights where it may or may not be necessary to use two control relays of differing sensitivities. END

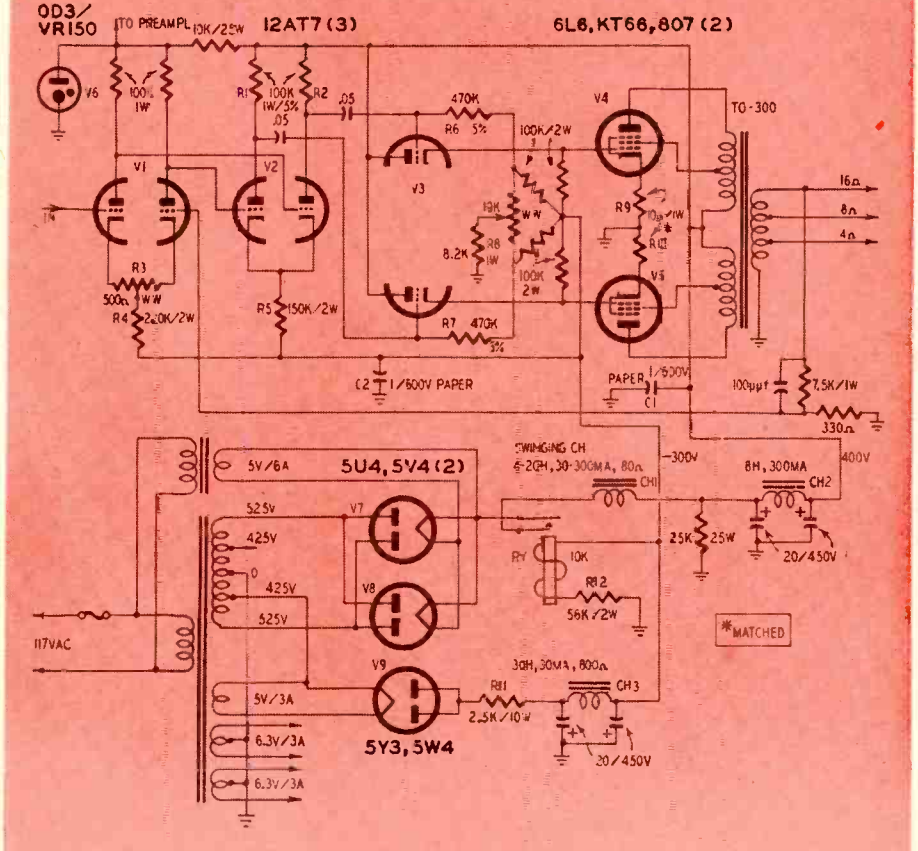
A LOW-DISTORTION AMPLIFIER

Excellent design produces extremely low IM at very high output

By HERBERT MALAMUD



Power supply and amplifier chassis.



Schematic diagram of the low-distortion amplifier—unit features 32-watt output.

THIS is the first amplifier—hi fi that is—I have seen which runs its output tubes in class AB_2! This class of amplification is known for high-power operation but is infamous for high distortion. I became convinced that distortion is not a necessary by-product of class AB_2. The completed amplifier justified that conviction! Considering its output, it is a small affair, with nine tubes, a 40-pound power supply and a 10-pound, comparatively puny, amplifier chassis (see photo).

Despite its small size, it delivers 32 watts of output before clipping is visible in a scope. At 4 watts, the intermodulation distortion (100 and 5,000 cycles, mixed 4:1) is .06%. At 30 watts, it is only 0.12%. Incidentally, 40 and 1,000 cycles, mixed 4:1, give 0.11% distortion at 30 watts. Frequency response, at 30 watts, is flat within 0.1 db from 20 cycles to 35 kc and at 20 watts flat within 0.1 db from 10 cycles to 70 kc. (My Hewlett-Packard audio oscillator does not go over 70 kc—I feel sure that the amplifier does!) At 1 watt, the low-end response was 3 db down at 2.3 cycles. Harmonic distortion was not measurable. Hum and other noise were also not measurable and are therefore calculated to be at least 90 db below 30 watts. This indeed justifies my conviction that good design can bring together low distortion

and class AB_2 operation in an amplifier which sounds, incidentally, as good as it measures.

Circuit

The layout (see diagram) is straightforward, beginning with a long-tailed pair* (cathode-coupled phase inverter) direct-coupled to a pushpull voltage amplifier. The negative supply needed for these two tubes is also used for the grid bias of the output stage. Resistors R1 and R2 should be precision units to aid in balancing the input. This can be done with a v.t.v.m. across the plates of V2. The input is grounded and R3 adjusted to give a zero v.t.v.m. reading.

The second stage is capacitor-coupled to V3, a cathode-follower pair in pushpull. Resistors R6 and R7 should be matched to 5% although this is not strictly necessary. The cathode follower is necessary, since the class AB_2 output tubes draw grid current.

The guiding principle of the power supply is *low impedance* to improve regulation without using a voltage-regulator circuit. To achieve this, the power supply uses two 5U4's in parallel. Chokes CH1 and CH2 have less than 100 ohms resistance each. Surplus units were used here although those named in the parts list should work as well.

The purpose of the relay is to delay the B plus voltage to the output tubes until after the grid bias supply is warmed up. This prevents destroying output tubes by excessive emission and protects them in case the negative supply fails. The relay coil can be any sensitive unit that operates at 10 ma or less. The value of R12 depends on the relay coil. Since its contacts are at high potential, mount the relay on insulating board or porcelain standoffs. Do not omit the relay, though some maintain that it may be replaced by a ¼-ampere fuse in the lead from R9 and R10 to ground and by making sure that V9 is a filament heater tube (5Y3) rather than a cathode heater type such as the 5V4. The builder can "pay his money and take his choice." I used a relay.

If the amplifier and power supply are built on one chassis, it should measure 13 x 17 x 3 inches. With a bit of crowding I put my power supply on a 12 x 10 x 3-inch chassis, and the amplifier, with an excess of empty space, fits on one 12 x 7 x 3-inch chassis. Separate chassis, I guess, contribute to the low hum level. If one chassis is used, C1 and C2 may be omitted.

The VR tube decouples sufficiently to provide an additional B plus lead for supplying 150 volts for a preamp or tone control circuit, if its current requirements are modest.

Substituting components

The parts list gives for most items, not necessarily the best component, but the one used in the amplifier, or its commercial equivalent. For example, a UTC, S-40 power transformer supplies 525 volts and has 425-volt taps. If the taps are not available in your transformer, the filament of V9 can be connected directly to either 525-volt lead of the transformer secondary, and R11 can then be increased to drop the negative voltage to about 300 at the output of CH3.

Resistor R4 is 220,000 ohms in the amplifier but should be adjusted until the plates of V1 are at 75 volts ±5. Similarly, R5 is 150,000 ohms or whatever is needed to give 270 volts ±10 at the plates of V2. Nominally 8,200 ohms, R8 should be adjusted to give the correct bias on V4 and V5. This is achieved when the no-load current through them is 45 ma for each tube. It is measured by a v.t.v.m. across R9 and R10, whose 10 ohms each is too low to produce any effect except to simplify tube current measurements.

A power transformer giving 500 or even 490 volts can be used instead of the 525-volt unit with small sacrifice in power output. In fact, with a 500-volt or lower power transformer 6L6's or 5881's can be used instead of the KT66's which allow a maximum of 510 volts d.c. on the plates. If one doesn't mind the plate caps, 807's could be used just as well, and indeed should be used if voltage higher than 510 d.c. is used.

I used the Acrosound TO-300 output transformer, pushing it near its rated 40-watt output level. At the time, I judged it to be the best available. Building it today, I might use a higher-powered Acrosound, the Partridge UL2, a newcomer, or the Peerless S-226-Q, which also would leave very little to be desired.

In testing this amplifier, I tried it out with tetrode output-stage operation. The output screen grids were disconnected from the screen taps of the transformer, connected together and then tied to the lower end of the VR-150 whose plate was connected to the same B plus lead as the output-transformer primary center tap. The screens draw enough current to operate the VR tube. There was no change in the maximum power obtainable. Since I had already bought the Acro transformer and since the Acro has correctly placed screen taps, I reconnected them.

Since the long-tailed phase splitter amplifies the potential difference between the pair of grids, the feedback was applied to the second grid of the pair. There is no grid resistor in the first tube because it is fed from a Livingston loudness control. The builder will probably want to use about a 500,000-ohm resistor from the input grid of V1 to ground. The amplifier uses about 18 db of feedback, giving 30 watts for a 0.6-volt input.

The 6-volt windings of the S-40 transformer may be connected in series and the common lead grounded. The 12 volts then are used for the filaments of V1, V2, V3 and for V4 and V5 in series. Alternately one winding could be used for V1, V2 and V4 and another for V3 and V5.

Separate filament windings are necessary for V7 and V8 and for V9. Since the 5-volt winding of the S-40 has insufficient current for a pair of 5U4's, it was used for V9 and a small, good-quality filament transformer for the high-voltage rectifier filaments.

The first three stages of this amplifier, up to the output stage, are worthy of and capable of feeding higher-powered output stages. For instance, using a stabilized 750-volt power supply with 807's should give in class AB_2 about 80 watts, which, after output transformer losses, results in about 60 watts.

Alternately, we might supply our negative voltage with a small selenium rectifier and use only the first two stages (omitting the cathode follower) to feed a class-A output stage. This will give us a medium-power (10 or 15 watts) amplifier with very low distortion. The output stages can be 6L6's and the power transformer a 350- to 400-volt unit, at about 150 ma, using a capacitor-input filter. With class-A operation, there is no need for good regulation of the supply voltage.

There are many possible variations of this amplifier. It is simpler, cleaner and cheaper to build than units of similar power and I believe it to be better than its competitors. END

Parts list for low-distortion amplifier

Resistors: 1—330 ohms, ½ watt; 2—470,000 ohms, ½ watt, 5%; 1—7,500, 1—8,200 ohms (see text), 1 watt; 4—100,000 ohms, 1 watt, 5%; 2—10 ohms, wirewound, matched, 1 watt; 1—56,000 (see text, R12), 4—100,000; 1—150,000, 1—220,000 ohms, 2 watts; 1—2,500 ohms, 10 watts; 1—10,000, 1—25,000 ohms (bleeder), 25 watts; 1—500, 1—10,000 ohms, wirewound, potentiometers.

Capacitors: 1—100 μμf; 2—.05 μf, 600 volts; 2—1 μf, 600 volts, bathtubs; 4—20 μf, 450 volts, electrolytics.

Tubes: 3—12AT7; 2—KT66; 1—0D3/VR-150; 2—5U4-G; 1—5Y3-GT.

Miscellaneous: 1—power transformer, 1,050, 850 volts c.t. @ 250 ma, 5 volts @ 3 amperes, 6.3 volts c.t. @ 3 amperes, 6.3 volts c.t. @ 3 amperes (UTC S-40 or equivalent); 1—transformer for 5U4-G filaments, 5 volts @ 6 amperes (Thordarson 21F04 or equivalent); 1—output transformer (Acrosound TO-300 or equivalent); 1—choke, 20-4 h, 30-300 ma, 80 ohms (Stancor C1403 or equivalent); 1—choke, 8 h @ 300 ma, 80 ohms (Stancor C1413 or equivalent); 1—choke, 30 h @ 30 ma (UTC S-25 or equivalent); 1—relay, close on 10 ma (Potter-Brumfield LS-5 or equivalent); 9—tube sockets; 1—chassis; 1—line cord.

*See Push-Pull Drivers," by G. F. Cooper, RADIO-ELECTRONICS, Vol. XXIV, No. 3 (1953).

Not For Sale

By Jeanne DeGood

The man who phones me day and night
And says his set's not working right
Must think he owns a part of me
Because he owns a guarantee.

But if the man could purchase me,
He wouldn't need a guarantee.

FOR GOLDEN EARS ONLY

The Garrard RC90 changer, and model T record player; the Fisher phono pre-amp; new records review

By MONITOR

FROM a listener's point of view, the important criteria for a changer or turntable are the noise level and wow. It is by no means easy to design a changer to meet these criteria sufficiently well to match the very high standards of today's other hi-fi equipment. The Garrard RC90 (see photo) meets these requirements very well.

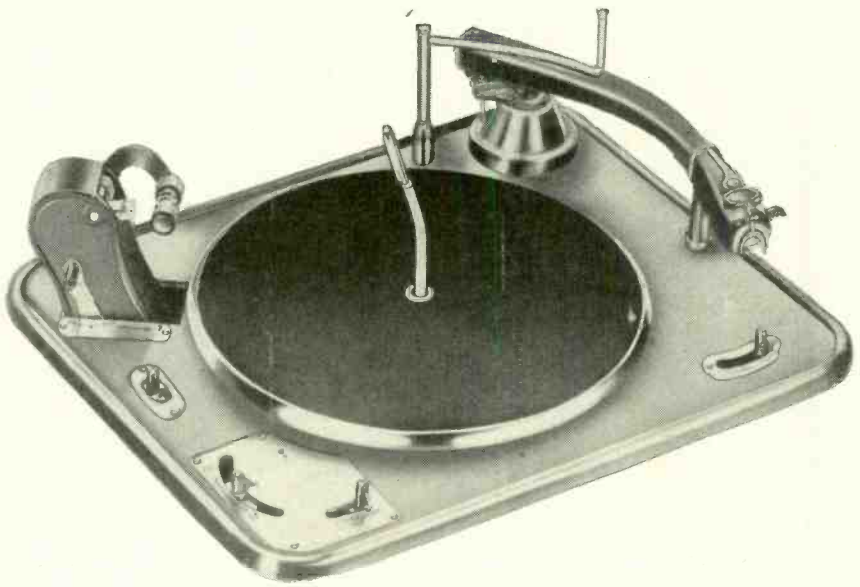
The noise level (including hum, rumble and flutter) is extremely low. As a matter of fact, noise is audible only on systems with response down to 30 cycles or lower; even then the amplitude is so low that it produces no significant masking of record content. The noise level was higher than that of the D & R turntable but is as good as that of some of the older broadcast type transcription players.

As for wow, I could just discern some on critical listening but it is completely insignificant for all practical purposes.

The low noise level is the result of the excellent motor and its isolation from the turntable. The motor is mounted on four very sensitive rubber mounts. The table, in turn, has four spring mounts. The drive from motor to turntable is through two rubber idlers. The idler which turns the turntable is mounted in a heavy flywheel and the turntable itself is very heavy. Thus, in effect, there are two flywheels in the string, which accounts for the low wow.

An admirable feature is the number of adjustments which can be made to achieve optimum performance. The arm provides an adjustment for needle angle in respect to record plane, an important factor in low distortion and record wear. Plug-in heads used enter a plastic insert in the arm. The insert can be revolved by loosening a setscrew and thus the needle angle can be set exactly vertical. Offhand, I know of no other changer which permits this adjustment so easily.

Needle pressure is adjustable also. With the G-E cartridge the range is from about 1 to more than 16 grams and I presume other cartridges will offer a similar tolerance. Arm height is also adjustable. The plug-in heads come with a variety of hardware sufficient to accommodate with proper clearance just about any cartridge with 0.5-inch mounting centers. Motor speed is adjustable over a range of ±10% by a lever coupled to a magnet whose retarding factor on the motor flywheel can be adjusted with a knob on top of the changer base. A stroboscopic disc for all three speeds is supplied with the changer for making speed adjustments. The changer can be leveled precisely by adjusting stopping nuts which position the mounting springs; this adjustment can be made without changing the tension of the springs.



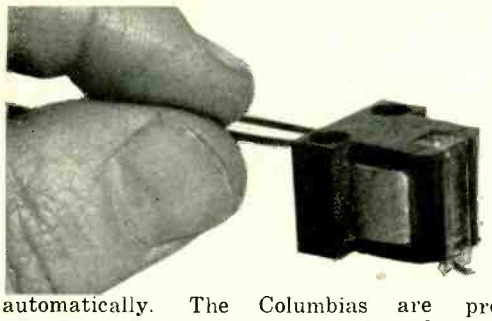
The Garrard RC90 three-speed changer.

Although the mechanism is a tangle of arms, levers, cams and springs, only two adjustments are normally necessary for proper changer operation. One is for the arm dropping position, the other for the automatic trip. Both can be made from the top of the changer. Record dropping troubles, due to wear and tear, can be corrected by a star wheel underneath. Despite the mechanism's complexity, it would appear that the design provides sufficient tolerance so that these adjustments should handle normal wear for years.

One of the nicest features is the muting switch which shorts the pickup during the changing cycle—the noises produced by changing are completely eliminated. You hear only the modulations on the record grooves. Another feature is that the changing cycle is just as fast at 33⅓ as at 78 r.p.m.

All sizes and types of commercial records can be played on the RC90 both automatically and singly. All controls are easily accessible and well positioned. The sequence of steps is logical, by no means complicated and quickly learned. The possibilities of trouble through improper operation are minimized; about the only hazard is that of handling the arm in the changing cycle.

Both the 7-inch records with RCA big holes (45's) and those with Columbia small holes (33⅓'s) can be played



Electro-Sonic cartridge uses the well-known D'Arsonval principle.

automatically. The Columbias are played on the same spindle as 10- and 12-inch records, and RCA types with inserts can be played this way as well. However, the RCA types can also be played on an RCA type spindle interchangeable with the regular spindle. The spindles are easily removable with a stack of records on the table, after playing. This makes removing the records safely very simple.

Finally, a switch provides for manual, single-record playing of all sizes of records. A special short spindle is provided and a large hole-reducing insert for RCA records is also part of the standard equipment.

The RC90 represents very ingenious engineering and a fine solution of changer problems. It should fill any requirement calling for a changer rather than a turntable.

Garrard model T record player

I was very pleased to test the Garrard model T single record player and I found it surprisingly good. Though, like the fabulous Ford of the same model number, it sells in the lowest price range, its performance is good enough to offer stiff competition to equipment costing several times more.

Total noise is gratifyingly low. In fact, it will be audible only with very large speaker systems and is not objectionable with horn or Karlson enclosures, even when considerable bass boosting is used. Wow was of no consequence and the fact that the idler is disengaged in the "off" position should minimize the development of wow with age.

The model T is very simple and convenient to use. Speed is changed with a lever in one corner, operable even with the table in motion. The same type of plug-in heads is used as in the RC90. Needle angle can be adjusted and needle pressure is adjustable from the top. A hole-reducing plastic spindle for RCA type records is supplied and a peg on the base holds it when not in use.

To play, simply place the record on the table. Lift the arm, move it to the right to engage the "on" switch and set it down on the record. As the final run-out groove is reached, the motor automatically cuts off and the turntable quickly brakes to a stop. When the arm is on the rest, it can be fastened in place with a curved plastic clip. The only possible criticism is that the shutoff lever goes off with a loud clatter. But perhaps even this is all to the good since it reminds one that the amplifier is still on. The model T is a very good $30 worth and fills the bill very happily for that troubled multitude whose golden ears are not matched by equally gold-filled purses.

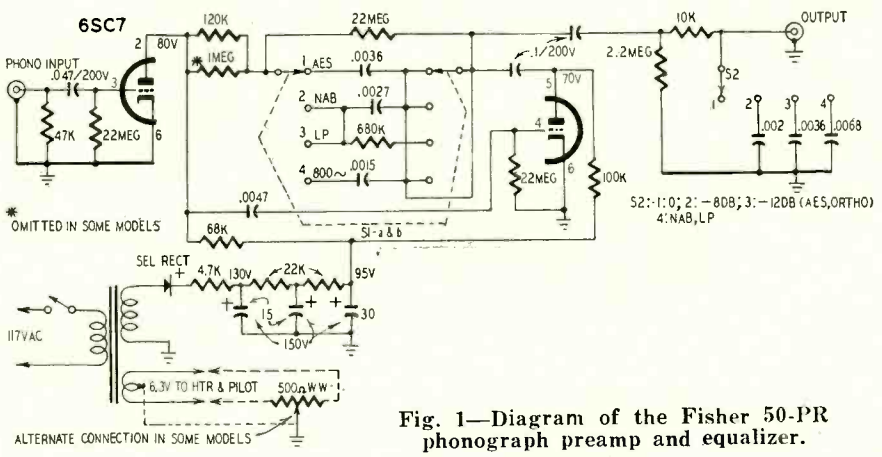


Fig. 1—Diagram of the Fisher 50-PR phonograph preamp and equalizer.

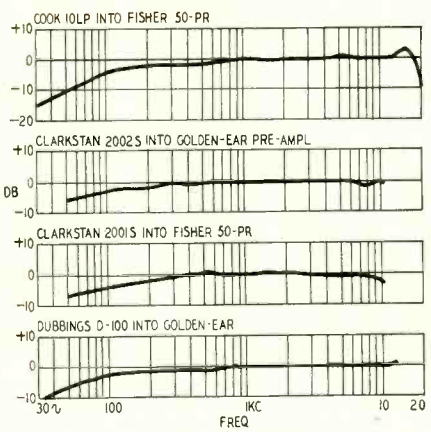


Fig. 2—Response curves obtained with Electro-Sonic phone cartridge.

The Fisher phono preamp

The pertinent questions to be asked about any phono preamp are: What is the signal-to-noise ratio? How good is its batting average on the multiplicity of recording curves?

The total noise measured at the output of the Fisher preamp tested was approximately 3 millivolts. The average output on LP records with a G-E cartridge was about 0.5 volt. That makes a voltage ratio of around 46 db which would rise to about 54 db for average output and 60 db for peaks on 78-r.p.m. records.

Most of this small amount of noise is residual hum of the power supply. Considering that this would be about 86 db down from the original a.c. level and that the preamp contains a power supply with only a two-section resistance filter and an inexpensive 6SC7, this is extremely good. The hum is inaudible at any living-room level and all in all I consider this a very fine showing in a production instrument.

The Fisher circuit (Fig. 1) is quite clever and I do not recall seeing it before. It is notable for the fact that the first stage is a straight-through amplifier with no equalizing function. This has the effect of producing the most favorable signal-to-noise ratio at the input. Both cathodes are grounded, which reduces heater-cathode leakage hum to a minimum.

Bass compensation is obtained through a feedback loop from the plate of the output tube to its own grid. Although the feedback available is not as high as with a two-stage feedback loop, bass boost is completely adequate. The treble equalizer is in the output circuit. Because of the feedback loop on the last stage, the output impedance of the preamp is nearly as low as that of a cathode follower.

The unit is compact and well built. The proximity of the power transformer to the bass-equalizer components apparently does not produce any significant hum pickup. The Fisher is meant to

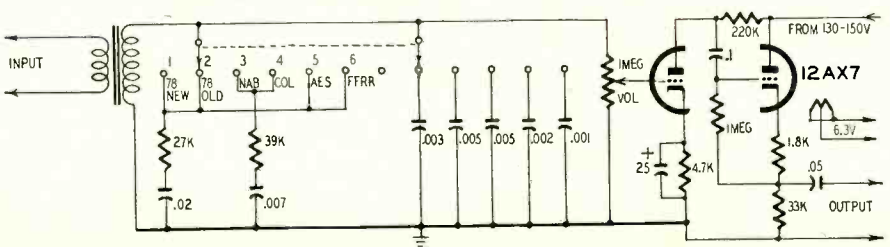


Fig. 3—Preamp-equalizer designed for the Electro-Sonic cartridge.

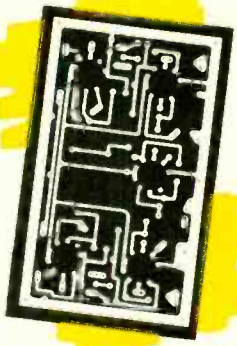
NEW 1955

Heathkit

Engineering Features

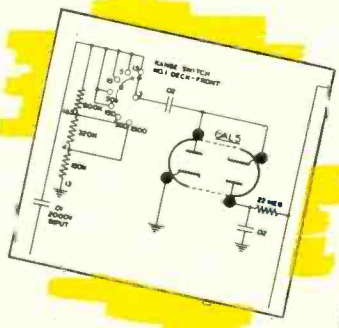
New PRINTED CIRCUITS

One of the many tremendous improvements in the new 1955 Heathkits is the use of an etched metal process printed circuit board. Printed circuits will be used in Heathkits whenever they will affect construction simplification, performance stabilization, and lend themselves to instrument design. Now for the *first* time a kit instrument company offers the advantages of modern printed circuit instrument construction technique. For the *first* time consideration has been given toward reducing kit assembly time. Also this is the *first* time that printed circuit boards have been hand soldered on a volume basis. Offered only by Heathkit, the pioneer and leader in kit instrument design.



New PEAK-TO-PEAK VTVM CIRCUIT

New 6AL5 full wave rectifier in AC input circuit permits full scale peak-to-peak measurements. Seven ranges — upper limits 4000 volts peak-to-peak. Just the thing you TV servicemen have needed in making TV circuit voltage checks. Precision resistor voltage divider limits AC RMS level to 150 volts. Prevents overloading the rectifier—extends upper limit AC RMS ranges to 1500 volts—further protects meter and circuitry against AC flash-over or arcing. Another definite example of continuing Heathkit design leadership in the kit instrument field.

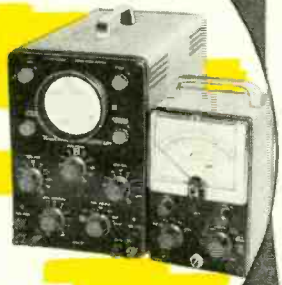


New HIGH READABILITY PANELS

New 1955 Heathkits feature complete panel redesign. Sharp white lettering applied to the beautiful charcoal gray panels, provide a new high in readability. Lettering is easy-to-read open style and panel calibrations are vividly clear against the pleasing soft gray background. New knobs of exclusive Heathkit design.

New 3" UTILITY SCOPE

The new 3" Scope is a "natural" for the well rounded line of Heathkit instruments. Small in size, 11¾" deep, 6½" wide, 9½" high, yet big in performance. Just think of the value, an Oscilloscope for $29.50. Brilliant intensity, sharp focusing, wide positioning range. An ideal portable Scope for the TV serviceman—a second shop scope—modulation monitor for you hams (deflection plate terminals in rear of cabinet). Performance to spare for all general scope applications. See specifications on following page.



New STYLING New COLOR

New styling and coloring is responsible for tremendous improvement in Heathkit appearance. The new instrument panel color combination is high definition white lettering on a soft charcoal gray panel. Cabinet color is a lighter feather gray. The satin gold baked enamel cabinet for the WA-P2 Preamplifier is further indicative of the modern pace-setting trend in Heathkit styling.

New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

New 1955 Heathkit Model 0-10 Scope features a new wide frequency range sweep generator covering 10 cycles to 500,000 cycles. This coverage is available in five virtually decading sweep ranges and is five times greater than the sweep frequency range usually available. Excellent retrace time characteristics, actually less than 20% at 500 KC. Use of the free running Heath circuit provides a larger margin of stability and a new high in Heathkit Scope performance.

Continuing PROGRESS FUTURE LINE EXPANSION

The outstanding improvements featured in the 1955 Heathkit line are representative of the progress characterized by Heath Company operation. Long range planning will provide a continuing succession of new kit releases to further expand the Heathkit line which already represents the world's greatest selection of electronic kits. The innovations in the 1955 line, are representative of additional new models scheduled for release for the coming years.

SEE THE INSTRUMENTS ON THE FOLLOWING PAGES

HEATH COMPANY • • Benton Harbor 20, Mich.

have its a.c. plug connected to an amplifier, tuner or control unit, so that the on–off function is performed remotely by the tuner or control unit. The switch is on the rear of the chassis and if it is not controlled remotely, it is awkward to turn on and off. This is as good an equalizer as I have ever used and yields fine listening with all records. It represents a very fine value at the price of around $22.

Electro-Sonic cartridge

A new phono cartridge is always exciting to me. The new Electro-Sonic is especially interesting because it offers wide-range, smooth response at a moderate price. The curves of Fig. 2 were obtained with the cartridge in a G-E Baton Arm and two preamps: the Fisher and a duplicate of Marshall's Golden Ear (see RADIO-ELECTRONICS, June, 1954). The notable point about these curves is their smoothness and flatness above 1,000 cycles. Actually the slight departures from complete flatness in this region and around the crossover points are ascribable largely to the records themselves and the equalizers.

I don't quite know how to account for the slope below 200 cycles. It is true the Fisher preamp doesn't appear to provide full equalization for the NAB bass slope, but both the Ferranti and G-E play back very flat with the Golden Ear preamp on these test records. I suspect it is due to nonoptimum matching and loading of the transformer. The cartridge itself ought to be quite linear all the way down. The instructions which come with the cartridge include a diagram for an equalizer which is supposed to produce flat response (Fig. 3). However, the slope at the low end is very easily compensated by a slight touch of the bass boost control on most control units; a loudness control also produces excellent correction. From a listening point of view the lows are excellent even without additional equalization. The treble response is extremely gratifying not only for its smoothness but for its cleanness.

The Electro-Sonic breaks all records for low impedance—1.5 ohms at the output of the cartridge. Hum pickup is therefore inconsequential with a really good turntable or changer. Some amplifiers can be driven to an acceptable output level without a matching transformer. Electro-Sonic, however, offers two excellent Danish matching transformers which offer a choice of stepup and output level. The low-impedance model will give an average output on LP's of either 7.5 or 15 millivolts; the latter connection provides a level 6 db above the G-E. There is also a high-impedance model with an output of 0.2 volt, enough for direct connection to some amplifiers.

The cartridge mounts easily in most pickup arms which take the G-E cartridge with adapting hardware furnished with it. The only precaution

NEW *Heathkit* 5" PUSH-PULL OSCILLOSCOPE KIT FOR COLOR TV

First color television service Oscilloscope with necessary high sensitivity and full 5 megacycle bandwidth.

New 5UP1 CR tube

New printed circuit construction, all components mounted on high insulation surface resulting in uniformly low circuit capacities.

New type wide frequency range Heath sweep generator 10 cycles to 500,000 cycles.

New cabinet styling and color harmony—charcoal gray panel with high readability white lettering.

New electronic positioning controls for instantaneous, definite positioning without bounce or overshoot.

BRAND NEW DESIGN: The new Heathkit Model O-10 Oscilloscope would be something special at any price, but is almost unbelievable at $69.50. Completely re-designed scope has broadband amplifiers for color TV work and offers brilliant overall performance. Vertical frequency response within 5 db from 5 cps to 5 mc. Even more astounding, the response is down less than 1½ db at 3.58 mc. the color TV sync burst frequency. It is essential that scopes for color work have these broadband characteristics.

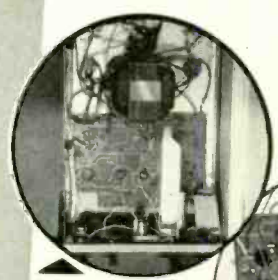
PRINTED CIRCUITS: Two printed circuit boards used in this fine instrument to insure stable, consistent performance. Problems solved by pre-engineering of boards, and their use guarantees completed unit that will have same characteristics as lab development model. Printed circuits simplify construction and save labor.

NEW SWEEP CIRCUIT: Sweep circuit operates with exceptionally good linearity from 20 cps to over 500,000 cps. 5 times the usual range for scopes in this price range. An entirely new circuit introduced for the first time in any Heathkit.

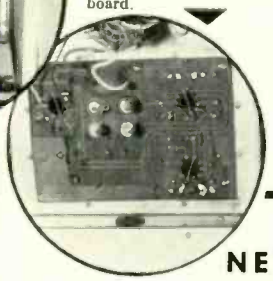
MODEL O-10

$69.50

Shpg. Wt. 27 lbs.



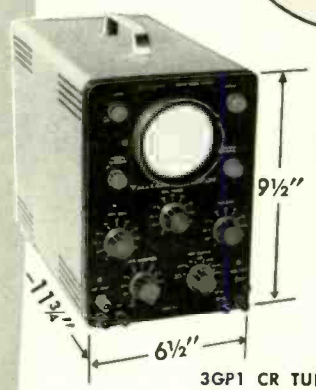
Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single *printed circuit* board.



Clean, open, under chassis construction and wiring. Possible only through use of pre-cabled wiring harness, and simplified printed circuit boards.

FEATURES: Other outstanding characteristics of this professional oscilloscope are: Built-in 1V peak-to-peak reference for calibration of plastic CRT face-plate; 5" 5UP1 CRT; push-pull hor. and vert. deflection amplifiers; hor. trace width expandable to 3 times diameter of CR tube to allow inspection of any small portion of the signal; deflection sensitivity, .025 volts per inch; wiring harness pre-formed and cabled to save construction time and insure professional appearance and operation. Incorporates efficient retrace blanking. Frequency compensated step attenuator at the vertical input. Entire tube face useable. No foldover on vertical over-load. Performance obtainable only in much more expensive laboratory models.

Uses 5UP1, 6AB4, 6BQ7, 12BH7, 6CB6, 12AT7, 2-12AU7, 6X4, 1V2, and 6C4. Quality components used throughout so that outstanding performance characteristics may be maintained for years to come. Plastic molded condensers are used in all coupling and by-pass applications. The "new-look" in Heathkit styling produces professional appearance in keeping with the professional performance of this instrument.



3GP1 CR TUBE

NEW *Heathkit* 3" PRINTED CIRCUIT

OSCILLOSCOPE KIT

MODEL OL-1

$29.50 Shpg. Wt. 15 lbs.

New compact utility Scope—lightweight—portable for service work.

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

New easy-to-build printed circuit board with high insulation factor.

New Heathkit instrument styling—charcoal gray panel with high readability white lettering.

New Heath twin triode sweep generator 15–100,000 cycle sweep.

EXCEPTIONAL VALUE: The brand new Model OL-1 Utility Oscilloscope is designed especially for portable applications so that outside servicemen or persons performing field tests can have the advantages of a scope available. Then too, it is ideal for home workshop, the ham-shack, or as an "extra" scope for the service shop. It is compact, light in weight, and surprisingly versatile in operation. An outstanding instrument for the price.

Front panel controls are "bench-tested" for ease of operation and convenience. Printed circuit board used for constant circuit performance. Assembly time cut in half!

SPECIFICATIONS: Vertical amplifiers feature frequency response within 1 db from 10 cps to 100 kc, and within 5 db from 5 cps to 500 kc. Vertical sensitivity .2 volts per inch at 1 kc, with input impedance of 12 mmfd shunting 10 megohms.

Horizontal response within 1 db from 10 cps to 200 kc, and within 5 db from 5 cps to 500 kc. Hor. sensitivity .25 volts per inch at 1 kc, input impedance of 15 mmfd shunting 10 megohms. Sweep generator covers 10 cps to 100,000 cps with stable positive lock-in circuit. Cathode follower input in both vert. and hor. amplifiers; push-pull vertical and horizontal deflection amplifiers; 3" CRT; electronic positioning controls for wide range of vertical and horizontal spot deflection; provision for internal and external sync; 60 cycle line sweep. New modern color styling and unusual performance make this instrument an outstanding value.

5BP1 CR TUBE

NEW *Heathkit* 5" PRINTED CIRCUIT

OSCILLOSCOPE KIT

MODEL OM-1

$49.50 Shpg. Wt. 24 lbs.

VERSATILE INSTRUMENT: The new Model OM-1 general purpose Oscilloscope represents an outstanding dollar value in reliable test equipment. Full 5 inch CRT. Printed circuit boards for ease of assembly, constant circuit characteristics, and rugged component mounting. Includes all the design features necessary for servicemen, students, experimenters, radio amateurs, etc. Frequency response of amplifiers flat within 1 db from 10 cps to 100 kc, and down only 7 db from 10 cps to 500 kc. Sweep generator range from 20 cps to 100,000 cps. Also features new Heathkit color styling with charcoal gray panel and high definition white lettering for readability even under subdued lighting conditions.

DESIGN FEATURES: A full-size, versatile oscilloscope at a price you can afford. Other features are: adjustable spot shape control; RF connections to deflection plates; direct coupled centering controls; external and internal sweep and sync; 60 cycle line sync; built in 1 volt peak-to-peak panel terminal reference voltage; professional appearance of cabinet, panel, and knob styling.

HEATH company

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BENTON HARBOR 20, MICHIGAN

AUDIO—HIGH FIDELITY

needed is to clear the armature pivot which extends above the top of the cartridge. In some cases it may be necessary to drill or recess a small hole in the slide or arm to provide clearance. When mounted in arms adjusted for the G-E cartridge, the Electro-Sonic will have a slightly longer overhang. This will change the tracking angle but apparently not seriously. The cartridge is lighter than the G-E and will require an adjustment of the tracking weight. It tracks nicely with pressures above 4 grams.

The principle of the cartridge is very simple. It is a moving-coil dynamic on the same D'Arsonval principle used in meters. The needle is mounted on the end of an armature on which there is a very small coil. The coil is within the gap of a strong magnet. Movement of the needle turns the coil, and the current flowing through the coil changes as a result of the magnetic flux lines it cuts. Since the movement of the coil is in a short arc—much shorter than that of a meter—the linearity is excellent. Vertical movement of the armature is restricted and produces little or no change in the current. Therefore, the pickup is very insensitive to scratch and warped records. The movement is very small and light; the compliance is limited principally by the mass of the needle alone and is excellent. The distortion is extremely low also. The needle cannot be changed except at the factory. Replacement of sapphire needles costs $7.50 and of diamond needles $15.00.

New records

Note: Records are 12-inch LP and play back with RIAA curve unless otherwise indicated.

Spanish and Latin American Music
Izler Solomon conducting
MGM E-3155

In the very first rank of test, demonstration and showoff records, this offers a very wide variety of test material in a form that is interesting and provocative and will stimulate lively interest and conversation at any record party. The pièce de résistance is Carlos Chavez' *Toccata for Percussion*. Toccata means literally "touch piece" and in this Chavez scores music for the percussion section which demands, and here receives, the greatest delicacy and subtlety of playing. Just about all the percussion instruments are represented and recorded with complete justice. The recording will sound good on any hi-fi system but it will also weed out the merely good from the superb. On a system with superb bass definition you will hear subleties of percussion tone not found in any other recording I know of.

The *Toccata* occupies one whole side. The other side presents some more useful material played by very unusual combinations of instruments. Revuelta's very amusing *Ocho por Radio* has some very fine high-highs and dissonances. Surinach's *Ritmo Jondo* is an impressionistic rendering of Spanish flamencas with plenty of handclapping and an excellent xylophone and tympani. Villa-Lobos' *Choros No. 7* is a sort of serenade for winds and strings with a fine intimate chamber quality. I think this belong in every hi-fi library and MGM is to be congratulated for a fine job or recording, very clean and never overcut or even strained.

Further Studies in High Fidelity
Capitol SAL-9027

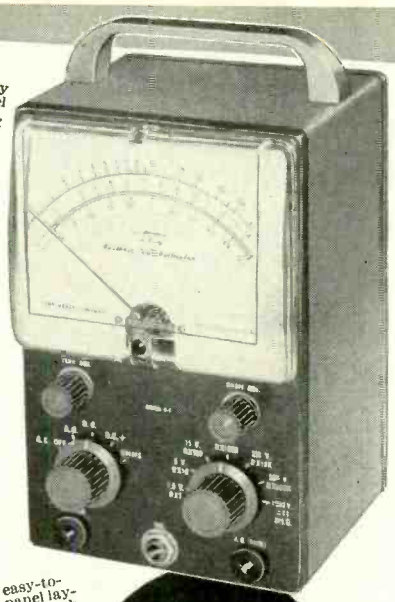
No more instructive evidence of progress in high-fidelity recording in the past 18 months can

NEW *Heathkit* VACUUM TUBE VOLTMETER KIT

PRINTED CIRCUIT DESIGN

New charcoal gray baked enamel panel with high readability, white lettering. New soft feather gray cabinet, subdued pilot light indicator.

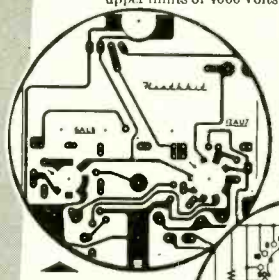
New printed circuit board for faster, easier construction—exact duplication of Lab development model.



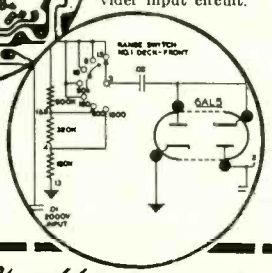
Another outstanding example of continuing Heath Company pioneering and leadership in the kit instrument field. A new **printed circuit** VTVM. New peak-to-peak circuit—new styling and new panel design. A prewired, prefabricated printed circuit board eliminates chassis wiring, cuts assembly time in half, assures duplication of Engineering pilot model specifications, and virtually eliminates possibility of construction error.

CIRCUIT:

A 6AL5 tube operated as a full wave AC input rectifier permits seven peak-to-peak voltage ranges with upper limits of 4000 volts P—P. Just the ticket for you TV servicemen. Voltage divider in the 6AL5 input circuit limits applied AC input to a safe level. This circuitry and the isolation of the meter in the cathode of the 12AU7 bridge circuit affords a high degree of protection to the sensitive 200 microampere meter.



Full wave rectifier in AC input circuit. Read peak-to-peak and RMS volts with upper limit of 4000 P—P and 1500 volts RMS. Voltage divider input circuit.



The first kit instrument to offer a labor-saving, error-free *printed circuit* board. Your instrument an exact wiring replica of Engineering development model.

RANGES:

Seven voltage ranges. 1.5, 5, 15, 50, 150, 500 and 1,500 volts DC and AC RMS. Peak-to-peak ranges 4, 14, 40, 140, 400, 1400, 4000. Ohmmeter ranges X1, X10, X100, X1000, X10K, X100K, X1 meg. Additional features are a db scale, a center scale zero position, and a polarity reversal switch.

New easy-to-read open panel layout. Off-on switch now incorporated in the selector switch.

MODEL V-7

$24.50

Shpg. Wt. 7 lbs.

IMPORTANT FEATURES:

High impedance 11 megohm input—transformer operated—1% precision resistors, 6AL5 and 12AU7 tube—selenium power rectifier— individual AC and DC calibrations—smoother improved zero adjust control action—new panel styling and color—new placement of pilot light—new positive contact battery mounting —new knobs—test leads included.

The new V-7 also sets the pace as a kit instrument style leader. Smart, good-looking charcoal gray panel and soft feather gray cabinet. High readability panel with sharply contrasting white calibrations. The pleasing, eye catching, modern styling is in harmonious balance with the outstanding circuit design improvements. Easily the best buy in kit instruments.

New peak-to-peak meter scale—new color harmony—new knobs.

Heathkit AC VACUUM TUBE VOLTMETER KIT

MODEL AV-2

$29.50 Shpg. Wt. 5 lbs.

Extreme sensitivity has been emphasized in the design of the Heathkit AC VTVM. Ten full scale RMS ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts. Frequency response is substantially flat from 10 cycles per second to 50 KC with input impedance of 1 megohm at 1 KC. Will accurately measure as low as 1 millivolt at high impedance. Total db range is —52 db to +52 db. An excellent kit for measuring the output of phono cartridges and the gain of amplifier stages. Use it also to check power supply ripple, as a sensitive null detector, and for compiling frequency response data. Features one knob operation, 200 microampere Simpson meter and precision resistors.

Heathkit 30,000 VOLTS DC PROBE KIT

Measure up to 30,000 volts DC with the Heathkit VTVM and the 336 high voltage Probe. Precision resistor provides multiplication factor of 100. Can be used with any 11 megohm input VTVM. Housed in a Polystyrene two color sleek plastic probe body for safety of operation.

No. 336

$4.50

Shpg. Wt. 1 lb.

Heathkit PEAK-TO-PEAK PROBE KIT

No. 338-C

$5.50

Shpg. Wt. 2 lbs.

Peak-to-peak values not exceeding 80 volts at a DC level of not more than 600 volts, can now be read directly by using 338-C Probe with previous model Heathkit VTVM's or any VTVM with 11 megohm input resistance. Probe construction features a modern printed circuit board for easy assembly. Frequency range 5 KC to 5 MC.

Heathkit RF PROBE KIT

The Heathkit RF Probe will permit the measurement of RF voltages up to 250 MC with an accuracy of ±10%. The limits are 30 volts AC and a DC level of 500 volts. Designed for any 11 megohm input VTVM. Modern styling, Polystyrene aluminum housing, Polystyrene insulation, and printed circuit board for easy assembly.

No. 309-C

$3.50 Shpg. Wt. 1 lb.

Heathkit AUDIO WATTMETER KIT

Read audio power output directly without using external load resistors with the new Heathkit Audio Wattmeter. Built-in non-inductive load resistors provide impedances of 4, 8, 16, and 600 ohms. Flat response from 10 CPS to 250 KC. Full scale power ranges are 0–5 MW, 0–50 MW, 0–500 MW, 0–5 W and 0–50 W. Model AW-1 will operate continuously at 25 watts and has a duty cycle of 3 minutes at 50 watts. Total db range in five positions is —50 db to +48 db, using the standard 1 milliwatt 600 ohms.

MODEL AW-1

$29.50

Shpg. Wt. 6 lbs.

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AUDIO—HIGH FIDELITY

be presented than playing this right after the original *Studies in High Fidelity*. This *Further Studies* is superior in every respect but especially in a better, cleaner, sharper and heavier bass on the classical side. The two percussion bands are more musical and more subtle; the classical side is better balanced as between bass and treble and much better defined. The high-highs are clean and prominent but do not override the bass. The flamenca passage of Antheil's *Capital of the World* is reproduced more cleanly and sharply here than in the original. The same is true of the *Rites of Spring* which will severely test the tracking and tracing abilities of the pickup and needle; if you hear distortion, check the needle and pickup alignment. Charles Fowler has again produced an excellent commentary.

PROKOFIEFF: *Classical Symphony*
TCHAIKOVSKY: *Serenade in C Major*
Wm. Steinberg and Pittsburgh Symphony
Capitol P-8290

The Prokofieff side seems the best Capitol recording I've heard this year. The bass is excellent and naturally dull; the highs are exciting and sharp but clean. The solo fiddle in the second movement, which is supposed to be birdlike, really is; the transient definition is very fine and sharp attacks and stops are reproduced with no discernible hangover. The plucked basses with fiddles riding them lightly in the middle of the second movement are a very fine measure of definition and IM. The witty subtleties of Prokofieff's tongue-in-cheek scoring, especially in the final movement where he shows off his skill in a delightfully different kind of polyphony, are clearly evident. All the instruments are good. A complete joy to me both from the musical and fidelity points of view.

The Tchaikovsky side presents an interesting contrast in miking. Miked more remotely the full resonance of the *Syrian Mosque* is very evident and increases the full romanticism of this music while the closeup miking increases the sharp wittiness of Prokofieff's scoring. Possibly the contrast makes the Prokofieff side sound all the better.

Orchestral Favorites: Vol. II
Various Orchestras
MGM E-3046

Another potpourri of popular short classical music including *Finlandia, A Night on Bald Mountain, Trojan's March* from Berlioz' Trojan operas, *The Air on the G String* and four other well known and well liked selections played by several orchestras including the London Symphony, the Lamoureux Philharmonia, etc. All receive better than adequate interpretation and the recording is excellent. There is a variety of hi-fi material of all sorts and the music is of the pop type which appeals most to the musically unsophisticated. Very good for demonstration and showoff and just to listen, too.

Our Favorite Encores
Ethel and Rae Bartlett on two pianos
MGM E-3150

Those who like two-piano music should welcome this good recording of today's most popular piano duo playing an even dozen works including Bach's *Sheep May Safely Graze* and *Jesu, Joy of Man's Desiring*, Granados' *Maiden and the Nightingale*, Ravel's *Habanera* and Rachmaninoff's *Tears*. Fine recording of the piano.

BRAHMS, SCHUMAN and LISZT: *Piano Variations on Themes by Paganini*
Friedrich Wuehrer, piano.
Vox PL-8850

Paganini's sensational virtuosity on the fiddle stimulated the above three composers to demonstrate similar virtuosity on the piano. Mr. Wuehrer gives them a really bravura performance in a brilliant piano recording which leaves no doubt that here is a big concert grand and the pianist is not sparing his muscles or worrying about overloading the recorder. The bass is big and resonant, full of beat notes. The high end is rather curiously tuned, perhaps to simulate the early pianos for which the music was written, and has an almost barrel-house tinkle which

NEW *Heathkit* TV ALIGNMENT GENERATOR KIT

Controllable inductor sweep oscillator with output entirely on fundamentals.

Triple marker system 4.5 MC crystal controlled—3 sets of low loss, low capacity shielded cables included.

Electronically operated, smooth continuously variable sweep circuit. No vibration, hum or noise.

Here is the most radically improved Sweep Generator in the history of the TV service industry. The basic design follows latest high frequency techniques which result in a combination of performance features not found in any other sweep generator.

SWEEP:

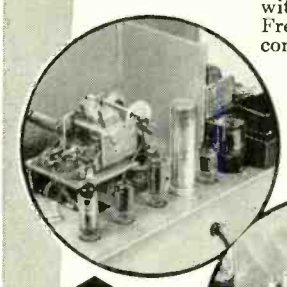
Sweep action is obtained electronically through the use of a newly developed controllable inductor, thereby eliminating all moving parts with their resultant hum, vibration, fatigue, etc. Frequency coverage entirely on fundamentals, is continuous from 4 MC to 220 MC at an output level well over a measurable .1 volt.

Frequency coverage: 4 MC—220 MC continuous including FM spectrum. RF output well over .1 volt.

MODEL TS-4

$49.50

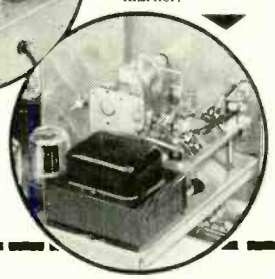
SHPG. WT. 16 LBS.



Triple marker system, 4.5 MC crystal controlled marker—continuously variable marker—provisions for external marker.

MARKER:

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 19 to 60 MC on fundamentals, and 57 to 180 MC on calibrated harmonics. A separate fixed crystal controlled 4.5 MC marker can be used for checking IF, bandpass, calibration, reference, etc. Provisions are also made for external marker use. A 4.5 MC crystal is supplied with the kit.



Automatic amplitude control circuit—constant output voltage regulated power supply.

POWER SUPPLY:

The transformer operated Power Supply features voltage regulation for stable oscillator operation. Three sets of shielded cables are furnished with the kit. Sweep range is completely and smoothly controllable from zero up to a maximum of 42 MC, depending upon base frequency.

Here is a TV Sweep Generator that truly no serviceman can afford to be without for rapid, accurate, TV alignment work.

NEW *Heathkit* SIGNAL GENERATOR KIT

MODEL SG-8

$19.50 Shpg. Wt. 8 lbs.

The new Heathkit service type Signal Generator, Model SG-8 incorporates many design features not usually found in this instrument price range. Frequency coverage is from 160 KC to 110 MC in five ranges, all on fundamentals, with useful calibrated harmonics up to 220 MC. The RF output level is well in excess of 100,000 microvolts throughout the frequency range. The oscillator circuit consists of a twin triode tube, one-half used as a Colpitts oscillator, and the other half as a cathode follower output which acts as a buffer between the oscillator and external load, thereby eliminating oscillator frequency shift usually caused by external loading.

All coils are factory wound and adjusted, thereby completely eliminating the need for individual calibration and the use of additional calibrating equipment. The stable, low impedance output, features step and variable attenuation for complete control of RF level. A separate 6C4 triode acts as a 400 cycle sine wave oscillator, and a panel mounted switching system permits choice of either external or internal modulation.

Heathkit LABORATORY GENERATOR KIT

MODEL LG-1

$39.50

Shpg. Wt. 16 lbs.

The new Heathkit Laboratory type Signal Generator definitely establishes a new performance standard for a kit instrument. An outstanding feature involves the use of a panel mounted 200 microampere meter calibrated both in microvolts and percent modulation, thereby providing a definite reference level for using the Signal Generator in design work, gain measurements, selectivity, frequency response checks.

DESIGN:

Additional design features are copper plated shield enclosure for oscillator and buffer stages resulting in effective double shielding. Fibre panel control shaft extensions in RF carrying circuits, thorough AC line filtering, careful shielding of the attenuator network, voltage regulated B plus supply, selenium rectifier, etc.

RANGES:

Frequency coverage from 150 KC to 30 MC all on fundamentals in five separate ranges. Output voltage .1 volt with provisions for metered external or internal modulation. Output impedance termination 50 ohms. Transformer operated power supply.

Investigate the many dollar stretching features offered by the LG-1 before investing in any generator for Laboratory or Service work.

NEW *Heathkit* BAR GENERATOR KIT

MODEL BG-1

$14.50 Shpg. Wt. 4 lbs.

The Heathkit BG-1 produces a series of horizontal or vertical bars on a TV screen. Since these bars are equally spaced, they will quickly indicate picture linearity of the receiver under test without waiting for transmitted test patterns. Panel switch provides "standby—horizontal and vertical position." The oscillator unit uses a 12AT7 twin triode for the RF oscillator and video carrier frequencies. A neon relaxation oscillator provides low frequency for vertical linearity tests. The instrument will also provide an indication of horizontal and vertical sync circuit stability as well as overall picture size. Operation is simple and merely requires connection to the TV receiver antenna terminal. Transformer operated for safety.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 20, MICHIGAN

AUDIO—HIGH FIDELITY

makes it all the more interesting. I have always liked the music myself and I find that most people do after hearing it a few times.

RICHARD STRAUSS: *Till Eulenspiegel, Don Juan, Death and Transfiguration*
Jascha Horenstein and Bamberg Symphony
Vox PL-9060

Vox continues to give a big money's worth with this 55 minutes of well recorded versions of the three shorter Strauss tone poems. They have an impressive bass and fine but not overpowering highs. Those who like the music will find plenty of good demonstration and showoff material in some good drums, excellent triangles and some fine peaks. Those who do not know the music should find it easy to learn to like it for all three tone poems illustrate stories in an easy-to-follow form.

MAHLER: *Songs of the Wayfarer, Songs on the Death of Infants*
Norman Foster, bass-baritone
Jascha Horenstein and Bamberg Symphony
Vox PL-9100

Mahler was almost unique in his predilection for combining solo voices with a full orchestra. These two works are completely characteristic and perhaps easier to take at first hearing than the symphonies using some of the same material. An excellent recording of the bass-baritone voice, which differs from the normal baritone in that the fundamental is of high amplitude equal to or greater than that of the high harmonics which give the normal baritone a sharp sandpaper edge.

This is miked fairly close up so that the sometimes perfervid emotion comes through easily. The music is mostly on the plaintive and mournful side (the wayfarer, too, is in mourning for a sweetheart marrying somebody else) but there are moments when the drums roll awesomely and others when they toll delicately in the background. Those who like vocal music should like this for the music and the excellent overall sound. The book type jacket includes original German texts and very literal translations which betray the naive quality of the poetry so completely that sometimes it seems incongruous to devote so much grand orchestral music to it.

Panama
Stardust
Dick Hyman Trio
MGM K-11916 (45 r.p.m.)

An excellent demonstration piece with nice percussives, excellent highs, plenty of brassy shimmer and a heavy double bass; all excellently clean for a pop.

Prelude to a Star
Bewitched, Bothered and Bewildered
Robert Maxwell, harp and orchestra
MGM K-11899 (45 r.p.m.)

The harp is nicely recorded on the *Bewitched* side while the other has some sharp, Montovani type strings. Plucked bass on one side, bowed bass on the other, both pretty big.

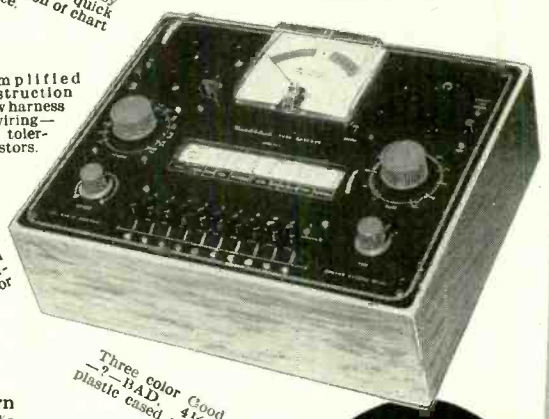
Mood Music
Leroy Holmes Orchestra
MGM E-246 (10 inches, 33 r.p.m.)

Another good example of a hi-fi recording of soft-light music with very fine bowed double bass, sharp strings, some sweet trombone solos and plenty of harp arpeggios. Sounds much better on a hi-fi system than on an ordinary player and the millions who love this kind of music will be able to discern the fact immediately.

'S Wonderful
Jack Kelly Quintet
MGM E-280

Excellent, resonant piano backed up by harp, electric guitar, double bass and percussion. Old favorites in a clean recording with a big double bass. Some fine high-highs from triangle set C. For definition listen to the very lightly played arpeggios on the very short harp strings and the very light traps in the background. END

Heathkit TUBE CHECKER KIT



The Heathkit TC-2 Tube Checker was primarily designed for the convenience of radio and TV servicemen and will check the operating quality of tubes commonly encountered in this type of work. Test set-up procedure is simplified, rapid, and flexible. Panel sockets accommodate 4, 5, 6, and 7 pin tubes, octal and loctal, 7 and 9 pin miniatures, 5 pin Hytron, and a blank socket for new tubes. Built-in neon short indicator, individual 3-position lever switch for each tube element, spring return test switch, 14 filament voltage ranges, and fine-set control to compensate for supply voltage variations, all represent features of the TC-2.

Results of tube tests are read directly from the large 4½" Simpson 3-color meter. Checks emission, shorted elements, open elements, and continuity. Wiring procedure has been simplified through the use of multi-wired color coded cable providing a harness type installation between tube sockets and lever switches. This procedure insures standard assembly and imparts a "factory built" appearance to the instrument. New Construction Manual furnishes detailed information regarding tube set-up procedure for testing of new or unlisted tube types. No delay necessary for release of factory data.

MODEL TC-2
$29.50
Shpg. Wt. 12 lbs.

Heathkit PORTABLE TUBE CHECKER KIT

The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylin impregnated fabric covering with a contrasting gray on the inside of the detachable cover.

MODEL TC-2P
$34.50
Shpg. Wt. 15 lbs.

Heathkit REGULATED POWER SUPPLY KIT

MODEL PS-2
$33.50
Shpg. Wt. 15 lbs.

Here is a source of regulated D.C. voltage for circuit development work. Power supply voltage and current drain to the circuit under test are constantly monitored by the 4½" panel mounted meter. Separate 6.3 volt at 4 ampere A.C. filament source available. The regulated and variable output voltage will be constant over wide load variations, and hum ripple will not exceed .012% at 250 volts under a 50 MA load. Completely isolated circuit, standby switch, and other desirable features, make the Model PS-2 extremely useful in a wide variety of applications.

Heathkit TV PICTURE TUBE TEST ADAPTER

The Heathkit TV Picture Tube Test Adapter used with the Heathkit Tube Checker Kit, will quickly check picture tubes for emission, shorts, etc. and determine tube quality. Consists of standard 12-pin TV tube socket, four feet of cable, octal socket connector, and data sheet.

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

Heathkit DECADE RESISTANCE KIT

MODEL DR-1
$19.50
Shpg. Wt. 4 lbs.

Twenty 1% resistors are decaded in 1 ohm steps to provide any value between 1 ohm and 99,999 ohms. Sturdy ceramic switches with silver plated contacts insure reliable service. Use the Decade Resistance in bridge circuits, meter multipliers, calibrations, or any application requiring a wide range of precision resistance values.

Heathkit AUDIO GENERATOR KIT

MODEL AG-8
$29.50
Shpg. Wt. 11 lbs.

Here is an Audio Generator with features generally found only in the most expensive instruments. Sine wave coverage from 20 cycles to 1 Megacycle—response flat ±1 db from 20 cycles to 400 Kc—continuously variable and step attenuated output. Because the output voltage is relatively constant over wide frequency ranges, the AG-8 is ideal for running frequency response curves in audio circuits. Once set by means of the attenuator, this voltage may be relied upon for accuracy within ± 1 db. Instrument features low impedance 600 ohm output circuit and distortion less than .4 of 1% from 100 CPS through audible range.

Heathkit DECADE CONDENSER KIT

The Heathkit Decade Condenser provides a ready source of capacity values from 100 mmf to .111 mfd inclusive in capacity steps of 100 mmf. Silver plated contacts on husky ceramic switches, assure positive contact for each switch position. Precision silver mica condensers ±1% accuracy for close tolerance accurate work.

MODEL DC-1
$16.50
Shpg. Wt. 3 lbs.

HEATH company
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 20, MICHIGAN

NEW *Heathkit* HIGH FIDELITY
PREAMPLIFIER
KIT

Equalization for LP, RIAA, AES, and early 78.

Separate bass and treble tone controls—special hum control.

Cathode follower low impedance output circuit.

Beautiful, modern appearance, blends with any interior color scheme.

Five switch selected inputs with individual level controls.

Here is the exciting new Heathkit Preamplifier with all of the features you Audiophiles have asked for and at a down-to-earth price level. Beautiful satin gold baked enamel finish, striking control knobs and arrangement, attractive custom appearance and entirely functional design.

DESIGN:

Uses three twin triode tubes in a shock mounted chassis, 2-12AX7 and 1-12AU7. Features tube shielding, plastic sealed color coded capacitors, smooth acting controls, good filtering, excellent decoupling, low hum and noise level, and all aluminum cabinet. Special balancing control for absolute minimum hum level. Cathode follower, low impedance output circuit for complete installation flexibility.

SPECIFICATIONS:

Provides five switch selected inputs, 3 high level, and two low level, each with individual level controls—4 position LP, RIAA, AES, and early 78 equalization switch—4 position roll-off switch, 8, 12, 16 with one flat position. Separate tone controls, bass 18 db boost and 12 db cut at 50 CPS, treble 15 db boost, and 20 db cut at 15,000 CPS. Power requirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12 9/16" wide x 5 7/8" deep x 3 5/8" high.

APPLICATION:

The new Heathkit WA-P2 Preamplifier has been designed to operate with any of the Heathkit Williamson Type Amplifiers and is directly interchangeable with the previous Model WA-P1 Preamplifier unit. Order your kit today and enjoy completely smooth control over the operation of your Hi-Fi system. Obtain the exact tonal balance of bass and treble with the precise degree of equalization you want. Note that the design of the WA-P2 accommodates the newly established RIAA curve.

MODEL WA-P2

$19.75

Shpg. Wt. 7 lbs.

HAM EQUIPMENT

Single knob band switching—pre-wound coils.

Crystal or VFO excitation—metered operation.

52 Ohm coaxial output—built-in power supply.

Heathkit AMATEUR TRANSMITTER KIT

The Heathkit AT-1 Transmitter has established a high reputation and has been enthusiastically accepted by hundreds of experienced operators as well as beginners. Power input up to 35 watts for the novice and suitable as a standby exciter for your higher powered rig later on.

Model AT-1 can be crystal or VFO excited and operates on 80, 40, 20, 15, 11 and 10 meters. The pre-wound coils with the oscillator and amplifier are switched simultaneously hy the rugged band switch. Meter switch allows a reading of the final grid and plate current on the panel mounted meter. Modulator input and VFO power sockets are provided as well as a key jack for CW operation. Other features include a crystal socket, standby switch, key click filter, AC line filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliampere power supply and 5U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

MODEL AT-1

$29.50

Shpg. Wt. 16 lbs.

Copper plated chassis—aluminum cabinet—easy to build.

Smooth acting illuminated and precalibrated dial.

Brand NEW HEATHKIT VFO KIT

The new Heathkit VFO is the perfect companion to the Heathkit Model AT-1 Transmitter and it has sufficient output to drive any multi-stage transmitter of modern design. Good mechanical and electrical design insures operating stability. Coils are wound on stable, heavy duty, ceramic forms using Litz or double cellulose wire coated with Polystyrene cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspread. Kit is furnished with a carefully precalibrated scale which provides well over two feet of scale length. Smooth acting vernier reduction drive and illuminated dial provides easy tuning and zero beating.

Power requirements 6.3 volts AC at .45 amperes, and 250 volts DC at 15 mils. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter. Seven band coverage 160 through 10 meters with 10 volt average RF output. Uses 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

Seven band coverage 160 through 10 meters at 10 volt RF output.

6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

MODEL VF-1

$19.50

Shpg. Wt. 7 lbs.

Heathkit GRID DIP METER KIT

The invaluable instrument for Hams, servicemen and experimenters. Useful in TV service work, for alignment of traps, filters, IF stages, peaking compensation networks, etc. Locates spurious oscillation, provides a relative indication of power in transmitter stages. Use it for neutralization, locating parasitics, correcting TVI, measuring CL and Q of components, and determining RF circuit resonant frequencies. The variable meter sensitivity control, headphone jack, 500 microampere Simpson meter, continuous frequency coverage from 2 MC to 250 MC. Prewound coil kit and rack included.

LOW FREQUENCY COILS:

Low frequency range extended to 355 KC by the use of two additional coils. Complete with dial correlation curves. Set 341-A for GD-1B and set 341 for GD-1A. Shipg. wt. 1 lb. Price $3.00

MODEL GD-1B

$19.50 Shpg. Wt. 4 lbs.

Heathkit ANTENNA IMPEDANCE METER KIT

MODEL AM-1

$14.50

Shpg. Wt. 2 lbs.

Determine antenna resonance and resistance, transmission line surge impedance, and receiver input impedance. Works with one-half and one-quarter wave lines. half wave and folded dipoles, harmonic mobile and beam antennas. Resistance type SWR bridge —100 microampere meter—frequency range 0-150 MC—impedance range 0-600 ohms.

Heathkit ANTENNA COUPLER KIT

For the Heathkit AT-1 Transmitter or any comparable Amateur Transmitter. Will handle power up to 75 watts at its 52 ohm coaxial input. Matches a wide range of antenna impedances with its L type tuning network and neon indicator. A tapped inductance provides coarse adjustment and a transmitting type variable condenser sets it "right on the nose." Will operate on the 10 through 80 meter bands.

MODEL AC-1

$14.50

Shpg. Wt. 4 lbs.

HEATH company

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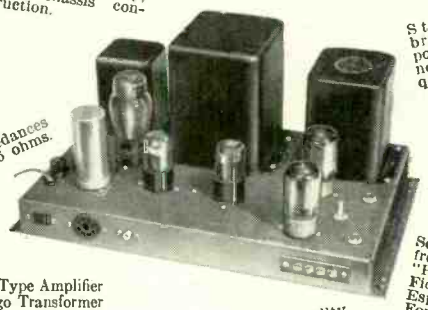
BENTON HARBOR 20, MICHIGAN

New LOW PRICED HEATHKIT SINGLE UNIT Williamson Type *High* Fidelity AMPLIFIER KIT



Lowest price high quality Williamson Type Amplifier ever offered.

Here is the newest Heathkit Hi-Fi Amplifier at the lowest price ever quoted for a complete Williamson Type Amplifier circuit. The W-4 Model has been designed for single chassis construction, and only for the new Chicago Transformer Company Model BO-13 "super range" high fidelity output transformer. This transformer, a new development in the Hi-Fi field, is being offered at substantial saving over transformers of comparable quality. It is outstanding in performance and on the basis of our tests, we find it equal in every respect to transformers used in the W-2 and W-3 Heathkit series.

LOW PRICES:

Through utilization of a single chassis with resultant economy obtained through elimination of duplicate sheet metal fabrication, connecting cables, plugs, sockets, and a new Chicago "super range" output transformer, a 20% price reduction has been made possible without sacrificing kit quality.

COMPONENTS:

The new Heathkit W-4 uses the same heavy duty power transformer and choke. It has all of the features of previous models including individual jacks and a wire wound control to balance the output tubes—plastic high quality capacitors and the exact circuitry previously utilized in Williamson Type Amplifiers. Intermodulation distortion and harmonic distortion are both at the same low level as in the W-2 and W-3 models.

CONSTRUCTION:

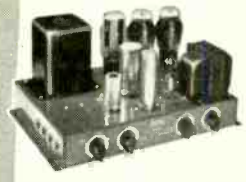
Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble this Amplifier in a few pleasant hours.

COMBINATIONS AVAILABLE

W-4M with Chicago "super-range" transformer only. Single chassis main amplifier and power supply. Shipping weight 28 lbs. Express only **$39.75**

COMBINATION W-4 with Chicago "super-range" transformer only includes single chassis main amplifier and power supply with WA-P2 preamplifier kit. Shpg. wt. 35 lbs. Express only **$59.50**

NEW *Heathkit* 20 WATT High Fidelity AMPLIFIER KIT



MODEL A-9B

$35.50

Shpg. Wt. 24 lbs.

In keeping with the progressive policy of the Heath Company, further improvement has been made in the already famous Heathkit High Fidelity 20 Watt Amplifier. Additional reserve power has been obtained by using a heavier power transformer. A new output transformer designed and manufactured especially for the Heath Company, now provides output impedances of 4, 8, 16 and 500 ohms. The harmonic distortion level will not exceed 1% at the rated output.

FEATURES:

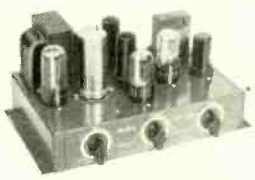
Outstanding features of the Heathkit 20 watt Amplifier include frequency response of ±1 db from 20 CPS to 20 KC. Separate (boost and cut) bass and treble tone controls. Four switch selected input jacks and a special hum balancing control. Flexibility is emphasized in the input circuits and proper equalization for all input devices is incorporated.

TUBE LINEUP:

12AX7 magnetic preamplifier and first audio amplifier. 12AU7 two stage amplifier with tone controls. 12AU7 voltage amplifier and phase splitter. Two 6L6 push-pull beam power output and 5U4G rectifier.

The Heathkit Model A-9B is excellent for custom installation and is designed for outstanding service at a very reasonable cost.

Heathkit SIX WATT AMPLIFIER KIT



MODEL A-7B

$15.50

Shpg. Wt. 10 lbs.

An outstanding value, this economically priced 5 watt Amplifier is capable of performance expected only in much more expensive units. Only 2 or 3 watts output will ever be used in normal home applications and Model A-7B will be more than adequate for this purpose.

SPECIFICATIONS:

Two switch selected inputs are available for crystal and ceramic phono pickups, tuner, TV audio, tape recorder, and carbon type microphone. Model A-7B features separate bass and treble tone controls, push-pull balanced output stages, output impedances of 4, 8, and 15 ohms, and extremely wide frequency range ±1½ db from 20 CPS to 20 KC. Not just a souped up AC-DC job. Full wave rectification, transformer operated power supply and good filtering, result in exceptionally low hum level.

MODEL A-7C

Provides a preamplifier stage and proper compensation for the variable reluctance cartridge and low level microphone. $17.50

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

Here is the famous kit form Williamson Type *high fidelity* Amplifier that has deservedly earned highest praise from every strata of Hi-Fi music lovers. Virtually distortionless, clean musical reproduction, full range frequency response, and more than adequate power reserve.

OUTPUT TRANSFORMERS:

This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous Acrosound TO-300 output transformer. This quality transformer features the popular "ultra-linear" output circuit for clean maximum power level. Separate chassis for amplifier and power supply.

SPECIFICATIONS:

Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt output less than .5% between 20 cycles and 20,000 cycles. IM distortion at 5 watts equivalent output .5% using 60 and 3,000 cycles. Output impedances of 4, 8, or 16 ohms. Overall dimensions for each unit 7" high x 5½" wide x 11½" long.

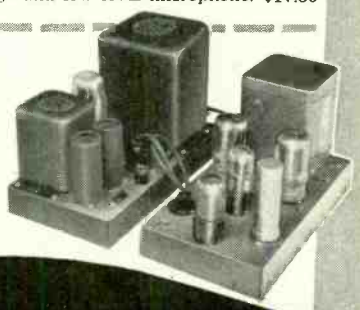
CONSTRUCTION MANUAL:

This fine kit is supplied with a completely detailed step-by-step Construction Manual and the only effort required is the assembly and wiring of the pre-engineered kit. Even the complete novice can successfully construct this Amplifier and have fun building it.

COMBINATIONS AVAILABLE:

W-3 Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P2 Preamplifier.) Shipping weight 37 lbs. Shipped express only..... **$69.50**

W-3M Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **$49.75**



HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 20, MICHIGAN

Heathkit COMMUNICATIONS RECEIVER KIT

Separate BFO oscillator tube and circuit.

Continuous coverage 550 KC—35 MC on 4 Bands.

MODEL AR-2

$25.50

(Less Cabinet)

Shpg. Wt. 12 lbs.

Phone—standby—CW panel switch.

RF gain control with AGC on-off switch.

Electrical bandspread tuning with logging scales.

An excellent example of typical Heath Company ability to produce top quality kit merchandise at ridiculously low prices, is the AR-2 Communications Receiver. Here is a transformer operated all-wave receiver with all of the desired features and none of the disadvantages commonly encountered in so-called "economy sets."

Receiver employs high gain miniature tubes and IF transformers, chassis mounted 5½" PM speaker, headphone jack, slide rule dial with Ham Bands plainly identified, and easy tuning with direct planetary drive. Continuous frequency coverage from 550 KC to 35 MC on 4 Bands, with electrical bandspread tuning and logging scales. Other features are RF gain control with AGC on-off switch—phone-standby-CW panel switch—prewound coils in a shielded turret assembly and copper plated chassis and shielding.

Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector-first audio, 12A6 beam power output, 12BA6 BFO oscillator, and 5Y3 rectifier. A lettered control plate is provided for the cabinet of your choice or you can order the optional Heathkit cabinet featuring the full size aluminum panel.

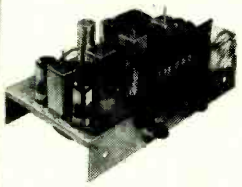
RECEIVER CABINETS

Proxylin impregnated fabric covered plywood cabinet available for BR-2 and AR-2 receivers. Includes aluminum panel, flocked reinforced speaker grill and protective rubber feet.

For BR-2 Receiver, Cabinet 91-9
Shipping weight 5 lbs. **$4.50**

AR-2 Receiver, Cabinet 91-10
Shipping weight 5 lbs. **$4.50**

Heathkit FM TUNER KIT



MODEL FM-2

$22.50

Shpg. Wt. 8 lbs.

Here is an FM Tuner that can be operated with your Hi-Fi Amplifier or through the "phono" section of the ordinary radio. Completely AC operated to eliminate problems usually encountered in "economy type" AC-DC tuner circuits. Features 8 tube circuit with separate mixer and oscillator, 3 double tuned IF stages followed by a limiter discriminator providing maximum sensitivity and selectivity across the full FM frequency band of 88 MC to 108 MC. The tuning unit is factory assembled and adjusted, thus eliminating tedious critical "front end" alignment problems. The attractive slide rule dial and vernier tuning combine to make the Heathkit FM-2 Tuner simple to operate.

Heathkit BROADCAST BAND RECEIVER KIT

MODEL BR-2

$17.50

(Less Cabinet)

Shpg. Wt. 10 lbs.

The Model BR-2 Broadcast Band Receiver is designed especially for the beginner without any sacrifice of quality. This receiver features a transformer operated power supply, high gain miniature tubes, sharply tuned IF transformers, new rod type built-in antenna, and a trouble-free planetary tuning system. Exceptional performance with unusually high sensitivity, good selectivity, and excellent tone quality from the 5½" PM chassis mounted speaker. Can be used either as a receiver, tuner, or phono amplifier. Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector, 12A6 beam power output, and 5Y3 rectifier.

HEATH COMPANY · Benton Harbor 20, Mich.

MAIL YOUR ORDER TODAY TO THE
HEATH COMPANY
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 20, MICHIGAN

WALNUT 5-1175

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(PLEASE PRINT)

QUANTITY	ITEM	MODEL NO.	PRICE

Enclosed find ( ) check ( ) money order for
Please ship C.O.D. ( ) postage enclosed for _____ pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS include postage for weight shown.

ORDERS FROM CANADA and APO's must include full remittance.

The PPA-700 Portable PA System

By HAROLD REED

A COMPLETELY portable, self-contained, self-powered public address system is needed on numerous occasions. For example, during an emergency it may be necessary to move about with a PA system, keeping it in continuous operation. The PPA-700 portable system produced by U. S. Recording and Research Company was designed to fulfill these requirements.

The system is always ready for instant use with the flick of a switch. Being completely battery-operated, there is no need for an external power source. There is no loss of time due to tube warmup delay, as the unit uses tubes with directly heated filaments. This makes it possible to cut off the filament voltage when the amplifier is being used in intermittent service, thereby extending battery life. The complete system, including loudspeaker and batteries, is built into a sturdy, reinforced carrying case, 14¼ inches wide, 8¾ inches deep and 7 inches high. The case provides a compartment for the microphone and cable. The total weight with the batteries installed is only 20 pounds.

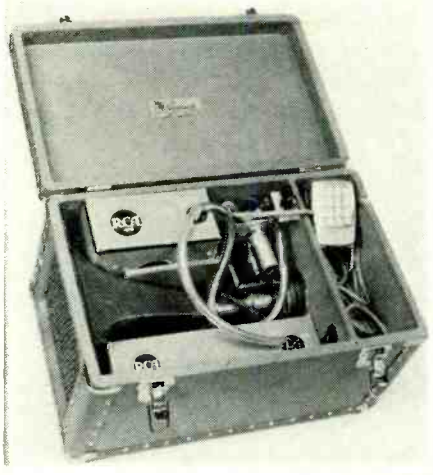
This portable PA system includes a model 715 ceramic Electro-Voice microphone with 25 feet of shielded, plastic-covered cable. The microphone has a push-to-talk, self-releasing switch for intermittent use, with provision for locking in the switch for continuous operation. A small slot is located at the top of the case on the right side. The microphone cable may be placed in this slot so that the lid of the case can be fastened down and the unit operated continuously while being carried about.

The built-in loudspeaker of the PPA-700, a University type, model 4408 Cobra Horn, consists of a one-piece aluminum casting, providing optimum vertical and maximum horizontal dispersion, with acoustic pressure uniform throughout the area of coverage. As can be seen in the photograph, the mouth of the loudspeaker is attached to one end of the carrying case, which is finished off with speaker grille cloth.

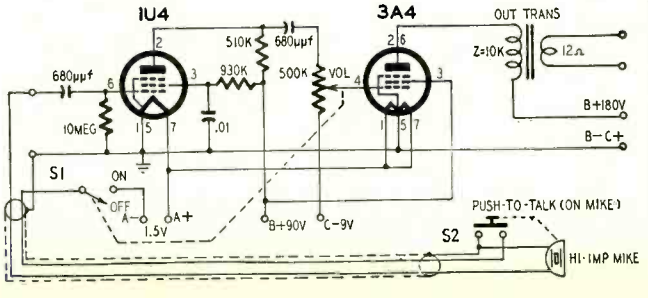
Two tubes are used in the amplifier, a 1U4 and a 3A4 (see diagram). These are low-current-drain types. A volume control and "on-off" switch are provided in the case. The supply voltages are furnished by two dry batteries, the RCA VS-043 and VS-019, or equivalent.

Microphone switch S2 is wired in series with S1 and is located at the left side of the microphone case. After S1 is thrown to the ON position, the unit is controlled by S2. For intermittent use this switch is operated in the normal push-to-talk manner. For continuous service, the switch button is pushed in and then upward, causing the switch to lock in until released by the operator. To prevent draining the batteries when the unit is not in use, due to pressure being accidentally applied to S2 when the microphone and cable are packed into the compartment, S1 should be placed in the OFF position when the equipment is taken out of service.

In making sound measurement tests with the PPA-700, 100-db sound level at a distance of 10 feet was recorded. Speech output from the loudspeaker was clearly distinguishable a block away on a metropolitan area street of average noise level. END



A top view of the PA system with the cover open to show major components.



A diagram of the amplifier in the PPA-700 PA system.

Improving INEXPENSIVE TAPE RECORDERS

Part II—The bulk eraser; improving frequency response

By HERMAN BURSTEIN

THE Dynamu erase head does a satisfactory job, but heavily loaded tapes can be erased better by the brute-force method, using a good-sized 60-cycle electromagnet. In less than an hour, I built such a bulk eraser. The cost: 50 cents for a junked power transformer (about the size found in expensive audio amplifiers), 5 cents for zip-cord, 10 cents for a sturdy line plug and 10 cents for rubber tape.

The E and I plates were removed from the transformer core and only the E plates were reinserted, all facing the same way. The zip-cord and plug were attached to the 117-volt winding. Leads to all other windings were snipped off and taped, and the bulk eraser was wound with rubber tape to protect the core and windings.

The eraser is easy to use. A reel of tape can be thoroughly erased in 15 seconds or less. Bring it slowly toward the eraser and then slowly away, describing a circular motion so that the magnetic field cuts all parts of the tape. Turn the reel over and repeat the procedure. From the length of time it takes the bulk eraser to become appreciably warm, its duty cycle may be estimated (for example, 1 minute on and 5 minutes off).

Nonsymmetrical electrical waveforms, such as produced by speech and music, contain a d.c. component which magnetizes the record–playback head. Head magnetization may also result from other sources such as sudden cutoff of

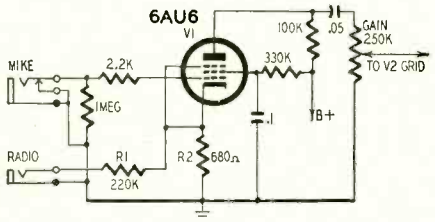
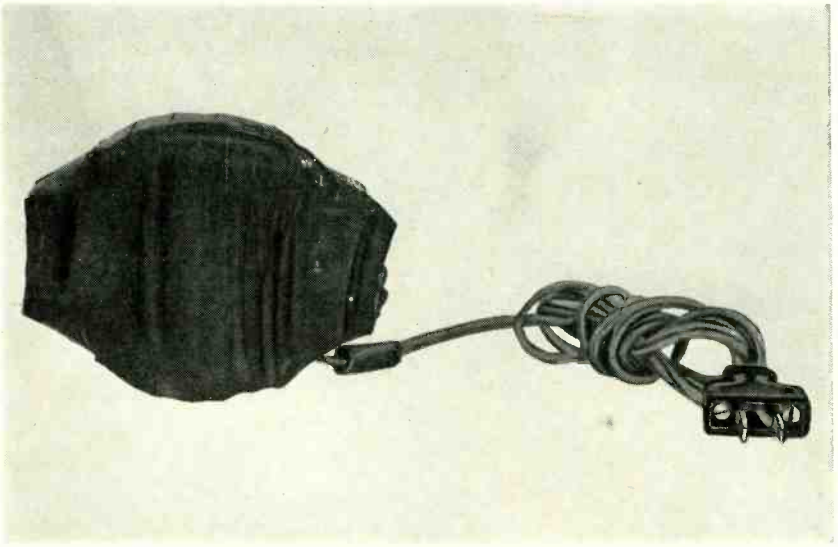


Fig. 1—Schematic diagram of the first stage of the Pentron record circuit.

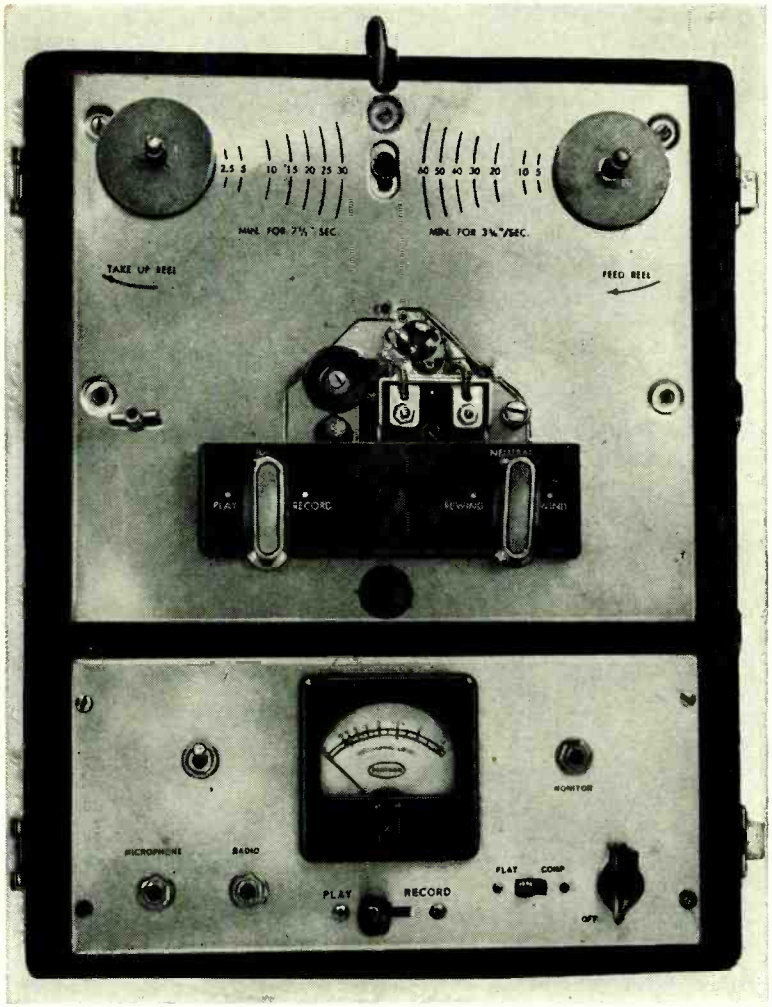
a signal fed to the head and contact with magnetized tools. This magnetization, representing a direct current, is a source of recording noise. It may also be a source of distortion by placing the tape on the wrong portion of its hysteresis loop. To eliminate head magnetization, the head should be demagnetized by the bulk eraser after approximately every 8 hours of use.

The bias waveform should be checked with an oscilloscope. It is vital that the waveform be symmetrical—departure from symmetry represents a d.c. component, a source of noise and distortion. Moderate departure from a sine wave appears to be unimportant as long as symmetry exists. If the waveform is not symmetrical, try changing the oscillator tube, component values, the oscillator coil (Dynamu has a specially designed coil for 100-kc pushpull operation) and, if all else fails, the



Inexpensive but effective bulk eraser made from old transformer.

Photo of the author's modified Pentron type PMD-1 tape recorder.



circuit itself. The Pentron's pushpull circuit is a popular one and ordinarily produces a very good waveform. I found the waveform in my unit excellent.

As shown in Fig. 1, microphone input of the Pentron PMD-1 goes to the grid of V1 while radio input goes to the cathode. Voltage division of 324:1 results from R1 and R2—respectively, 220,000 and 680 ohms—in series. To increase the radio-input signal R1 was replaced by a 33,000-ohm resistor, producing a voltage division of only 49:1. Since the recorder's gain control follows V1, the increased signal fed to V1 permits a lower gain setting and therefore a reduction of noise from this tube and its circuitry.

Choice of a 33,000-ohm resistor to replace R1 was based on the following: Signals were fed by an audio oscillator directly to the cathode of V1. A check of V1's output with an oscilloscope indicated that no appreciable distortion occurred for signals under 0.4 volt at all audio frequencies. Next, the audio oscillator supplied signals to the control unit of my audio system, and the level of each signal was increased until reproduction—through the speaker—became intolerably loud at a low setting of the control unit's gain control. Under these conditions, the control unit's output to the tape recorder was never more than 5 volts. Consequently, a 12.5:1 (5 volts ÷ 0.4 volt) reduction of signals fed to the recorder would apparently prevent overloading V1. Allowing a safety factor of 4:1, a voltage attenuation of approximately 50:1 would seem well on the safe side.

A load of 33,680 ohms (33,000 and 680 in series) across the control unit of my audio system does not unduly load the control unit stage feeding the tape recorder. Fig. 2 shows this stage, using one half of a 12AX7. The plate load resistor is 10,000 ohms. Shunting this resistor with a value of about 34,000 ohms produces less than 3-db drop in signal fed to the following stages.

To avoid loss of low frequencies fed to the tape recorder, C1 in Fig. 2 (shown as .05 μf in the original circuit of the control unit) was replaced by a 0.25-μf capacitor. Thus the low-frequency cutoff point is about 20 cycles for the control unit when feeding the modified Pentron.

Frequency response

A check of the Pentron (see photo) after the Dynamu heads were installed, using 0.8-ma bias current to the record–playback head, showed useful response down to about 50 cycles and up to about 10 kc. Although response was smoother than before, it was not smooth enough to meet the professional standard of ±2 db.

Dynamu specifies a bias current of 0.4 to 0.8 ma (see Fig. 3). Experiments with the bias showed that decreasing it below 0.8 ma could extend useful response to 15 kc or more, but only at the cost of an increase in distortion, particularly of the lower frequencies. Bias current was varied by changing the value of R1 in Fig. 4, using a 100,000-ohm potentiometer. Oscilloscope inspection during playback of waveforms recorded at high levels indicated that using 0.8-ma bias instead of lower values down to 0.4 ma produced appreciably less distortion at the lowest frequencies—about 30 to 100 cycles. This elevated bias permitted useful response to beyond 10 kc. Also, raising bias well above the minimum specified by the manufacturer of the Dyanmu head increased by several db the amount of signal recorded on the tape.

Further experiment resulted in sev-

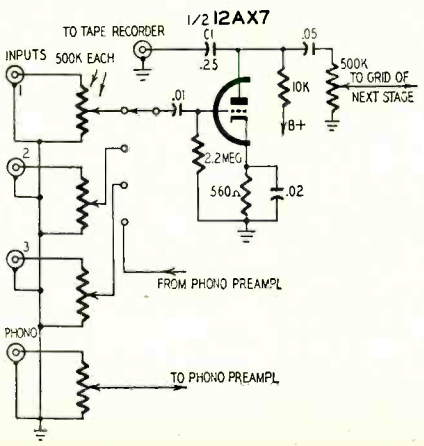


Fig. 2—Schematic of author's control unit stage feeding the tape recorder.

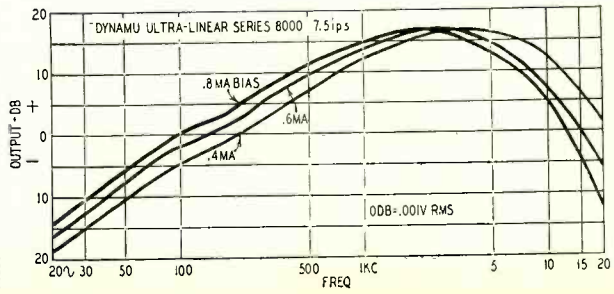


Fig. 3—Effect of bias current variation.

eral simple changes. They involved a total of six components and (referred to 1 kc = 0 db) produced a frequency response 3 db down at 44 cycles and 10 kc, 6 db down at 35 cycles and 11 kc, and virtually flat (±2 db) between 48 cycles and 9.5 kc. Fig. 5 shows the final

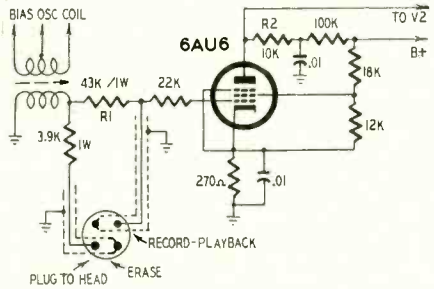


Fig. 4—Schematic of the first stage of the modified Pentron playback circuit.

response curve of the modified Pentron PMD-1. The equalization changes were:

1. Fig. 6 shows that two resistors (R1, R2) and one capacitor (C3) were changed to alter bass boost when recording. Resistor R1 was changed from 100,000 to 390,000 ohms, R2 from 150,000 to 220,000 ohms and C3 from .003 to .005 μf. The original circuit provides a bass boost reaching about 4 db at 100 cycles, remaining the same down to 50 cycles and declining to only 2.6 db at 40 cycles. The modified circuit attains slightly over 3-db boost at 50 cycles and continues to increase the amount of boost down to 40 cycles—very close to NARTB standards. The approximately 3-db boost at 60 cycles when recording means that 3 db less boost is required at 60 cycles in playback, thus significantly reducing hum picked up by the head. Although still more bass pre-emphasis might seem desirable when recording, this is not practicable because recording distortion is greatest at low frequencies.

2. Fig. 6 shows two changes involving capacitors. C2, 50 μμf, was added to boost high frequencies at the 7.5 i.p.s. speed. C1, which provides treble boost only at the 3.75-i.p.s. speed (COMPENSATE position of the switch) was reduced from .001 to 320 μμf because R1 was increased from its original value. At the 3.75-i.p.s. speed the modified Pentron is 3 db down at 50 cycles and 5 kc and flat within this range when the FLAT–COMPENSATE switch is in COMPENSATE position both in record and playback. Not only is this as good as the frequency range generally available on AM radio, but it is not much below the range of many FM programs, particularly those originating from intercity telephone-line networks.

3. In the playback circuit, R2 was changed from 33,000 to 10,000 ohms, as shown in Fig. 4, to maintain response down to 40 cycles or better. The original playback circuit provides a maximum boost of about 11 db at 70 cycles, with no further boost thereafter, whereas the modified circuit reaches a maximum boost of about 18 db at 30 cycles.

Although the azimuth alignment of a record–playback head need not be precise to prevent attenuation of high frequencies when playing back *its own* recordings, it is highly desirable to make such an alignment and to test it periodically for at least two reasons: to prevent high-frequency attenuation when previously recorded tapes are played after the head has been moved or replaced; to prevent high-frequency attenuation when a commercial prerecorded tape is played. In addition, it is psychologically comforting to know that one's tape recorder is up to standard.

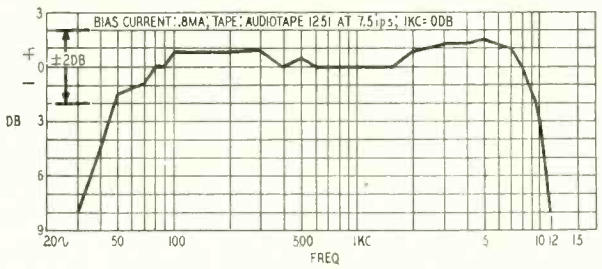


Fig. 5—The response of the modified Pentron recorder.

I used a Dubbings azimuth alignment tape—carrying a 7.5-kc frequency—to align my Dynamu record–playback head. It was necessary to pivot the head only a fraction of a degree from its original setting, made by eye, to get maximum response. Yet, the playback level of the 7.5-kc signal was increased by more than 10 db.

The Dynamu heads, the modified VU meter circuit, the low-noise resistors,

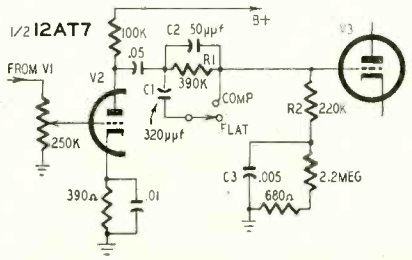


Fig. 6—Schematic of the second and third stages of the modified Pentron.

the additional filter capacitance, the higher signal input, the bulk eraser and the several components for changing equalization, bias frequency and bias current, contribute to a tape recorder that provides a high degree of satisfaction that ordinarily comes only with machines costing several times as much. A phonograph record transferred to tape and played back is indistinguishable from the original. At normal levels, such as most persons use in listening to radio and TV, no noise can be heard except with the ear right against the speaker. At moderately loud levels that do not exceed the region of comfort,

noise is apparent only within 2 or 3 feet of the speaker and only during silent or near-silent passages in a very quiet room. At levels that begin to exceed the region of comfort, noise is slightly apparent during quiet passages but is masked by the major portion of average program material.

Using the tape recorder

Following are several useful hints so that the newcomer to tape recording may get the most out of his machine, whether it be expensive, inexpensive or a modified low-priced recorder such as my Pentron.

If the transport mechanism of the tape recorder does not automatically disengage the tape from contact with the heads during fast wind and rewind, this should be done manually by removing the tape from the heads and letting it wind or rewind directly between the reels. If the tape contacts the heads, fast wind and rewind cause enough abrasive action to shorten their life considerably. Removing the tape from the heads also prevents accidental erasure if the machine does not have an interlock.

Excessively fast wind or rewind may create tensions in the tape that produce distortion. Generally, the slower the wind or rewind the better. If the transport mechanism permits, a high-speed wind or rewind should be slowed down. In the case of the Pentron, this speed is partly dependent on belt tension governed by a lever. The pressure exerted by this lever can be adjusted by lock nuts so as to slow down wind and rewind speeds somewhat.

The gain control of the tape recorder should be set high and the gain control of the amplifier (or control unit) into which the recorder plays back should be set low, rather than vice versa. A low setting of the amplifier's gain control cuts down tape-recorder noise in stages following the recorder's gain control. However, too high a setting of the recorder's gain control may overload the first stage of the amplifier which it feeds. In my case, advancing the recorder's gain control between two-thirds and three-quarters of the way gives satisfactory results. The actual setting is not critical.

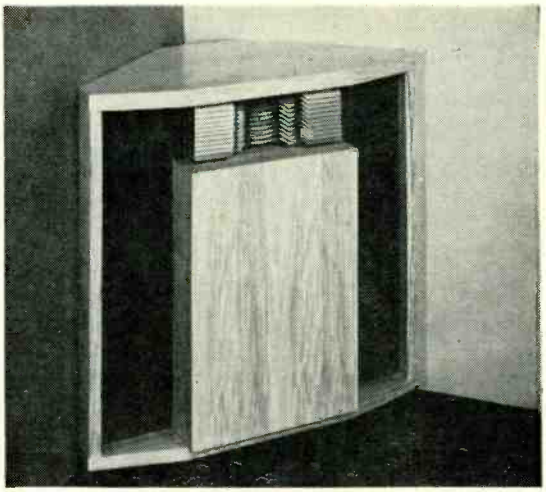
Before each use, especially a recording session, the machine should be allowed to warm up for 10 minutes or more to stabilize mechanically and electronically. Before recording, the machine should be set in the recording position to allow the oscillator and bias current to stabilize. During prerecording warmup the tape should not be in contact with the heads because of heat from the erase head.

The heads should be periodically cleaned with alcohol. A Q-tip or equivalent makes cleaning easy. The purpose is to remove the film of tape oxide gradually deposited on the heads by friction. This film, however slight, impairs performance, especially high-frequency response. END

HORN-TYPE SPEAKER SYSTEMS

Part II—Variations in the Klipsch design; the exponential labyrinth; the radial horn

By GEORGE L. AUGSPURGER



The Lansing Hartsfield corner horn.

THE Klipsch design (see photo) is familiar by now to all hi-fi enthusiasts. The bass section of the Klipschorn divides, rounds a sharp corner, reunites vertically, divides laterally and emerges in a rectangular cross-section along two axes roughly parallel to the room walls. It is a clever, critical, complicated, but extremely effective design. In spite of the fact that the Klipsch configuration terminates in a double horn with axes parallel to the floor, Klipsch claims that the horn makes use of the full solid angle formed by the walls and floor. It does so because the mouth of the horn is already large enough so that the discontinuity from speaker system to room corner is not too important.

This discontinuity could be largely eliminated in a design whose axis is 30° off the floor. Such a configuration has other difficulties, however, and probably no one even thought much about it after the first demonstration of the Klipschorn; everyone was too busy trying to think up variations on the Klipsch patent. Most of these new designs simplified the interior construction of the horn, such as Fig. 1. Some even went as far as Fig. 2 which, used with some small variations in almost all of the smaller Klipsch-licensed units, is a corner horn partly by virtue of advertising copy. It really works as a bass-reflex cabinet having the port coupled to a broadbanded air column. Broadbanding is achieved because the tuned column has a large resistive component in addition to its inductive (mass) characteristic. This is the result of the conic flare and the corner location which do give a certain horn effect.

Another variation of the Klipschorn is shown in Fig. 3. One of the really original new products, made by Pro-Plane Sound Systems, Pittsburgh, uses this interior configuration plus a genuine exponential flare rather than a conical approximation. But the best feature of this folded horn (Fig. 4) is that it is cast from a ceramic material. A ceramic folded horn is a great improvement in a small unit over Masonite or wood construction since the problems of acoustic transmission and resonance by horn surfaces are practically eliminated. I have heard the ceramic folded horn and it is surprising what a difference the cast ceramic construction does make in audio quality.

The home constructor can easily use this folded design as a basis for a Masonite horn which can then be stiffened with plaster or concrete for a really good home-built bass horn. Keep the horn restricted to the lower frequencies since the two relatively long sections will generate tuned-column resonances if they are given a chance.

Still another stepchild of the Klipschorn is the L. E. E. Catenoid (see photo), first introduced at the New York Audio Fair in October, 1954. The interior arrangement of this horn can be visualized from its cross-sectional diagram (Fig. 5). The driver faces down and a single expanding column comes up and around before it emerges as the familiar double rectangular horn. The "completely new and revolutionary" feature of the Catenoid is that the expanding cross-section is obtained from a catenary rather than an exponential formula. Although we are assured that this is the "first really new speaker development in years," I for one am still hazy on the precise advantages of the catenary curve.

The curve used by Jensen departs from true exponential design to achieve more uniform radiation right down to the cutoff frequency. For the Catenoid, the reason advanced is that a catenary curve is easier to approximate with conic sections. Really! As nearly as I can remember, a catenary is almost identical to a parabola. Anyway, it is

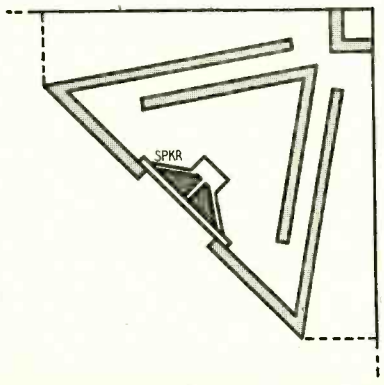


Fig. 1—Diagram shows layout of simplest type of back-loaded corner horn.

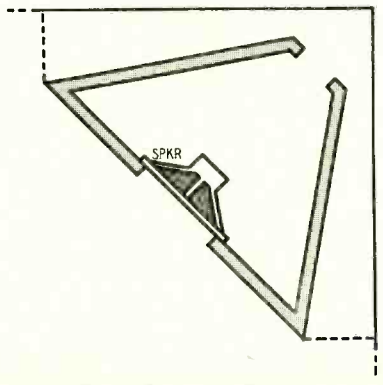


Fig. 2—Basic layout of a port-loaded system—not really a corner horn.

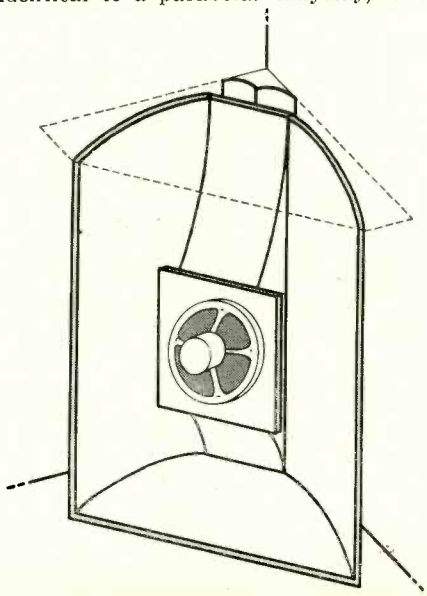
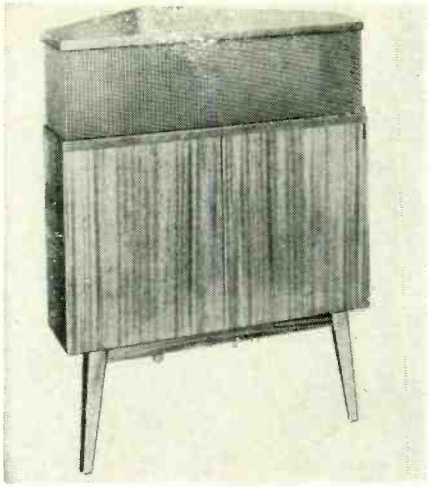
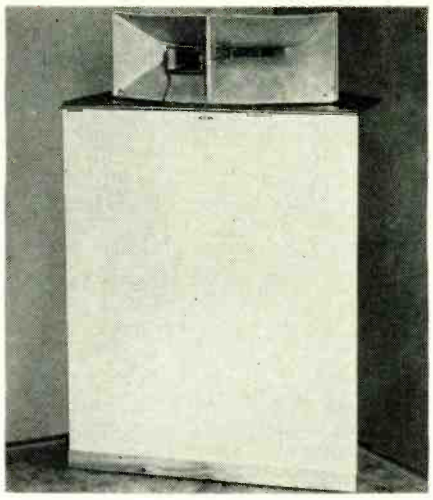


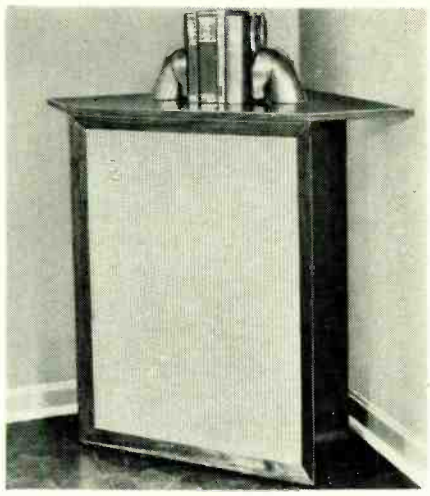
Fig. 3—Simple reflex corner horn.



Brociner's corner horn model 4.



Klipschorn with outer shell removed.



Exterior of the L. E. E. Catenoid horn.

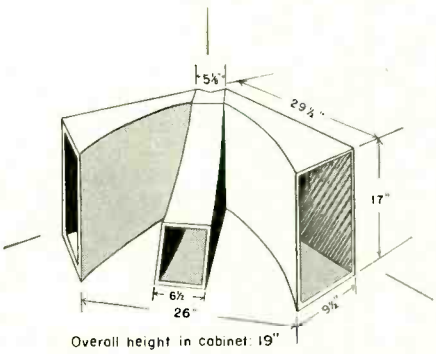
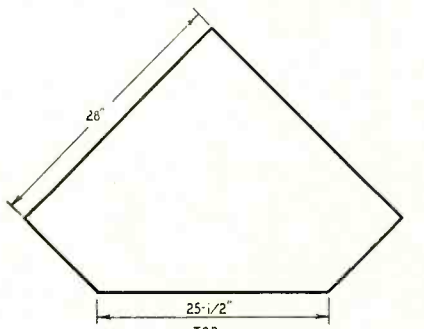


Fig. 4—The ceramic folded horn.



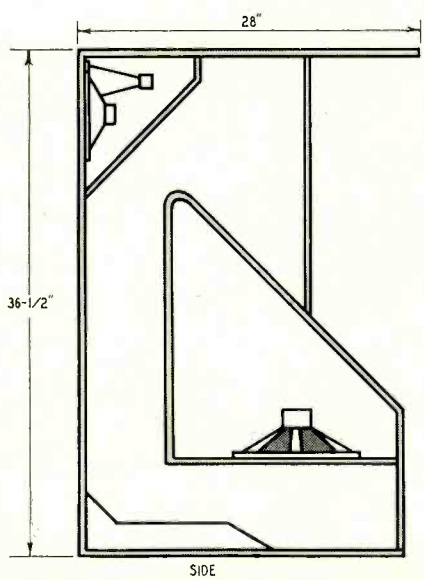


Fig. 5—Internal layout of Catenoid.

so close that we might as well be honest and call the horn paraboloid. Since there are any number of ways in which various sections of a parabolic curve might be adapted to horn design (with some interestingly valid reasons why such a curve would be desirable for certain physical situations), I have included a graph (Fig. 6) comparing an exponential and a parabolic curve so that you can see just what all the sound and fury are about.

In any case, either in spite or because of its so-called catenary design, the L. E. E. has received considerable favorable comment. In the Catenoid cabinet is built a carefully integrated three-way speaker system. The horn is used only for the bass frequencies, with separate units taking over the mid- and high-frequency ranges. Except for very low notes the L. E. E. Catenoid is a satisfactory system.

Among the members of the Klipsch-derived family is one system that in my estimation is noticeably superior—the Lansing Hartsfield. I think the reason why the reproduction from this new Lansing system is so superior is simply that the company has refused to cut corners. The cabinet is the most absolutely solid hunk of horn you ever saw. The tweeter, a massive affair that looks like it could take about 50 watts, sounds clean and pure even in the very highest registers.

The Hartsfield is a good example of

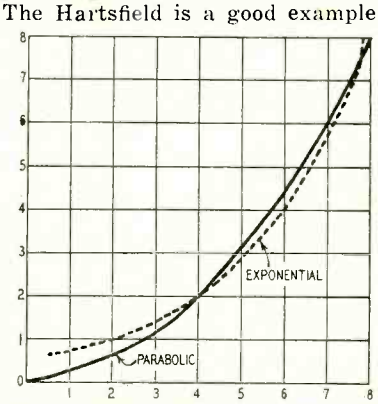


Fig. 6—Parabolic and exponential curves.

what really exceptional results can be realized just by taking a good standard design and then making sure that the physical properties of the horn, in the flesh, come as close as possible to the theory. No "revolutionary damping principle" (for example, Fiberglas), no "pipe-organ bass from a cabinet no bigger than a shoe box" (no one is going to live up to *that* one for a long time)—just a corner exponential horn carefully matched to the finest drivers that Lansing could and did build. Such a system is naturally in the Rolls-Royce class as far as price goes, but after all, "A thing of beauty . . ."

Another type of corner horn gets its inspiration from the Ephraim design (see Part I, April) rather than the Klipschorn. Since a full-sized version of a triangular corner horn (Fig. 7) is a very large affair, it has never been offered commercially. The closest thing to it was worked out as the complement to the fabulous Lowther PM-2 driver by P. G. A. H. Voigt and marketed in Britain by Lowther. A cross-section of the Voigt horn is shown in Fig. 8. Since even the large design of the Voigt model does not provide adequate

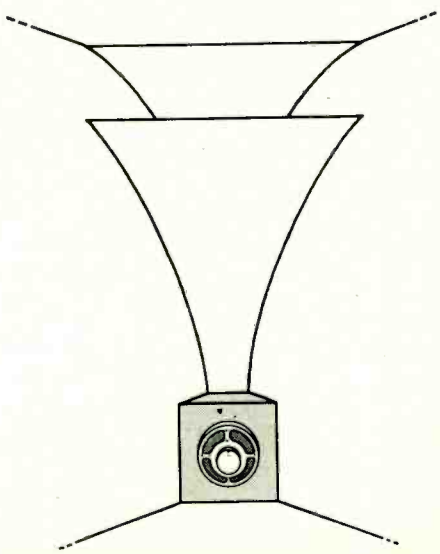


Fig. 7—Full-sized vertical corner horn.

radiation below 50 cycles, a tuned column is used to load the back of the driver down to about 30 cycles.

The Voigt is much too large and frilly in design to find a ready market in this country, so Lowther looked for a new design which could be used with the few PM-2's available for export to the United States. Yours truly was given the assignment, and I must admit that, due to lack of adequate facilities (and equal lack of inspiration) at the time, I muffed it completely. After I rather ingloriously returned to experimenting with an improved version of my own corner-horn design, Victor Brociner whipped up an extremely clever cabinet which takes full advantage of the PM-2's amazing capabilities as a hi-fi horn driver. A cross-sectional sketch of the Brociner model 4 (see photo) is shown in Fig. 9. The Lowther driver covers the range from 20 to 16,000 cycles almost effortlessly and Brociner uses a double reflecting horn for the highs together with a folded horn for the lows to take full advantage of the extended frequency range of the driver.

The folded horn terminates in a triangular section pointing straight down; but since the cabinet stands off the floor, the actual horn mouth is rectangular. Brociner has gone to a lot of trouble to make the cabinet exceptionally sturdy and to keep the common separating partitions of the bass horn sections as vibration-free as possible. The result is a single driver coupled to a double horn which will duplicate the high standards of the most expensive three- and four-way systems.

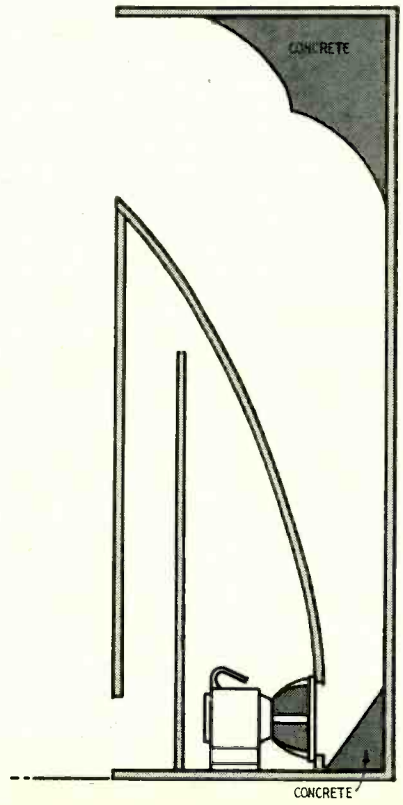


Fig. 8—Interior design of Voigt horn.

The exponential labyrinth

I know of only two available commercial systems that fall into this category. Stromberg-Carlson uses a folded horn for its hi-fi series which differs a little from the usual in that it makes no effort to avoid mouth reflections. Instead, a slow rate of flare is used and the length of the horn is calculated as one-quarter the wavelength of the resonant frequency of the speaker. This arrangement gives the familiar tuned-labyrinth effect of lowering the bass response while at the same time using an exponential flare for increased radiation efficiency.

The Karlson enclosure is an entirely different sort of design and, if you can understand exactly how it works, you have a much greater natural aptitude in this field than I. I include it in this category because it supposedly makes use of the broadbanding effect of an exponential slot. While such an effect definitely does exist if the slot terminates a tuned air column, the Karlson design has modified this concept to a pair of tuned reflex chambers with the speaker, backwave chamber and everything else finally exhausting into the room via an exponential opening. Whether this was all carefully worked out with a slide rule beforehand, or whether the Karlson enclosure came about through a long session of sweat and tears, is really nobody's business. It gives about the best bass response of any cabinet its size. For the man with a good 12-inch speaker and practically no budget, Karlson offers the enclosure in kit form at a most reasonable cost.

The radial horn

A few weeks ago while in Pittsburgh I heard a new half-ton speaker system demonstrated in the Buhl Planetarium.

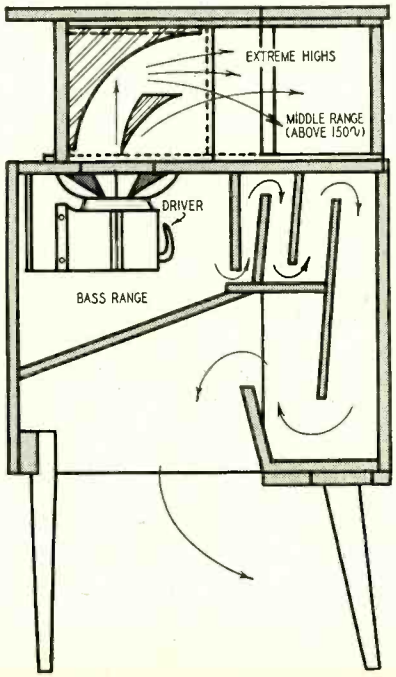


Fig. 9—Layout of the Brociner model 4.

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Pinpoint control system is unsurpassed in consistent accuracy of indication. Stops antenna instantly at desired position. No drift or ambiguity.

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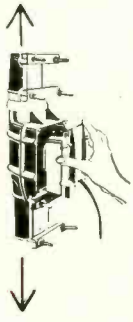

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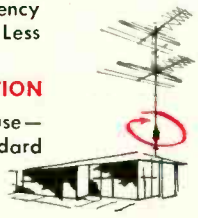

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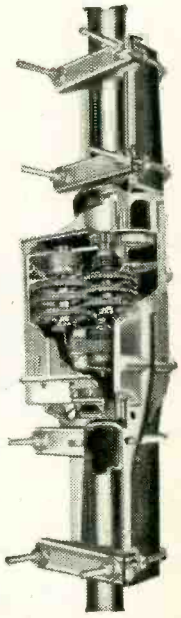

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AUDIO—HIGH FIDELITY

A photograph appeared in the November, 1954, issue on page 64. The Radial Exponential Transducer is the only thing I have ever heard capable of reproducing the really low frequencies —down around 20 to 35 cycles. It wasn't guesswork either—the planetarium owns a permanently installed Klipschorn which I used for comparison. Don't ever let anyone tell you that there is nothing worth bothering about in the range below 50 cycles. I found out later when talking to the designer, Antony Doschek, that I wasn't the only one so impressed by the performance of the big horn. Top-notch audio men from some of the big, well-known firms had heard the Doschek system and candidly admitted that their own development laboratories had nothing to compare with the 12-foot concrete horn.

Several features of its radial design make it ideal for high-fidelity purposes. There is no problem of column resonance. The configuration is best visualized by thinking of a saucer raised by spacers so that it sits about ½-inch off the tabletop. Obviously, there aren't any columns in the usual sense, so the tuned-air-column problem just doesn't exist.

Another feature of the configuration is that the sound source is a radial slot. Just why this should give better low-frequency response than a radial array of separate horns, I don't pretend to understand. Nevertheless, if the radial horn is separated by spacers into a group of individual horns, the bass efficiency drops off. When the spacers are removed, the curve flattens out again. The 12-foot radial horn has a measured sound pressure curve which begins to *rise* at the cutoff frequency of the horn and is still gently rising at 20 cycles! I won't be surprised if next year's Audio Fair is flooded with "revolutionary new genuine radial exponential horns." Even I have an idea in the back of my mind . . . if we just divide the radial horn into unequal sections, and then fold the backwave chamber. . . .

For those who want to build their own exponential horn design, it really isn't difficult to get good results if you steer away from complicated configurations. Unless you can manipulate electroacoustic formulas without difficulty, use unity coupling of driver to horn and avoid coupling chambers. A coupling chamber is actually an acoustic bandpass filter and some awfully weird sounds can be traced to guesswork in its design. I am an expert on weird sounds produced by design guesswork—I know what I'm talking about.

Keep all surfaces rigidly braced and, if possible, back the whole horn with concrete. Better yet, build it from brick or concrete blocks. If you are handy at masonry, it's an excellent method of construction. Make your horn adhere to a true exponential formula as closely as possible and *don't* use sharp folds or bends unless you are following a tried and true design. END

AUDIO—HIGH FIDELITY

HIGH-FIDELITY DICTIONARY

PART IV

By ED BUKSTEIN

Strain pickup

A pickup cartridge using the principle of the strain gauge. A strain gauge consists of a thin wire attached to a flexible backing. If the wire is stretched, it becomes thinner and longer and its resistance increases. When the wire contracts, it becomes thicker and shorter and its resistance decreases. In the strain pickup, the strain-sensitive coating is applied to a thin, plastic backing. Movements of the stylus vary the resistance of the element and therefore modulate the current flow through it.

Stroboscope

A flashing light used to study rotating or reciprocating machinery by making it appear motionless. For example, if the flashing rate of a stroboscope is made equal to the rotating frequency of an electric fan, the blades will appear motionless. This is because the blades are in the same position each time they are illuminated.

Stroboscopic disk

A disc, similar in shape to an ordinary record, used to check turntable speed. The disc, imprinted with a series of radial lines, is placed on the turntable and illuminated with a light flickering at the 60-cycle rate. The spacing of the radial lines is such that they appear stationary if the turntable speed is correct. Separate sets of lines or markers are used for 78, 45 and 33⅓ r.p.m. Some stroboscopic discs have markings for 25- as well as 60-cycle illumination.

Stylus

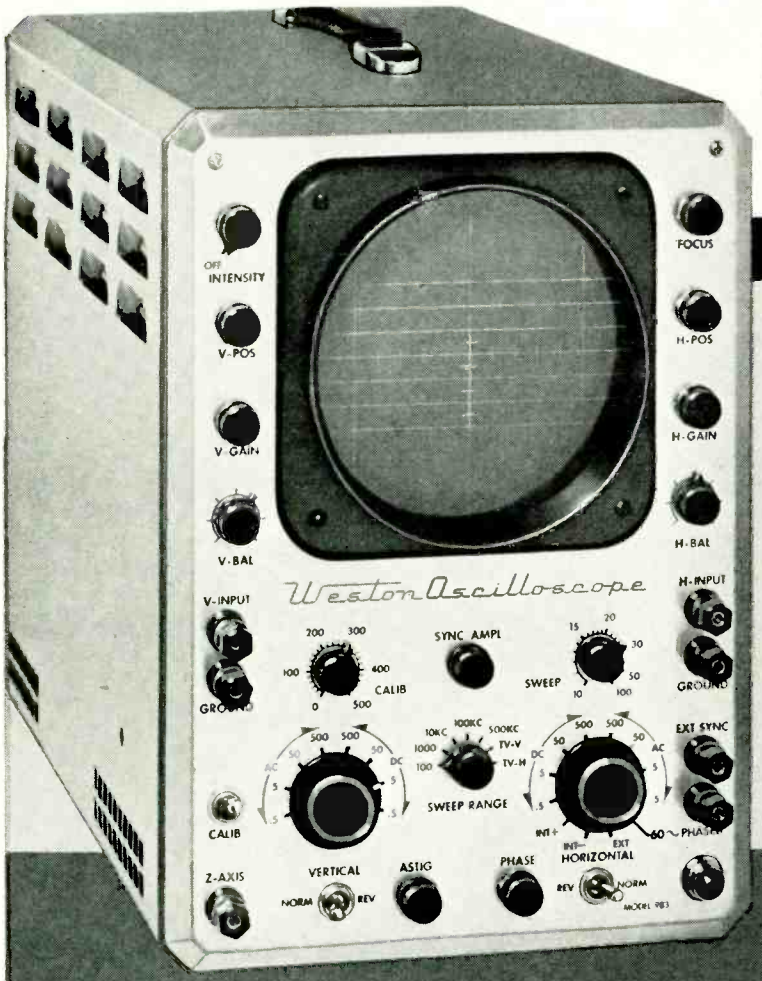
The needle of a recorder or playback unit. In the recorder, the stylus serves to cut material from the disc to produce the groove. In the playback unit, the stylus rides in the groove, imparting its motion to the cartridge where it is translated to a corresponding electrical signal.

Stylus alignment

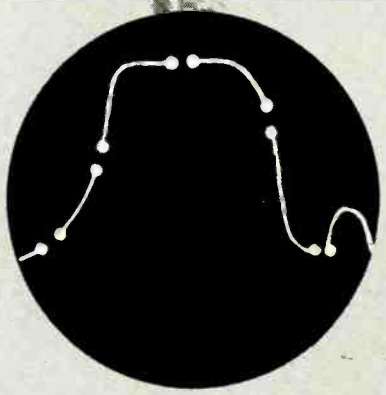
The position of the stylus with respect to the record. Viewed from a head-on position, the stylus should be perpendicular to the surface of the record.

(*Continued on page* 90)

NOW...



WAVEFORM ANALYSIS



Response curves accurately displayed. Ideal for use with Weston intensity marker display. A fast, retrace sweep circuit with cathode follower output prevents pattern distortion.

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The Model 983 is a high gain, wideband Oscilloscope designed to accurately reproduce waveforms comprising a wide band of frequencies. High sensitivity of 15 millivolts per inch RMS makes this Oscilloscope ideal for—SETTING RESONANT TRAPS...SIGNAL TRACING IN LOW LEVEL STAGES ...AS A GENERAL NULL INDICATOR...for PHASE CHARACTERISTIC MEASUREMENT IN INDUSTRIAL APPLICATIONS...and for SWEEP FREQUENCY VISUAL ALIGNMENT OF TV RECEIVERS.

The scope contains identical vertical and horizontal push-pull amplifiers with a choice of AC or DC coupling without affecting either sensitivity or bandwidth. Both amplifiers have compensated step attenuators and cathode follower input.

It has excellent square wave reproduction with overshoot of only 2 to 5% with a rise time of 0.1 microsecond. The scope response is essentially flat throughout the specified range of 4.5 mc and is usable to 6 mc.

The unit has provisions for internal calibration, internal phased sine wave, and Z-axis intensity modulation. Reversal of polarity of both horizontal and vertical signals is easily accomplished by means of toggle switching. *Tube replacements are non critical, and etched circuitry facilitates quick and rapid maintenance.*

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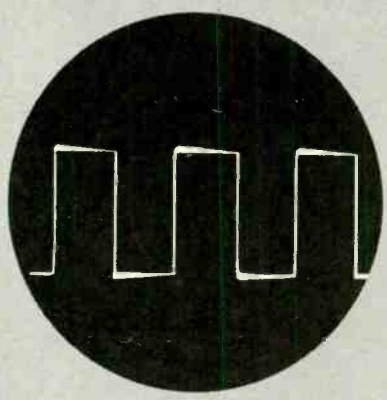
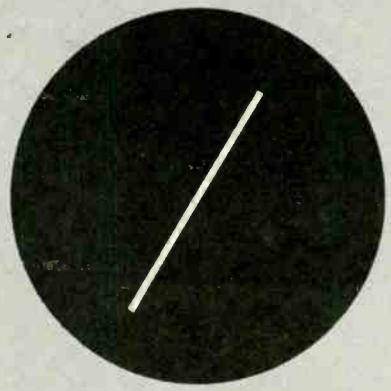
SQUARE WAVE RESPONSE



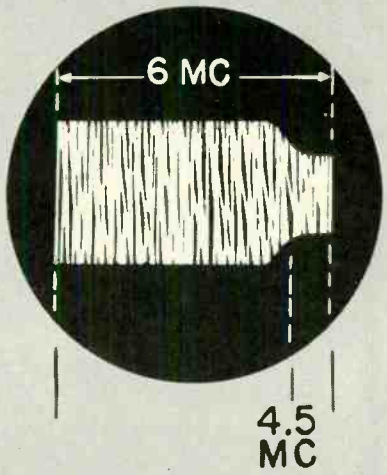
Overshoot is anly 2 ta 5%. Rise Time is 0.1 Microsecond. Square wave depicted 250 kc.

PHASE MEASUREMENTS



Phase shift between horizontal-vertical amplifiers, 0-100 kc-0°, to 1 mc within 2°; by internal adjustment with gain controls at max 0° phase shift possible on any specific frequency to 6 mc.

RESPONSE CHARACTERISTIC



Note flatness throughout specified range; usable to 6 mc.

980 LINE OSCILLOSCOPE

SPECIFICATIONS: MODEL 983 OSCILLOSCOPE

Wide Band Frequency Response: Flat within 1.5 db from 0-3.58 mc and within -3 db to 4.5 mc on both vertical and horizontal amplifiers. Transient response: overshoot 2 to 5%. Rise time: 0.1 microsecond.

High Deflection Sensitivity: 15.0 millivolts per inch, RMS, on both vertical and horizontal amplifiers.

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Calibrating Voltages: 500 millivolts, 5 volts, 50 volts, 500 volts, peak to peak. Readily available and adjustable by front panel controls.

Z-Axis Modulation: Input terminal mounted on front panel.

Sweep Frequencies: 10-500,000 cps, variable. Preset TV/V position—30 cps. Preset TV/H Position—7875 cps. Retrace Time—better than 2% to 100 kc; at 500 kc less than 10%.

Internally Phased Sine Wave: Adjustable through 170°.

Vertical and Horizontal Polarity: Reversible.

Input Impedance: Vertical Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf. Vertical Amplifier (with Shielded Cable), 1 meg shunted by 120 mmf. Vertical Amplifier (with Low Capacitance Probe), 10 meg shunted by 12 mmf. Horizontal Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf.

Power Supply: 105/125 volts, 50/60 cycles.

Tube Complement: (1)-1V2, (1)-5U4-GA, (6)-6BQ7A, (4)-12BY7A, (4)-6AH6V, (1)-6U8, (1)-5UP1, (1)-0D3, and (1)-5NO60T.

Case: Grey hammertone finished steel.

Panel: Aluminum finish with etched, black markings.

Size: 10" x 14" x 19.5" **Approx. Weight:** 40 lbs.

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AUDIO—HIGH FIDELITY

Surface noise

Noise voltages produced as a result of the friction between the stylus and the surface of the record. (See Noise.)

Test record

A record designed to test the quality and characteristics of turntables, pickups, amplifiers, etc. Some test records contain a series of audio tones and are useful for checking frequency response. Some test records provide signals that sweep through the entire audio spectrum and can be used to obtain a frequency response curve of the equipment under test on the screen of an oscilloscope. Still other test records contain two frequencies, one high and one low, for checking IM distortion.

Three-way loudspeaker system

A sound-reproducing system using three separate loudspeakers, each designed for a specific portion of the audio spectrum (high, low and mid-frequencies). The high-frequency loudspeaker is also known as a tweeter, and the low-frequency speaker as a woofer. Filter networks are used to channel the signal frequencies to the proper loudspeakers. These filters are called crossover or dividing networks.

Threshold of audibility

That amount of sound intensity just barely audible to the average person.

Threshold of feeling

That amount of sound intensity just barely painful to the average person.

Tone control

A control, usually part of a resistance-capacitance network, used to alter the frequency response of an amplifier.

Tracking errors

Lack of coincidence between the paths followed by the cutting and the playback stylii. The cutting stylus is driven by a feed-screw mechanism that moves it in a straight line from the edge of the record toward the center. The playback stylus is mounted at the end of a pivoted tone arm and therefore describes an arc as it moves from the edge of the record toward the center.

Turnover cartridge

A pickup cartridge designed for use with 3-speed playback equipment. Long-playing records, such as the 33⅓- and 45-r.p.m. types, require a .001-inch stylus; while 78-r.p.m. records use a .0025- or .003-inch stylus. The turnover cartridge has two stylii: one of each size. A lever or knob extending from the end of the pickup permits either stylus to be placed in playing position. Some models contain two separate cartridges.

Turnover frequency

In disc recording, the frequency below which constant-amplitude recording is used and above which constant-velocity recording is employed. TO BE CONTINUED

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+3.48 Swing Bin
$32.98 Total Cost
—16.03 Savings
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your deal price

48% off list price of capacitors and bin

Now Astron *introduces*— Swing Bin Jr. —another completely practical capacitor servicing kit created *because you asked for it!* Your widespread popular response to the first Astron Swing Bin offer prompted this new special version.

The 90 fabulous Blue • Point molded plastic paper tubulars in this kit are in 18 assorted popular values —a *complete* servicing stock.

Fabulous Blue • Points are the *most* dependable molded plastic capacitors made • New solid thermosetting impregnant • Continuous 85°C operation *without derating* • Impervious bonded shell and seal • Low power factor • High insulation resistance • Individually tested and guaranteed. Install the same capacitor used and approved by leading set manufacturers!

Like its big brother—Swing Bin Jr. has been specifically designed to make servicing easier...keeps entire capacitor stock in easy reach...off bench for more work space...visual stock control.

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checking and correcting IMPEDANCE MISMATCHES

Double-ended traveling-detector probe checks antenna and front end

By ROBERT G. MIDDLETON*

A v.t.v.m., double-ended traveling-detector probe (see photo) and grid dip meter can be used for simple, practical tests of antenna and front-end mismatch. The circuit arrangement of the probe is shown in Fig. 1. Lead-in is threaded through a slot between a plastic cover plate and plastic base. No metallic connection is made to the lead-in. However, mounting screws (A–A) provide a loose capacitive coupling to either side of the lead-in.

Isolating resistors are used in both the high and ground leads of the probe network. The isolating resistors prevent r.f. energy from spreading out from the high-frequency network, along the input cable, to the v.t.v.m. Unless the r.f. is isolated from the d.c. meter cable, the arrangement becomes "hot" and unmanageable.

Fig. 2 shows the test setup for checking an antenna for impedance match. The r.f. energy for a selected channel is obtained from a grid dip meter and is coupled into the lead-in by a link. One or two turns on the link are sufficient to obtain ample indication on the 1.5-volt d.c. range of the v.t.v.m.

To check for impedance match, move the probe at least one-quarter wavelength along the lead-in, while watching the v.t.v.m. indication. A constant indication, such as 1 volt, as the probe is moved along the line shows that the antenna is matched to the impedance of the lead-in at the particular test frequency being used. A variation in the v.t.v.m. reading, such as from 0.5 to 2 volts, as the probe is moved along the lead-in shows that the antenna is mismatched to the lead-in.

Fig. 3 shows how the probe is used to check the impedance match of a front end to the lead-in. An 8-foot (or longer) length of 300-ohm lead-in is used as a standard to establish the 300-ohm impedance. One end of the line is energized by a link coupled to the grid dip coil and the other end is connected to the front-end input terminals. The receiver need not be turned "on"—there is little change in input impedance from the "on" to the "off" condition.

Move the probe along the line, watching the v.t.v.m. for a change in indication. As in the antenna test, a constant indication on the v.t.v.m. scale indicates a matched impedance. Substantial variation in meter indication shows that mismatch is present and that all of the voltage on the line is not being accepted by the front end—a certain fraction is being reflected.

The double-ended traveling-detector probe can be constructed from a standard lightning arrester. The chief precaution to be observed is to avoid shunting excessive capacitance across the lead-in, which will introduce appreciable disturbance into it. Standard lightning arresters are designed to shunt very little capacitance across the lead-in, so that normal operation will not be appreciably disturbed.

To make up the probe, remove the gap components and the ground strap from the case of the arrester, leaving only the terminal screws. Make a round plastic cover plate (the insulation-piercing washers have been discarded) to hold the lead-in in the slot while permitting free sliding of the probe along the lead-in.

The terminal screws provide a very loose capacitive coupling to the line conductors. Connect the probe components to the terminal screws as shown in Fig. 1. Connect the isolating resistors to a pair of machine screws on the back of the probe case for convenience in clipping the v.t.v.m. input cable to the probe. Fig. 4 shows how the d.c. input cable to the v.t.v.m. is used in test work. The input cable should be run approximately perpendicular to the lead-in to avoid pickup of r.f. energy and development of standing waves.

The method described here is applicable to a wide range of impedance-match tests, other than antennas and front ends. For example, the impedance characteristics of a TV distribution system, set couplers, filters (lumped or stub) may be tested. The effectiveness of matching bars may be easily determined. The disturbance caused by mounting another antenna near the antenna under test may be checked.

*Chief field engineer, Simpson Electric Co.

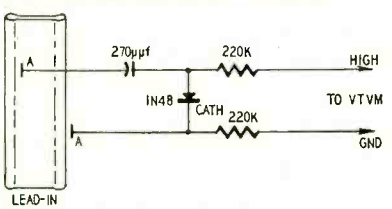


Fig. 1—Circuit of the double-ended traveling-detector probe. Mounting screws A–A provide loose coupling to lead-in.

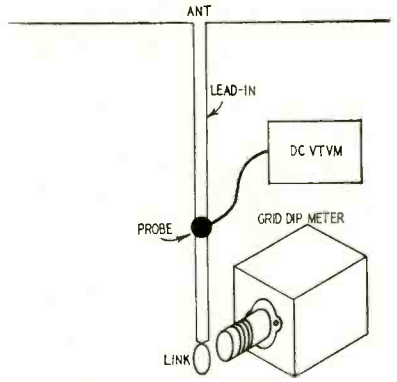


Fig. 2—Setup for checking impedance match between antenna and lead-in.

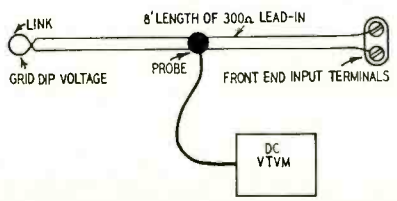


Fig. 3—Checking the impedance match between the front end and lead-in.

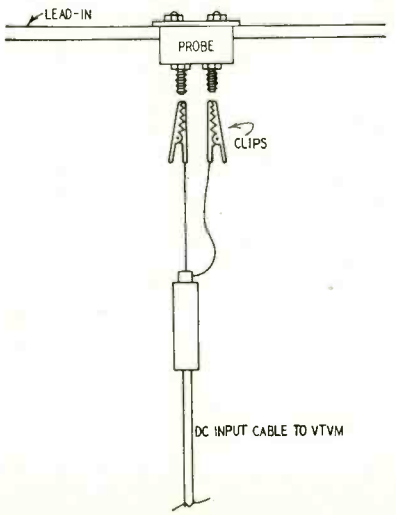


Fig. 4—Position of v.t.v.m. input cable.

A word of caution concerning the indicating meter is in order. A v.t.v.m. has a much higher input resistance on the low-voltage ranges than does a multimeter. Thus, the v.t.v.m. draws only a small fraction of the current on the first range of that drawn by a multimeter. For example, a 20,000-ohms-per-volt meter has an input resistance of 24,000 ohms on the 1.2-volt range; a typical v.t.v.m. has an input resistance of 11,000,000 ohms on that range. Since the first range is usually used with the probe, input resistance becomes very important for obtaining accurate readings.

In general, the use of a multimeter as a probe indicator will prove unsatisfactory since the probe is unable to provide the current demand of the meter. For the example given, the multimeter draws approximately 500 times as much current from the probe as the v.t.v.m. However, since a v.t.v.m. is standard service equipment, this requirement is seldom a matter for concern.

Although the ratio of maximum to minimum indication observed on the v.t.v.m. is a measure of the standing-wave ratio on the line, this SWR does not indicate the amount of mismatch at the antenna (or front end). The reason for this lack of relationship is that the line is not matched at the source-voltage end. In other words, the low-impedance link used as a means of energy transfer from the grid dip meter to the line does not necessarily provide a source resistance of 300 ohms. Accordingly, if the antenna (or front end) develops voltage reflections due to mismatch, this reflected voltage is re-reflected from the grid dip end of the line, which confuses the standing-wave pattern.

Thus, the probe indicates only the presence of match or mismatch; it does *not* indicate the exact amount of mismatch. When the antenna (or front end) is matched to the line, no energy is reflected on the line, so that the indication of match is not disturbed by the presence of the link. In this way the probe is an accurate impedance-match indicator.

There are many methods of correcting mismatches—some good, some mediocre and others practically ineffective. Everyone is probably familiar with the expedient of sliding a patch of tinfoil along a lead-in until maximum contrast is obtained in a weak picture.

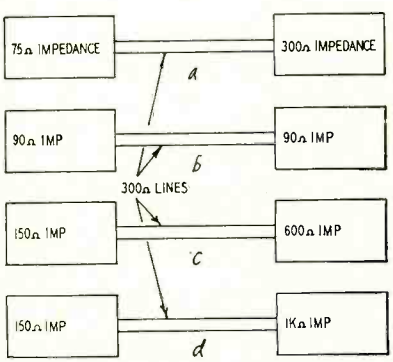
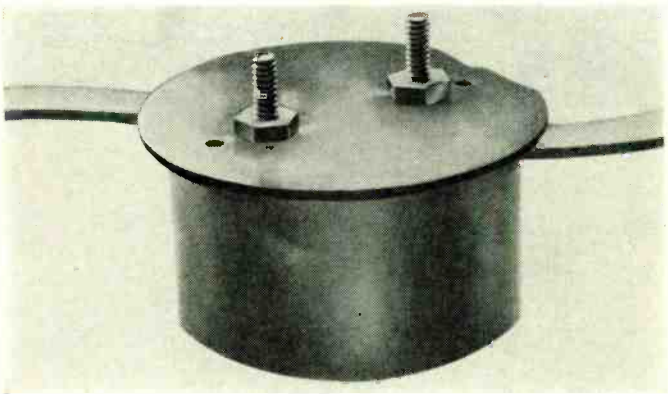


Fig. 5—Impedance combinations: *a* cannot be improved by varying the length of lead-in; *b* and *c* can be matched; *d* can be adjusted for improved results.



A double-ended traveling-detector probe. The screws provide capacitive coupling.

Fig. 5 shows that the lead-in can sometimes be cut to a critical length to obtain a good match; in other situations only a partial match is obtainable and in still other cases no improvement can be realized by such matching.

It is a general principle of efficient matching that the impedance correction should be made as close as possible to the point of mismatch instead of at some point a half-wave multiple along the line. The reason for this rule is that the mismatch appears as "hot" spots along the line at half-wave intervals, and losses are unduly great at each "hot" spot due to increased radiation and absorption losses.

A line-section balun, as shown in Fig. 6, will provide a perfect match between a 75- and 300-ohm impedance over all v.h.f. channels. However, since these are the only two impedances which can be matched by this balun, its application is somewhat limited. The spacing between the line sections should be at least 1 inch to avoid mutual couplings.

Q bars provide the most practical matching scheme (Fig. 7). Unlike the balun arrangement, the Q bars match perfectly only at one frequency, but they will match any two impedances that may be encountered. The bars are kept parallel and the spacing between them adjusted to eliminate standing waves on the lead-in. When the values of the unmatched impedances are known, Fig. 8 can be used to calculate the proper spacing between the bars. The required value of Q-bar impedance for matching is given by the formula:

$$Z = \sqrt{Z1\ Z2}$$

where Z is the impedance of the Q bars, Z1 the impedance of the lead-in and Z2 antenna impedance.

Stubs are also used upon occasion to match two impedances; but since there are two variables to contend with instead of one, stub matching has not attained the widespread use of Q bars. The stub must be cut to a certain critical length and must also be connected at a critical fraction of a wavelength from the mismatch impedances. END

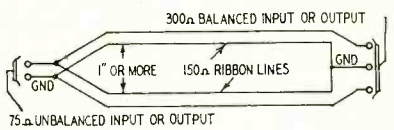


Fig. 6—Balun for 75- to 300-ohm match.

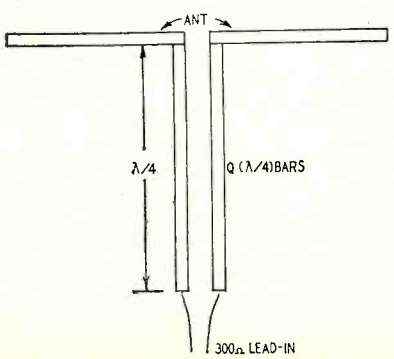


Fig. 7—Quarter-wave matching bars,

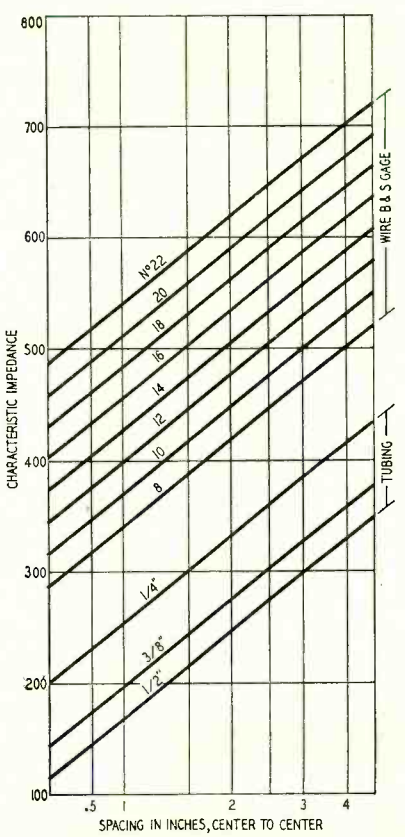
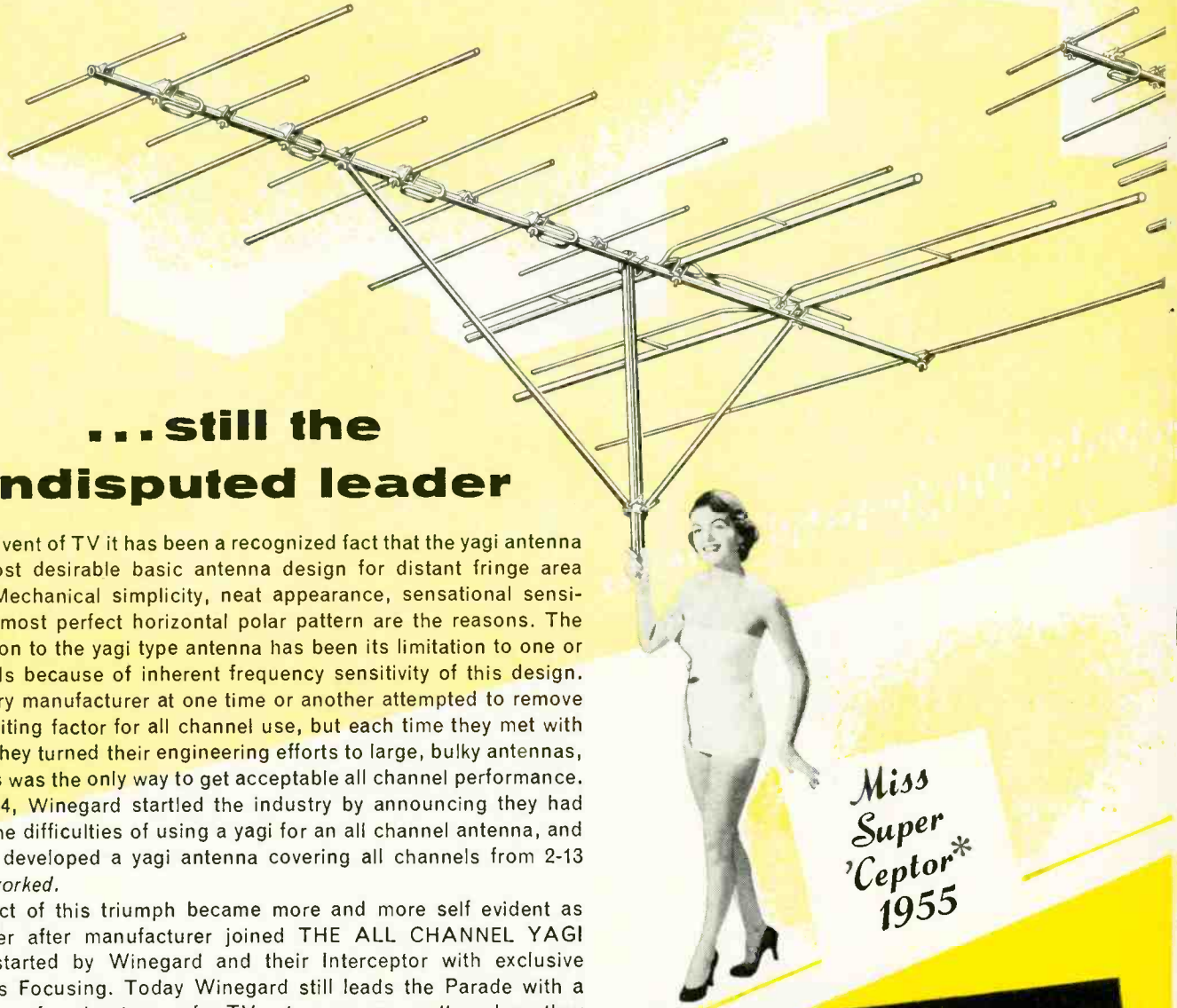


Fig. 8—Diagram for determining the size and spacing of Q-bar matching.

WINEGARD *started the*



...still the undisputed leader

Since the advent of TV it has been a recognized fact that the yagi antenna was the most desirable basic antenna design for distant fringe area reception. Mechanical simplicity, neat appearance, sensational sensitivity and almost perfect horizontal polar pattern are the reasons. The only objection to the yagi type antenna has been its limitation to one or two channels because of inherent frequency sensitivity of this design. Almost every manufacturer at one time or another attempted to remove this one limiting factor for all channel use, but each time they met with failure. So they turned their engineering efforts to large, bulky antennas, figuring this was the only way to get acceptable all channel performance. Early in 1954, Winegard startled the industry by announcing they had overcome the difficulties of using a yagi for an all channel antenna, and had at last developed a yagi antenna covering all channels from 2-13 *that really worked.*

The impact of this triumph became more and more self evident as manufacturer after manufacturer joined THE ALL CHANNEL YAGI PARADE started by Winegard and their Interceptor with exclusive Electro-Lens Focusing. Today Winegard still leads the Parade with a complete line of yagi antennas for TV set owners no matter where they live—even in the most extreme fringe areas.

Miss Super 'Ceptor 1955*

Here's Why Winegard Leads in Sales Gains

Calendar of all channel yagi events (shown below)

NOTE: Winegard months ahead of nearest competition with real all channel yagi antenna.

WINEGARD CALENDAR

THIS! Winegard announces Interceptor. First all channel yagi that really worked. — Jan.

THEN THIS! During these months . . . Interceptor outperforming . . . outselling other antennas. Literally taking market by storm. — May

FINALLY THIS! Winegard—gives industry "Super 'Ceptor" . . . new yagi antenna with super sensitive Electro-lens . . . gives sensational performance even up to 200 miles on all channels (VHF). (To keep Winegard well out in front in the Yagi parade) — Dec.

1954 **1955**

COMPETITION'S CALENDAR

Jan. — During this period . . . competitive manufacturers still making large wind resistant arrays.

Oct. '54-early '55 — Dates when most other manufacturers started to join the all channel yagi parade.

ALL CHANNEL YAGI parade in 1954!

Only Winegard features a complete line of Antennas with **Exclusive ELECTRO-LENS FOCUSING!***

*Patent No. 2700105

Look! Here's Proof that Winegard leads in 1 ENGINEERING 2 PERFORMANCE

- . . . The "Super 'Ceptor" has more working elements on all channels.
- . . . The "Electro-Lens"*, the patented director system that works efficiently on *both* bands with NO interaction and without needless bulk. (Exclusive with Winegard.)
- . . . The full length of Winegard antennas works on all channels—(many competitive antennas use only the back half for low band—only the front half on the high band.)
- . . . Multi Resonant Driven Elements—a modified Tee matched dipole that works on the low channels as a ½ wave dipole . . . on the high band as "full wave" dipoles. (Another Winegard engineering first.)

"Super 'Ceptor" DIAGRAM A

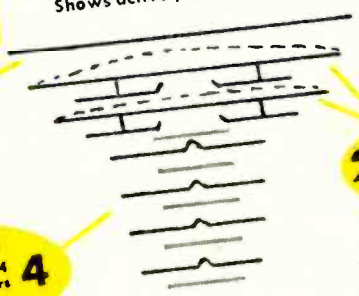
Shows active elements on high channels (7-13)

TOTAL 20 active elements working together in perfect phase on channels 7-13.

NOTE: dotted line on driven element to show current formation on channels 7-13.

"Super 'Ceptor" DIAGRAM B

Shows active yagi elements on channels 2-6



TOTAL 7 active genuine yagi elements on low band 2-6.

NOTE: dotted line on driven elements show current formation on channels 2-6.

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May 16-18

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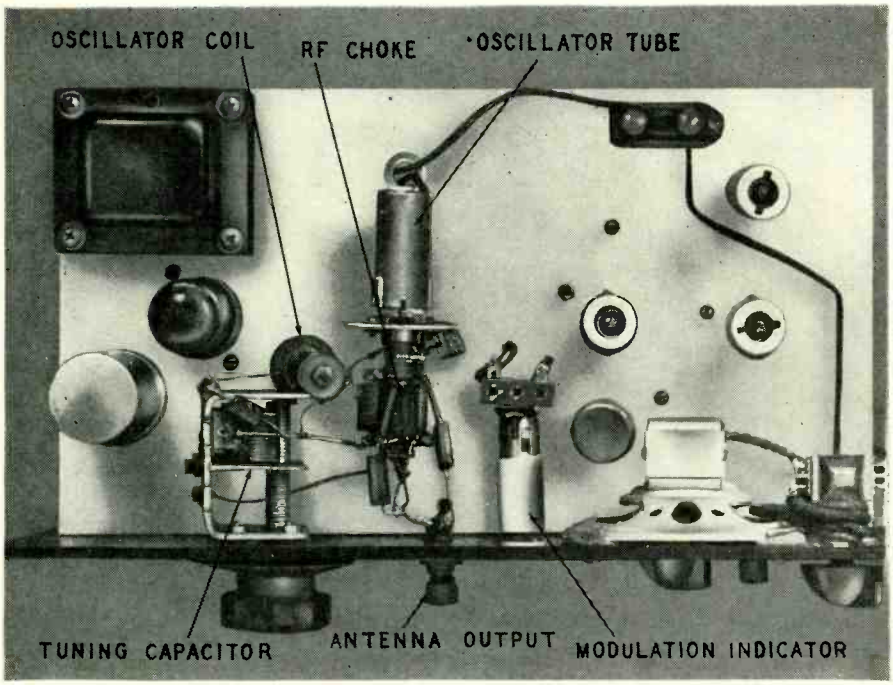
WINEGARD COMPANY

3000 Scotten Boulevard, Burlington, Iowa

Phono Oscillator plus Signal Tracing Amplifier

By PAUL S. LEDERER



Chassis contains the phonograph oscillator and signal-tracing amplifier.

THERE are many possible uses for a phonograph oscillator around the house—an electronic baby sitter, the playing of records through a radio, remote control of various devices. I built one with only enough signal strength to be picked up over a range of about 50 feet. See Fig. 1. As I already had an audio amplifier (Signal Tracing Amplifier, RADIO-ELECTRONICS, May, 1953), it was a simple matter to add an oscillator stage and modulate it with the amplifier. The amplifier circuit is in Fig. 2.

The oscillator circuit (Fig. 1) is conventional, using a 6AK6 tube in an electron-coupled Hartley circuit with a nonresonant output. Plate and heater voltages are supplied by the amplifier.

A novel feature is the use of an audio voice-coil-to-single-grid transformer for modulation. As can be seen from the diagram of the amplifier (Fig. 2), there is a d.p.d.t. switch at the output connecting the secondary of the output transformer either to the speaker or to a dummy load. In place of this dummy load the low-impedance side of the modulation transformer is connected. With a microphone or phonograph pickup feeding into the audio amplifier, it is necessary only to switch amplifier output to the modulation transformer and apply plate voltage, through a s.p.s.t. switch, to the oscillator stage to put W-HOME on the air.

The oscillator is designed to cover the broadcast band from 580 to 1510 kc. The frequency-determining network consists of a tapped coil and two capacitors. One is a single-gang variable type with a maximum capacitance of about 360 $\mu\mu$f, the other is a 33-$\mu\mu$f padder which was added to put the frequency range within the broadcast band.

The coil, with an inductance of 200 μh, consists of 118 turns of No. 33 enameled copper wire, tapped 40 turns from the grounded end. The coil was wound on a hollow form 7/16 inch in diameter and has a winding length of 15/16 inch. A powered-iron core (Stackpole Carbon Co., Y26 material) to fit the coil form and 1 inch long fully inserted into the form brought the inductance to the desired value of 200 μh. If the powdered-iron core is not available, an air-core coil of the same inductance can be wound with No. 33 wire on a form ¾ inch in diameter and occupying 15/16 inch, again tapped about 40 turns from the grounded end.

For convenience, a modulation level indicator was added to the amplifier, From the plate of the output tube of the amplifier (6AQ5) a 2.0-μf capacitor in series with a 120,000-ohm resistor was connected to one terminal of a type NE-17 neon bulb, whose other terminal was grounded.

To obtain the correct amount of modulating voltage the volume control of the amplifier is adjusted until the neon bulb just barely flashes with a peak signal. This represents an input voltage of about 0.7 across the input of the modulation transformer, resulting in good modulation. END

Parts for phonograph oscillator

1—33,000, 1—47,000 ohms, ½-watt, resistors; 1—33 $\mu\mu$f, 1—100 $\mu\mu$f, 1—150 $\mu\mu$f, silver mica, capacitors; 2—.001 μf, mica, capacitors; 1—20 to 360 $\mu\mu$f, variable, capacitor; 1—200 μh coil (see text); 1—3-mh coil; 1—audio input transformer, 3- to 6-ohm primary, 25,000-ohm secondary; 1—6AK6 tube, and socket; 1—s.p.s.t. switch.

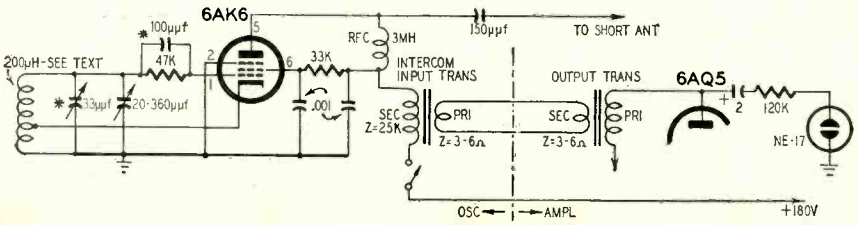


Fig. 1—Schematic of phonograph oscillator and modulation level indicator.

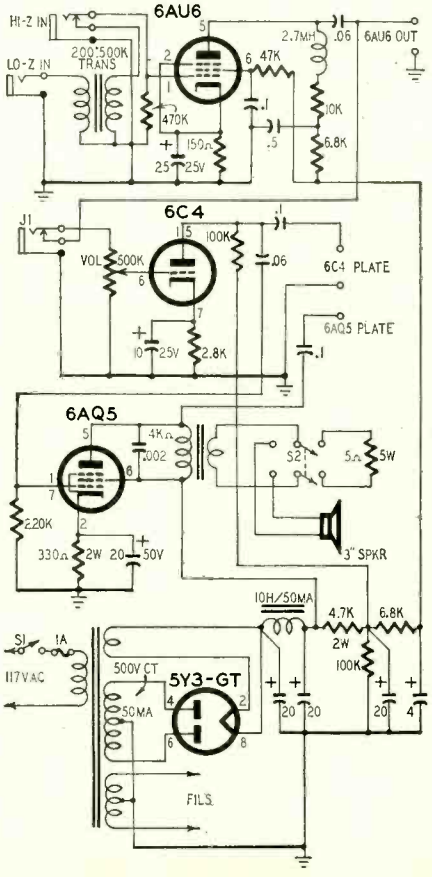


Fig. 2—The signal-tracing amplifier.

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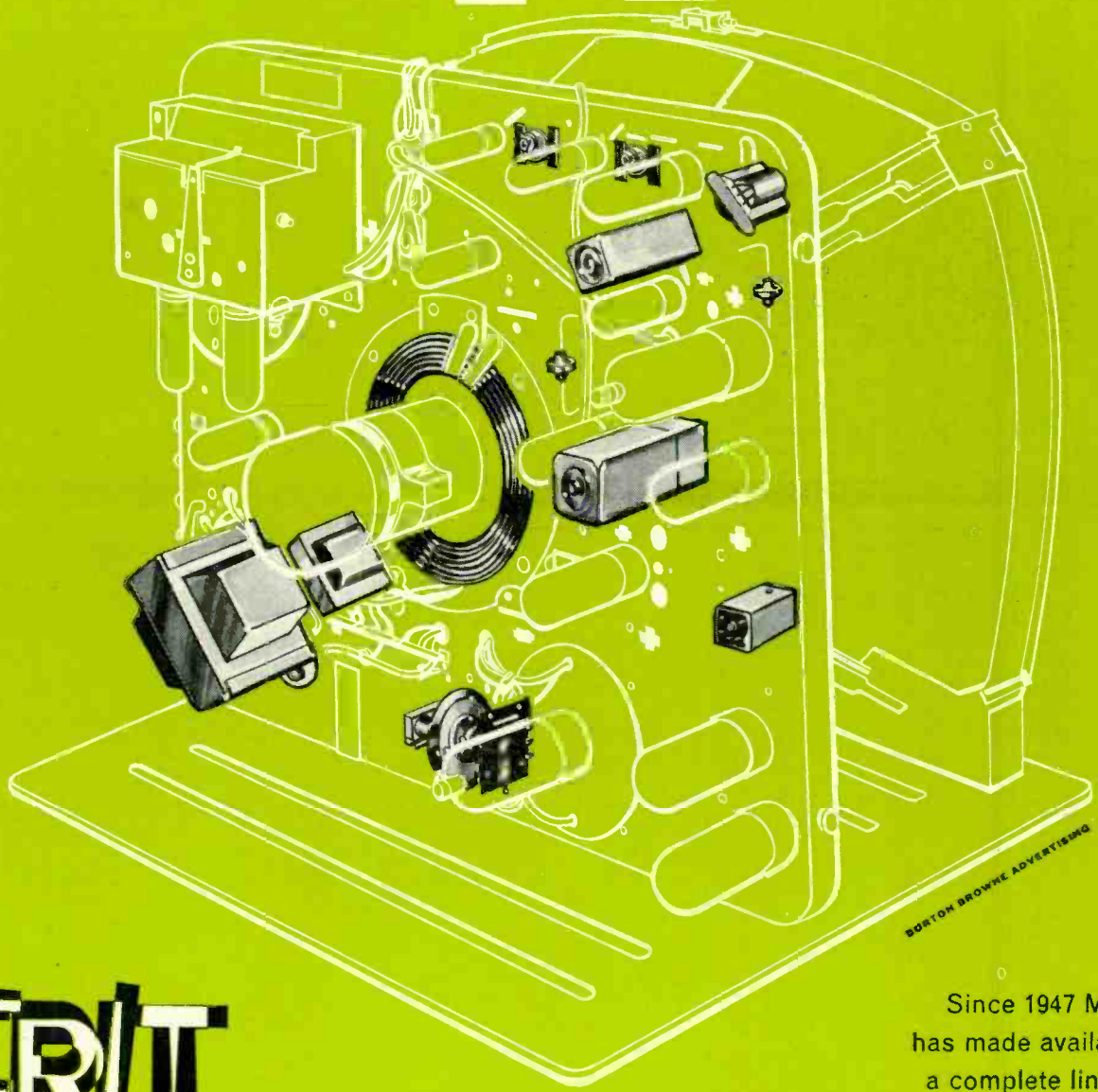

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TEST INSTRUMENTS

RE: LINEARITY GENERATOR

A number of readers reported that they are not satisfied with the performance of the TV linearity generator described in the October issue and pointed out that the underchassis photo shows several resistors that do not appear in the diagram. These inquiries were passed on to Mr. Dunscombe who supplied the following information, together with a recommended circuit which should eliminate trouble occurring in the flip-flop circuit used in V2 (see diagram):

"The diagram is correct as printed in Fig. 2 of the October issue. The underchassis photo is of an earlier model so it shows some components not shown in the diagram. In the early model, a 100,000- and a 33,000-ohm resistor were used in series to make up the 130,000-ohm resistor R8. The HORIZONTAL BARS control in the original (a 150,000-ohm potentiometer connected to pin 5 of V2) was not large enough so I added a 47,000-ohm resistor in series with it and specified a 200,000-ohm unit (R10) in the diagram.

"An isolating resistor was used between the B plus line and pin 2 of V2. This was later removed to increase the depth of modulation.

"The original plate load connected to pin 1 of V2 consisted of a 10,000- and a 12,000-ohm resistor in series. A value of 22,000 ohms was specified.

"I've tried several different 175-kc i.f. transformers in V1-b and they all oscillated readily so I cannot see why others have difficulty at this point. (Try reversing leads of one coil.—*Editor*) V1-b is a simple t.p.t.g. oscillator. The waveform at the junction of R3 and R4 (with and without V2 oscillating) is almost sinusoidal with a little third-harmonic distortion that steepens the leading edge of the oscillation and produces a good signal for syncing the horizontal oscillator in a TV set. Values of 2,200 ohms for R2 and 50 $\mu\mu$f for C2 are about optimum so I suspect that dud components are the cause of failure in this circuit.

"V2 is basically a cathode-coupled flip-flop with a.c. fed through C3 so it runs at multiples of 60 cycles. Too much a.c. sync voltage on the grid crowds the pulses produced by V2 into the positive half-cycle of the sinusoid produced by V1. The value specified for C3 should give good locking without distorting the pulse spacing as viewed on a scope connected to the plates of V2. Try a lower value capacitor that corrects this condition while still providing good locking.

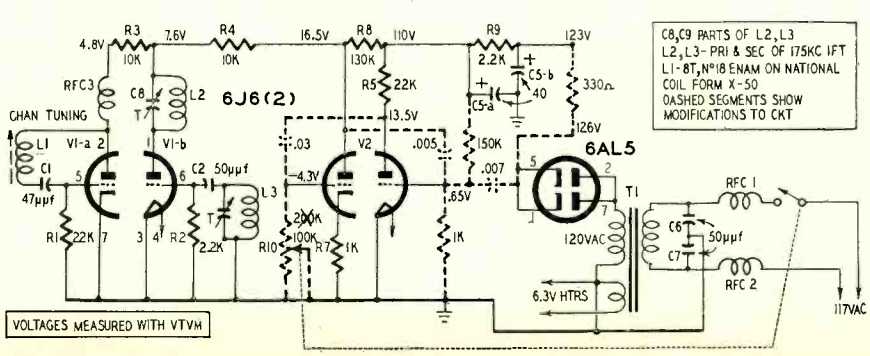
"The secret of getting a good crossbar pattern lies in the circuit of V2. The waveform at pin 2 must have a steep front to sync the horizontal oscillator in the TV set. The signal from V1-b is superimposed on the positive pulse at pin 2 of V2. If V2's signal has a sloping front, the vertical pulses from V1-b will start small and build up to maximum amplitude. V1-b does not oscillate during the negative (space) half of the signal from V2 because its plate voltage is too low.

"Between vertical sync pulses, the horizontal oscillator in the set operates at some random frequency about 15,750 cycles. When the horizontal sync pulse arrives at the a.f.c. tube, the oscillator takes a few cycles to lock in if the sync amplitude is not constant. When this happens, the vertical bars tilt right or left, depending on the free-running frequency of the set's oscillator. This problem has been mentioned in articles on linearity generators but I've never seen it discussed in detail.

"I recommend the modified circuit shown below to readers who still have trouble with the flip-flop circuit used in V2. The circuit is changed to a multivibrator with a.c. coupling between plates and grids. This circuit is free-running and locks in readily at the line frequency.

"The 150,000- and 1,000-ohm resistors connected to the grid (pin 6) of V2 should be selected from several 20% units so the voltage on pin 6 is 0.65 ±.05 volt. Sync pulses (about 2 milliseconds) are developed acro s the 330-ohm resistor in the cathode circuit of the 6AL5 and are differentiated at the grid for positive lock. Voltages shown were measured with a vacuum-tube voltmeter."

It is hoped that the information given here will answer the questions that have arisen concerning Mr. Dunscombe's linearity generator. END



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TEST INSTRUMENTS

METER RESISTANCE MEASUREMENT

By RONALD L. IVES

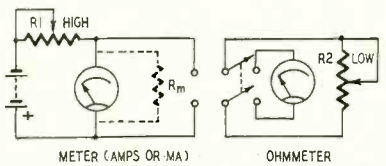
BURNOUTS caused by attempting to measure a meter movement resistance with an ordinary ohmmeter have again become common. It seems that the time-tested "half-scale" method—probably originated by Edward Weston some time prior to 1890—has been forgotten.

The fundamental method is simple, and the accuracy, *when meter resistance is low and sensitivity high,* is great. To determine the resistance of a meter movement, connect the meter, a variable high resistance (R1) and a battery in series (see diagram). Adjust the variable high resistance until the meter reads full-scale deflection.

Shunt the meter movement with a variable resistance (R2). Adjust R2 till the meter reads half-scale. Disconnect R2 and measure its value. This will be the meter movement resistance, the probable error being usually less than 1%, inconsequential in most electronic work.

Series resistor R1 must be high enough so that the meter movement is not overloaded, damaging the windings and pointer. For a 1-ma movement, the series resistance should exceed 1,000 ohms per battery volt. A 50-microampere movement requires more than 20,000 ohms per volt, and a 20-microampere movement should have at least 50,000 ohms per volt in series to limit the current.

Meter movement resistances vary greatly from brand to brand and moderately from instrument to instrument. For most common types of panel instruments, the variable shunt resistor R2 for a 1-ma movement should be about 100 ohms. A 50-microampere movement is likely to need a variable shunt resistor of about 2,000 ohms, and a



Schematic shows test setup for measuring the internal resistance of meters.

20-microampere movement needs a shunt having an initial value of about 5,000 ohms. *If R1 is too low, the movement may be damaged, but no value of R2 will harm the instrument.*

In calculating the meter resistance, a

"I WANT THE TUBES WITH THE GOOD HOUSEKEEPING GUARANTY SEAL!"

"TV and radio tubes are mysterious things to me, but that Good Housekeeping Seal is a tried and true friend. I trust any product that has earned it. So when you replace tubes in *my* sets, be sure they're CBS tubes . . . *the tubes with the Good Housekeeping Guaranty Seal.*"

REPLACEMENT OR REFUND OF MONEY
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Check and Remember

1. It's a *woman* you talk to on most service calls.
2. CBS is addressing its national advertising especially to women.
3. 53% of *all women* are influenced in their purchases by the Good Housekeeping Guaranty Seal.
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Use CBS tubes . . . the tubes in which women have confidence.

Millions will see or hear about CBS tubes on TV and radio . . . and in national magazines throughout 1955.

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TEST INSTRUMENTS

slight error is introduced. For example, if a 3-volt battery is used to test a 1-ma movement with an internal resistance of 52 ohms, the value of R1 for full-scale deflection would be 2,948 ohms (assuming zero battery resistance). When R2 is placed in parallel with the meter, the total circuit resistance becomes somewhat less than 3,000 ohms and the total battery current is somewhat more than 1 ma. When R2 is adjusted so that the meter reads half-scale, the meter passes 0.5 ma, but R2 is passing a little more than 0.5 ma.

Since the meter resistance and R2 are in parallel, the voltage drops across both are the same. Thus, with the same voltage drop and with R2 drawing more current than the meter movement, R2 will have slightly less resistance than the meter movement.

The amount of error involved depends upon the ratio of R1 to meter resistance. In this case, the error is less than 0.9%. By increasing the battery voltage, R1 will have to be increased, reducing the possible error. In the above example, if a battery voltage of 90 is used, the error would be slightly less than .03%, a value of little importance in most electronic work. END

Radio Thirty-Five Years Ago
In Gernsback Publications

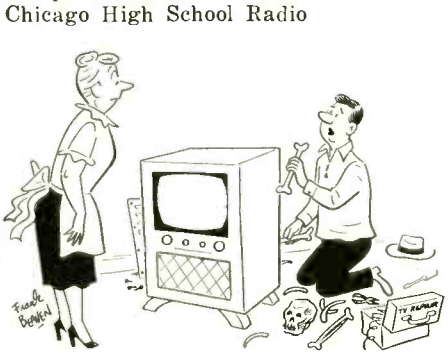
HUGO GERNSBACK
Founder

Modern Electrics	1908
Wireless Association of America	1908
Electrical Experimenter	1913
Radio News	1919
Science & Invention	1920
Television	1927
Radio-Craft	1929
Short-Wave Craft	1930
Television News	1931

Some of the larger libraries still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

In May, 1921 *Science and Invention (formerly Electrical Experimenter)*

New York Radio Convention
Telemegafone on Ships, by Arthur H. Lynch
Radio Vaudeville
A Decremeter for the Amateur
Compact Audion Control Unit
Chicago High School Radio



Suggested by A2/C T. J. Trygier

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- Color demod. phase alignment.
- Color gain adjustments.
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- 3.58 mc traps and coils.

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NEW! *The complete sweep circuit tester — takes the guesswork out of sweep circuit troubleshooting.*

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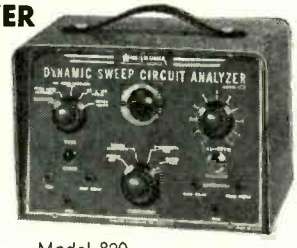
1. Horizontal and vertical sawtooth for signal substitution. (15KC and 60 CPS.)
2. Complete flyback and yoke testers.



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NEW! Sensitive circuit checks *one turn shorts* in yokes *as well as* xfmrs.

- ▶ Oscillating neon indicator *more sensitive than a meter.*
- ▶ Advanced design also tests color yokes and xfmrs.
- ▶ Saves time with fast test of —
  - Flyback transformers
  - Deflection yokes
  - Bypass and electrolytic condensers
  - Continuity of coils, xfmrs

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COMPATIBLE FIELD STRENGTH METER

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NEW! *Here is the FSM that won't be made obsolete by color TV!*

For good antenna installations (color or bl. & wh.) **YOU NEED:**

1. Microvolt testing
2. Bandwidth testing

FEATURES:

- ▶ Tests for color performance on antenna installations.
- ▶ Tests for bandwidth for better bl. & wh. pictures.
- ▶ Reads microvolts *directly* on 3 scales.
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Technotes

INTERMITTENT OSCILLATOR

The set would play perfectly, sometimes for hours. Then it would fail—the volume dropped and the signal disappeared entirely. Yet, by retuning, stations on the high-frequency end of the dial could be brought in (weakly) at other points on the dial, while the low-frequency stations could not be brought in by any maneuver. To make matters worse, the set would not remain inoperative long enough to get the test prods into position for testing.

It was plainly oscillator trouble. All the usual checks were made: voltage, current and resistance measurements; new oscillator tubes; soldered connections gone over with a hot iron—everything perfectly normal.

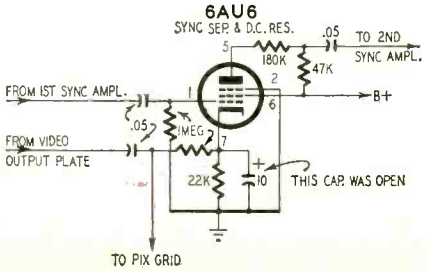
Finally, during an inoperative period I picked up a pair of plastic probing tweezers and did some tugging at wire connections. When I came to the wire attached to the oscillator grid lug on the 6SA7 socket, I gave it a sharp sideways and upward pull.

Immediately, the set started playing at full volume. And it has played perfectly ever since. An intermittent high-resistance connection had developed at this point. The irony is that the very first move I made was to touch the hot soldering iron to this connection, yet nothing happened because the solder had melted on only one side of the lug. The heat had not penetrated to the other side where the high resistance had formed.—*Joseph Amorose*

EMERSON MODEL 511

This set, one of the early models using the 120066 chassis, came in with severe horizontal pulling and vertical jitter. Tube substitution didn't help. All voltages and resistances checked O.K. Using a scope for signal tracing, I found that the sync pulses were good up to the 6AU6 sync amplifier and d.c. restorer. The sync pulses could be observed at the cathode of the 6AU6.

The trouble was traced to an open



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MODEL T-10—fingertip electrical operation. Rocker switch on top controls turning. Highly accurate. Indicator dial. List Price **$29.95**

MODEL K-22—"economy" model. Famous Alliance precision manufacture. Neat, compact, modern design. Fingertip control . . . List Price **$24.95**

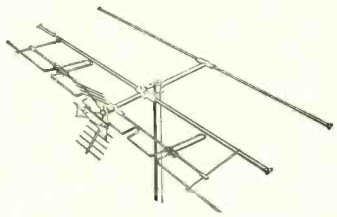
ALLIANCE UHF CONVERTERS

MODEL BY-90—the recognized quality converter built for top performance, long, trouble-free service. Superior reception. List Price **$29.95**

MODEL UC-2—practically automatic! Single, simple control provides continuous tuning. Modern decorator styling. List Price **$24.95**

MODEL UC-1—"hideaway" model—mounts out of sight on back of set. Only slide rule tuning dial shows slightly. Unusual value. List Price **$18.95**

ALLIANCE TRICEPTOR ANTENNA



MODEL TC-2, The Monolober—a totally new and different UHF-VHF antenna. Has uniform gain, high directivity; minimizes or eliminates interference; pre-assembled "snap-out" design for quick installation. All-weather construction, wind-tested, light weight, no tieing needed.

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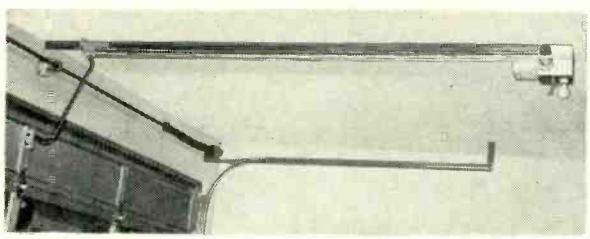

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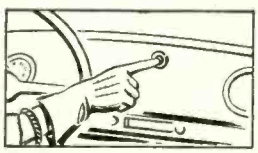
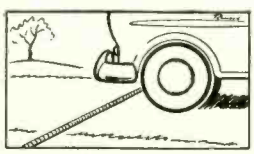
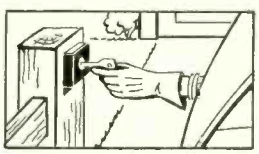


Radio Control—operates from push-button on car dash.



Hydraulic Control—from hose across driveway.



Key-Switch Control—from driver-level post box.

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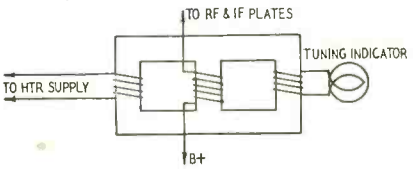
10-μf cathode bypass capacitor that was causing compression of the sync tips. It was eliminated by replacing the bypass capacitor.—*Gregory Roska*

MAGNETIC AMPLIFIER

Probably not too many of today's technicians remember but about 1929 Grigsby-Grunow, in some of the Majestic models, used the magnetic amplifier principle in the construction of a tuning indicator. Time has dimmed my memory; but as one of their engineers at the time, I believe the circuit was about as shown in the diagram.

When the set was tuned off resonance,



the plate current was relatively large, causing magnetic saturation and a dim pilot lamp. Tuning to resonance reduced the plate current flow and the pilot lamp, used as a tuning indicator, brightened. Tuning was always for the brightest glow. As I recall, we saw nothing remarkable about the circuit. It has been known for many years that d.c. flow in an inductor will reduce its value.—*H. L. Matsinger*

NOISY VOLUME CONTROLS

Contact noise developed in the volume control of new or relatively new sets is generally due to loss of spring tension rather than wear and may be corrected simply.

Remove the control, pry off the cover or switch assembly, spread the "C" washer holding the shaft in place and remove shaft and rotor. Clean all contact surfaces, bend the contact springs outward and reassemble.

To simplify positioning the switch-actuating components on switch type controls, advance the rotor to the "on" position before taking the switch apart. Reassemble with the rotor at the same maximum position.—*V. F. Woychoski*

FORD 6FM780 RADIO

Sluggish manual tuning and failure of the automatic selector can be cured by first cleaning the entire assembly with carbon tet and then lubricating the moving parts with mineral oil. In some cases it may be necessary to allow the oil to penetrate for several days.

Before applying power, operate the assembly by pushing in the plunger by hand. It may be necessary to force it in several times before it can be operated electrically. Clean off excess oil and lubricate with graphited oil or SAE 20. Sprinkle some dry graphite on the release gear. Very light grease will do. Don't overdo the job in any case, since lubricants attract dirt which can cause trouble in a short time. —*G. P. Oberto*

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VIDEO PEAKING

Optional high-frequency video peaking is provided in most circuits based on the RCA 630TS. It consists of connecting a 470-$\mu\mu$f capacitor across the cathode bias resistor of the second video amplifier. This definitely improves detail but it reduces the relative amplification of low-frequency signals to the point where partial or complete loss of interlace may occur.

Substitution of a capacitor of lower value, about 250 $\mu\mu$f, will provide sufficient peaking for most programs and still preserve satisfactory interlace. If desired, a three-position switch may be used to select the proper peaking capacitor for each program.

No capacitance should be used for high-quality local studio programs since it usually leads to ringing. A value of 240 $\mu\mu$f is suitable for the average network program, while 470 $\mu\mu$f should be used for film programs where the improvement in picture quality due to sharpened high-frequency response more than compensates for loss of interlace.—*G. DeLaMater*

PHILCO 38-9

The complaint concerned an annoying intermittent. The set would play fine for hours, then the volume would drop off and a loud, scratchy noise lasting several seconds could be heard. Turning the power switch off and on would restore normal operation. All the routine checks were made; new tubes tried, coupling capacitors replaced and voltages measured.

Several days later, toward dusk, I noticed a small spark jumping from one of the plate resistor leads attached to a tube socket. The resistor was barely visible because of a bypass capacitor blocking it. The arcing was taking place from the resistor lead to the grounded rivet on the socket. Bending the lead away from the rivet solved the trouble.—*Joseph Amorose*

FM CONVERTER

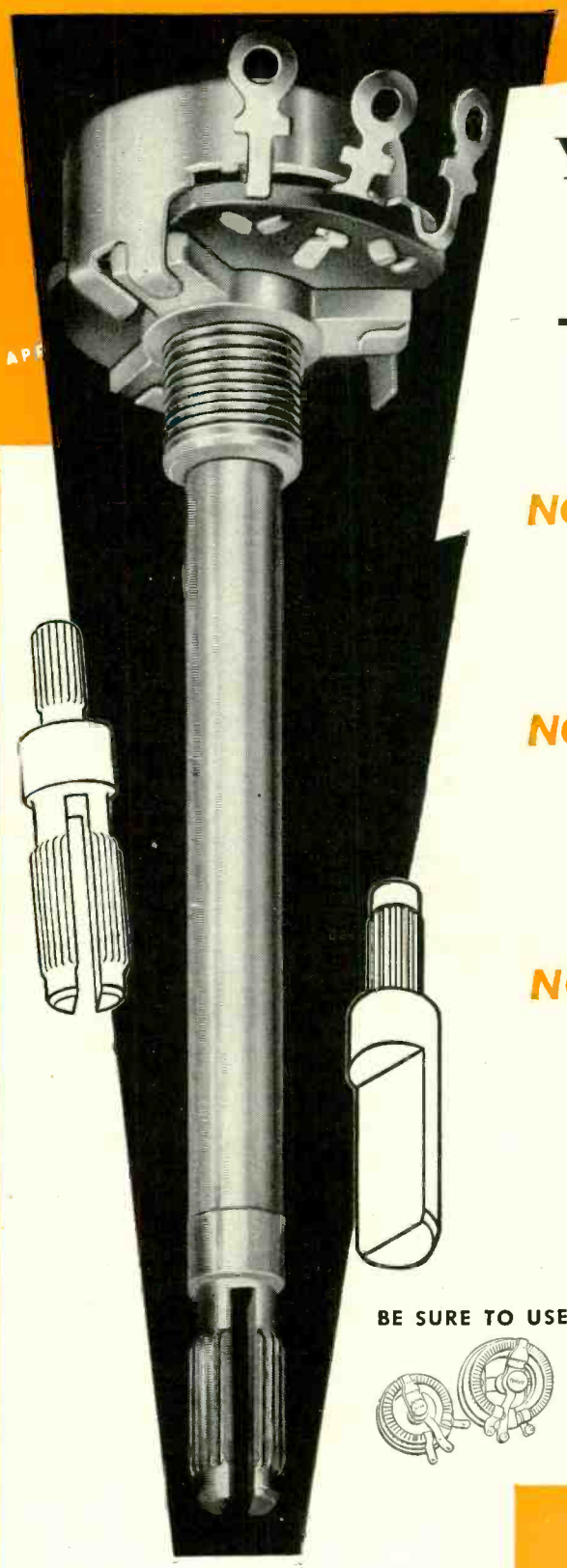
If an FM set uses a triode converter and there is a long lead from the converter plate to the first i.f. transformer, the i.f. primary tuning capacitor is often mounted on the converter socket. Under these conditions the lead to the i.f. can often pick up i.f. signals radiated from the rear end of the set. This pickup causes peculiar oscillations.

They can be eliminated by mounting the tuning capacitor at the i.f. can between the plate terminal and a ground point. This is virtually a sure-fire cure.—*Charles Erwin Cohn*

DU MONT RA-119A

Fluctuating picture contrast in this set can usually be traced to an intermittently shorting capacitor in the plate circuit of the a.g.c. detector. This trouble seems to occur only when the set is first turned on. A check of the a.g.c. voltage discloses that it, too, is fluctuating. Replacing the defective capacitor cures the trouble.—*John A. Comstock*

END



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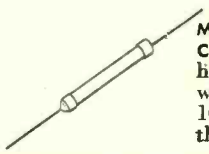

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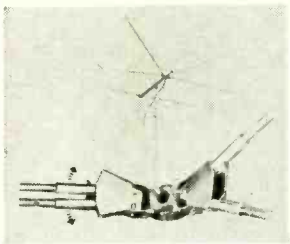
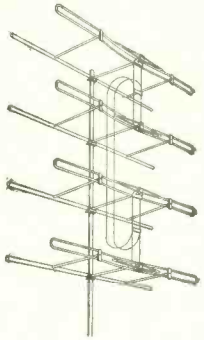
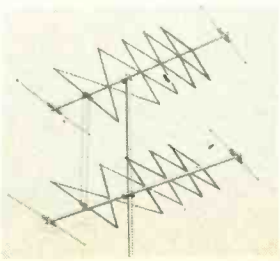
Nonassembled *Maverick 340* line has 10 models designed for quick installation. Notch-lock clamp plate prevents elements from turning or twisting. Fan type, 6- and 8-element and standard X type heads; high-band stubs and directors; X type and straight-bar reflectors available.—**Channel Master Corp.,** Ellenville, N. Y.



V.H.F. TV ANTENNA, *Finco model F-4.* Good performance on low- and high-band channels up to 200 miles or more from station. Produces in-phase collinear currents, eliminates phase-reversing harnesses. Has 4 driven, low-band, in-phase folded dipoles plus 12 driven high-band in-phase folded elements. Extremely flat frequency response—less than 1-db variation.—**Finney Co.,** 4612 St. Clair Ave., Cleveland 3, Ohio.

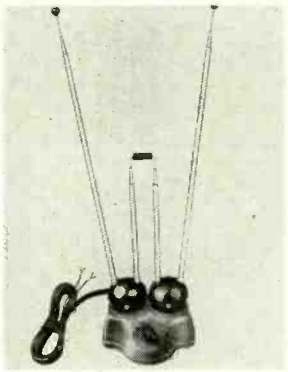


HIGH-BAND ANTENNA, *JFD Yagi-Helix YH713,* for deep fringe reception. Equivalent to 7 separate 10-element single-channel high-band Yagis. Length: 5 feet. Stacks 3 feet apart. Average gain 11 db on high band, average 13.5 when stacked. High directivity; good front-to-back ratio. Stackable in different directions to pick up more than one high channel from more than one direction by using stacking bar supplied and taking off at normal center position. — **JFD Manufacturing Co., Inc.,** 6101 16th Ave., Brooklyn 4, N. Y.

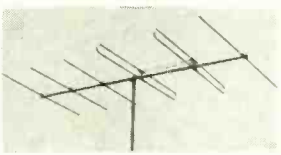


TV MAST, 18-gauge *Jontz* in 20-, 30-, 40-, 50-foot models. Top section 16-gauge galvanized strip rolled into tubing identical to *Jontz Standard* series. Available only in standard sectional combinations starting with 1¼ inches at top and increasing ¼ inch each section.—**Jontz Manufacturing Co.,** 1101 E. McKinley St., Mishawaka, Ind.

INDOOR ANTENNA, *RMS model B-29,* features 6-position selector switch and adjustable 3-section telescoping phasing bar for fine-tuning antenna for peak performance.—**Radio Merchandise Sales, Inc.,** 2016 Bronxdale Ave., New York 62, N. Y.



FM ANTENNA, *Taco No. 644,* improved model of patented twin-driven antenna. Has 3 directors, 2 driven elements, reflector. Available as single or stacked array, depending upon gain required. Terminal impedance matches 300-ohm transmission line. For reception of stations in different directions, mechanical rotor recommended. Coverage of 88–108-mc band obtained through



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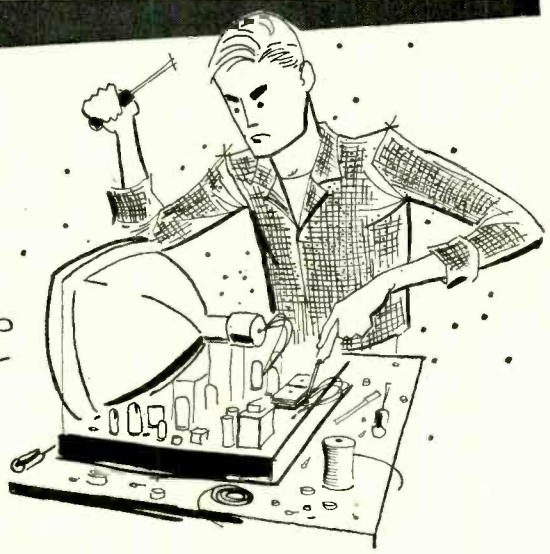

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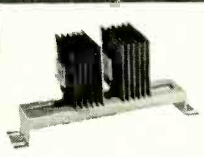

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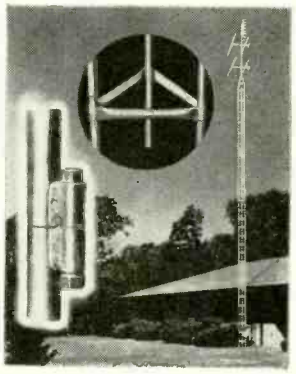
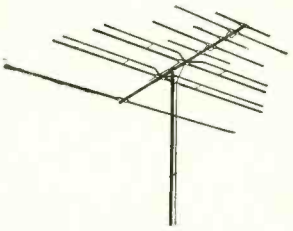
broad-band tuning.—**Technical Appliance Corp.**, Sherburne, N. Y.

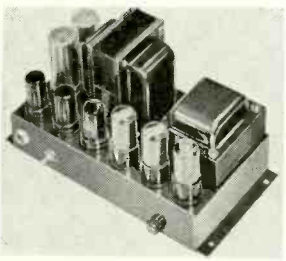
TELEVISION TOWER, *Kuehne*. Improved electro-plated zinc coating for permanent weather-proof finish. Lateral load bearers eliminate horizontal bolts and holes through the vertical tower members, making stronger joints and producing tower that stands free up to 50 feet. Safe in gales up to 80 miles per hour.—**Kuehne Mfg. Co.**, TV Tower Division, Mattoon, Ill.



TV ANTENNA, *Trio 77*, all v.h.f.-channel Yagi type. Intermixed high- and low-band elements arranged for single-line operation. High-gain Yagi performance; no interaction between high- and low-channel elements; very high rejection of signals off rear and sides.—**Trio Manufacturing Co.**, Griggsville, Ill.



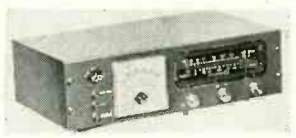
AUDIO AMPLIFIER, *Webster model 96-10*. Frequency response at 1 watt output. flat within 0.3 db, 20–40,000 cycles (down 2 db at 100,000); at 10 watts output, flat within 0.5 db, 20–22,000 cycles. Harmonic distortion 0.3% at 3 watts, 50 cycles; 0.75% at 10 watts; 50 cycles. Noise level —80 db below 10 watts. Output impedances of 4, 8 and 16 ohms available on screw terminals. 6¼ x 12 x 6¼ inches. Weighs 16 pounds.—**Webster Electric Co.**, 1900 Clark St., Racine, Wis.



3-SPEED TAPE RECORDER, *Bell RT-75*, has full pushbutton control with straight-line slot threading. Positive action lever selects 7½, 3¾ or 1⅞ i.p.s. Frequency response at 7½ i.p.s. rated at 30 to 12,000 cycles; 7,500 and 4,500 cycles maximum response at 3¾ and 1⅞ i.p.s., respectively. The 1⅞-i.p.s. speed provides 6 hours' dual-track recording on 1,800-foot, 7-inch diameter reel.

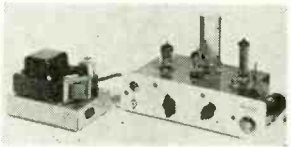
Controls include volume; tone boost and cut; pushbutton recording, with safety interlock to prevent accidental erasure. Microphone inputs for both high-impedance and ceramic or dynamic mikes. Radio-phono-TV input mixable with microphone inputs. 6 x 9-inch speaker. Outputs include 3.2-ohm jack for external speaker and high-impedance jack (bypasses output stage) for feeding external hi-fi amplifier. — **Bell Sound Systems, Inc.**, 555 Marion Rd., Columbus 7, Ohio.

FM-AM TUNER, *Collins Custom Special*, cascode front-end sensitivity 3 μv with 30-db quieting on FM. Tuning meter used for FM; tuning eye for AM.



AM circuit is t.r.f. with 4-gang tuning capacitor giving 20-kc flat-top response. Usable audio-frequency response to beyond 10,000 cycles.—**Collins Audio Products Co.**, P. O. Box 368, Mountainside, N. J.

TAPE PREAMPLIFIER, *Fentone TPR-1*, for *Motek Audiophile Tape Deck* or other transport mechanisms with bias and erase frequencies of 45 kc or higher. Separate chassis for preamp proper and power supply, permitting remote installation and reducing hum. Two inputs, mike and phono; radio or hi-fi amplifier tape output. Bias and erase frequency 45–55 kc, adjustable; signal–noise ratio, 55 db; recording frequency range better than 50–10,000 cycles ±3 db; playback, 50–14,000 cycles, ±3 db. Output 1 volt across 1 meghom.—**Fenton Co.**, 15 Moore St., New York 4, N. Y.



HI-FI AMPLIFIER KIT, *HEATHKIT model W-5M*. New balancing circuit for closer dynamic balance between KT-66 output tubes; increased output at low frequencies, full octave below present Heathkit Williamson type amplifiers; increased power output; reduced

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6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
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FULL PHOTOGRAPHIC COVERAGE

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

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

TUBE PLACEMENT CHARTS

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

TUBE FAILURE CHECK CHARTS

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

COMPLETE PARTS LISTS

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

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Address.....

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

(Continued)

IM and harmonic distortion; tweeter-saver to suppress high-frequency oscillation.

Frequency response within 1 db from 5 cycles to 160 kc at

1 watt. Hum and noise 99 db below rated output; 80.2 db below ¼ watt.—**Heath Co.**, Benton Harbor 20, Mich.

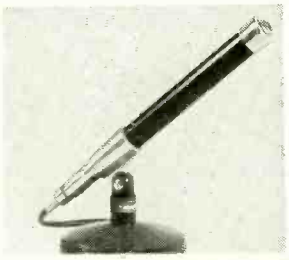
SPEAKER SYSTEM, *Permoflux Largo 12* (larger version of Largo 8) features Super Royal 12-inch speaker and 32KTR

super tweeter. Enclosure similar to Largo 8, but larger. Cabinet base horn-loads speaker backwave. Peak-free reproduction 30–16,000 cycles. Power-handling capacity 20 watts. Slanted speaker panel for proper sound focusing. Impedance 8 ohms; overall size 23⅛ x 27¼ x 15½ inches.—**Permoflux Corp.**, 4900 W. Grand Ave., Chicago 39, Ill.

20-WATT HI-FI AMPLIFIER, *Sherwood S-1000.* Push-pull 6L6-GB's in wide-range Ultra-Linear circuit handle 40-watt peaks, pushbutton record equalization, speaker-damping selector, center-set loudness control, Z729 low-noise photo preamplifier, low-distortion tone controls. Front-panel controls include phono scratch, rumble filter

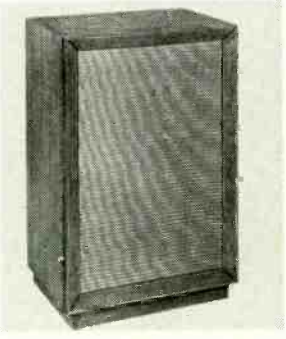
switches.—**Sherwood Electronics Labs., Inc.**, 2802 W. Cullom Ave., Chicago 18, Ill.

DYNAMIC MICROPHONE, *Turner model 57,* for broadcast-



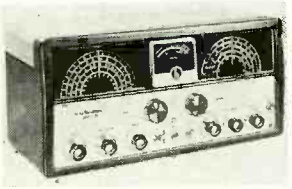
ing, telecasting, recording, public address. High or low impedance selected by connecting to proper pair of conductors at terminal end of 20-foot 3-conductor shielded cable. Frequency response, 50 to 13,000 cycles; output level, 55 db below 1 volt per dyne per square cm. Slide on–off switch. Matching desk stand available.—**Turner Co.**, 933 17th St. N.E., Cedar Rapids, Iowa.

SPEAKER ENCLOSURE,



Standard Wood Tune-A-Port MI, has baffleboard adjustable from outside by raising or lowering port by two external small knobs. Accommodates 12- or 15-inch single, coaxial or triaxial speaker systems. Sound enclosure 10,000 cubic inches. High power-handling capacity. Full ¾-inch mahogany veneer stock; interior acoustic padding. 36 x 24 x 17 inches.—**Standard Wood Products Corp.**, 47 W. 63 St., New York 23, N. Y.

SHORTWAVE RECEIVER, *Hallicrafters SX-96.* Double conversion superheterodyne over entire frequency range, precision gear drives and selectable side-band reception of



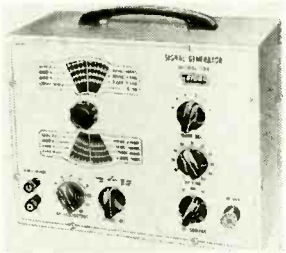
both suppressed and full carrier. Delayed a.v.c., CW operation with a.v.c. on or off. Calibrated bandspread, S meter and phone jack on front panel. Has 10 tubes, rectifier and voltage rectifier.—**The Hallicrafters Co.**, 4401 W. 5th Ave., Chicago 24, Ill.

C.R.T. REJUVENATOR, *Central Multiphase Rejuva-Tube,* available in kits and factory wired. Tests, repairs, rejuvenates electrostatic and electromagnetic TV picture tubes in sets. Detects open or shorted ele-

ments, leakages as high as 3 megohms between elements. Metered circuit removes particle shorts between cathode and heater. Meters cathode activity during rejuvenation; tells when to stop rejuvenation to prevent damage to cathode-emitting surface. Built-in current limiter prevents accidental cathode ribbon burnouts. Detects gassy tubes. Completely portable.—**Central Electronics, Inc.**, 1247 W. Belmont Ave., Chicago 13, Ill.

R.F. SIGNAL GENERATOR, *Eico model 324,* for i.f.–r.f. alignment; signal tracing; troubleshooting AM, FM, TV receivers; marker generator for alignment of high- and low-frequency TV i.f.'s 400-cycle sine-wave audio testing. Frequency range 150 kc to 145 mc on fundamentals in 6 bands; 111–435 mc on calibrated harmonics.

Variable depth of internal modulation from 0–50% by 400-cycle Colpitts oscillator; variable-gain external-modulation amplifier requires only 0.8-volt



audio input for 30% modulation. Fine and coarse (3-step) attenuators have 50-ohm output impedance. R.f. output 100,000 microvolts; a.f. output to 10 volts. — **Electronic Instrument Co., Inc.**, 84 Withers St., Brooklyn 11, N. Y.

5-INCH SCOPE, *Hickok model 770.* Frequency ranges: vertical amplifiers: d.c. to 2.5 mc, 3 db down, bandwidth switch in narrow position; d.c. to 5 mc, 3 db down, bandwidth switch in wide position. Horizontal amplifier: d.c. to 500 kc, 3 db down. Sweep circuit oscillator, 2 cycles to 30 kc. Fixed sweep fre-

NEW DEVICES *(Continued)*

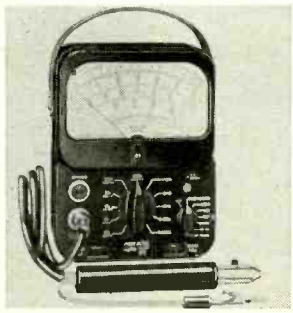
quencies 30 and 7,875 cycles.

Vertical amplifier input impedance: 2.2 megohms, 50 μμf; horizontal amplifier, 2.2 megohms, 50 μμf.

Deflection sensitivity: Vertical amplifier: .010 r.m.s. volt per inch, bandwidth switch in

narrow position; .035 r.m.s. volt per inch, bandwidth switch in wide position. Horizontal amplifier, .075 r.m.s. volt per inch. —**Hickok Electrical Instrument Co.**, 10531 Dupont Ave., Cleveland 8, Ohio.

V.T.V.M.-OHMMETER, *Precision model 88*. Zero-center d.c. v.t.v.m. eliminates need for test-lead reversal or polarity switching; 6 overlapping zero-center d.c. ranges from ±1.2 to ±1,200 volts. Positive and negative reading, left-hand zero d.c. v.t.v.m. 0–1.2 volts full scale through 1,200 volts, in 6

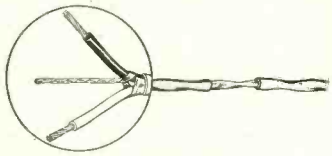


convenient steps. Full-scale electronic ohmmeter covers resistance values from zero to 1,000 megohms in 5 decimally related ranges with 10 ohms center scale on the R × 1 range. High-impedance low-capacitance a.c.-r.m.s. v.t.v.m. for general analysis; 6 ranges to 1,200 volts with a separate 1.2 voltmeter scale for optimum low-voltage accuracy. Peak-to-peak reading a.c. v.t.v.m.; 6 ranges through 3,200 volts peak to peak with separately calibrated 3.2 voltmeter scale. Accessory high-frequency vacuum-tube probe, *model RF-10A*, available.—**Precision Apparatus Co., Inc.**, 70-31 84th St., Glendale, N. Y.

FLYBACK-YOKE TESTER, *Winston model 810*, for color or black-and-white, tests horizontal output transformers and yokes. Good–bad tests use special os-

cillating neon indicator driven by d.c. amplifier. Separate calibrated positions for continuity and shorted-turn tests on iron-core and air-core transformers as well as yokes. — **Winston Electronics, Inc.**, 4312 Main St., Philadelphia 27, Pa.

SOUND-SYSTEM CABLE, *Belden No. 8790*, a balanced twisted pair. Spiral-wrapped tinned-copper shield eliminates time-consuming termination, is easily unwrapped, twisted, soldered.



Provides line balance and eliminates cross-talk. Due to smooth surface and small size (0.225 inch O.D.), easily pulled through conduit.—**Belden Manufacturing Co.**, 4647 W. Van Buren St., Chicago 44, Ill.

SOLDERING AIDS, *CBS-Hytron* hexagonal-handled models: *SH20A* has straight reamer tip; *SH20B*, angled (31°) tip for reaching into close-packed chassis. Useful fork tip obvi-

ates fumbling with long-nosed pliers. Spade type reamer tip clears lug hole of solder, pushes wires aside. **CBS-Hytron**, Div. of Columbia Broadcasting System, Inc., Danvers, Mass.

SHAFT-KUT KIT, *Centralab SK-1*, 6 tools to aid in adapting control and switch shafts. Custom-made shaft clamp stool. Holds variety of diameters of shafts in vise. Fine-tooth hack-

saw blade, precision half-round needle file, "A" size drill and drill stop for drilling out holes in knobs, small screwdriver also included.—**Centralab**, Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

CABLE KITS, *Packard*, TV and radio suppressor type for automotive and marine installations, regardless of spark-plug lead length. Has a conductor of linen and nylon cord impreg-

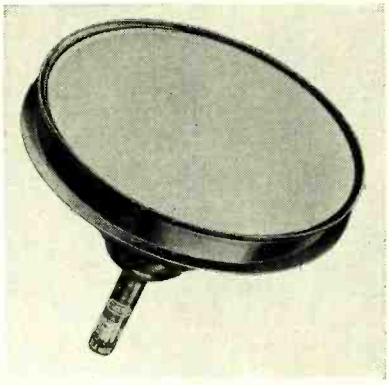
nated with conducting material.—**United Motors Service**, Div. of General Motors, GM Building, Detroit 2, Mich. END

All specifications given on these pages are from manufacturers' data.

new Tubes & Transistors

21AXP22

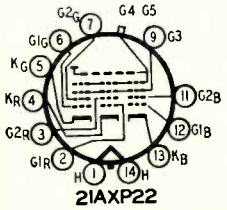
RCA has released technical details of the 21AXP22 (see photo), the 21-



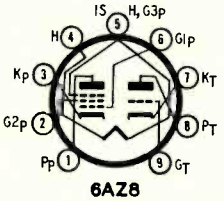
inch direct-view metal-shell picture tube for color television receivers. It produces either a full-color or black-and-white picture measuring 19 5/16 x 15¼ inches, with rounded sides and a projected area of 260 square inches.

The 21AXP22 uses three electrostatic-focus guns spaced 120° apart with axis tilted toward the tube axis to facilitate convergence of the three beams at the shadow mask. It features individual convergence control of each beam radially by internal magnetic poles and supplemental control of the blue beam tangentially by internal magnetic poles, and an assembly consisting of a spherical metal shadow mask with uniform holes and a metalized, tricolor, phosphor-dot screen on the inner surface of the spherical filterglass faceplate.

The tricolor, phosphor-dot screen is composed of an orderly array of small, closely spaced phosphor dots arranged



21AXP22



6AZ8

in triangular groups. Each group consists of a green-, red- and blue-emitting dot and is aligned with a corresponding hole in the shadow mask.

Each of the electrostatic-focus guns has an indirectly heated cathode, control electrode (grid 1), accelerating electrode (grid 2), focusing electrode (grid 3), second anode (grid 4) and a pair of beam-converging pole pieces.

The tube base (see diagram) of the

NEW TUBES AND TRANSISTORS *(Continued)*

21AXP22 is the same used for the CBS-Colortron 205 (described November, 1954). Maximum ratings (voltages with respect to cathode) are as follows for grid-drive service: second anode, 25,000 volts, 800 microamperes; grid 3, 6,000 volts; grid 2, 800 volts; grid 1, 400 volts negative bias, 0 volts positive bias, 2 volts peak positive.

6AZ8

RCA has announced the 6AZ8, a general-purpose multiunit tube of the nine-pin miniature type containing a medium-mu triode and a semiremote-cutoff pentode in one envelope. It is intended for a wide variety of applications in black-and-white and color television receivers.

The triode unit, with its relatively high zero-bias plate current, is useful in low-frequency oscillator, sync-separator, sync-clipper and phase-splitter circuits. The pentode unit features high transconductance and a semiremote-cutoff characteristic to minimize cross-modulation effects and overload distortion in video i.f. stages.

The basing arrangement (see diagram) and internal construction of the 6AZ8 are designed so that coupling between the triode and pentode unit is virtually eliminated.

The pentode unit has a separate base pin for the cathode only. Grid 3 and the internal shield which are normally connected internally to the cathode are instead connected to one of the heater leads. This arrangement facilitates using an unbypassed cathode resistor to minimize changes in input resistance and input capacitance with bias, without causing oscillation which otherwise might occur if grid 3 were internally connected to the cathode. Because grid 3 is connected within the tube to one side of the heater (pin 5), it is important that pin 5 be connected to ground to maintain grid 3 at ground potential.

The heater voltage of the 6AZ8 is 6.3; the heater current is 450 ma.

6BC8

A miniature nine-pin medium-mu dual triode with semiremote-cutoff characteristics has been announced by Sylvania. The 6BC8 operates very well as a cascode amplifier in v.h.f. tuners, which with its remote characteristics makes possible the design of more effective a.g.c. systems.

The 6BC8 avoids the objectional effects of crossmodulation—encountered with more conventional tubes such as the 6BQ7 and 6BZ7 when reception of a weak signal is degraded because of strong adjacent-channel interferences—since the transfer curve of the tube approaches the desirable square-law characteristic, the optimum shape for minimum crossmodulation.

The heater voltage of the 6BC8 is 6.3; the heater current, 400 ma. The following characteristics apply when the tube is used as a class-A amplifier (each section): plate voltage, 150; grid voltage, 0; cathode bias resistor, 220

ohms; plate current, 10 ma; transconductance, 6,200 μmhos; amplification factor, 35.

2N104

A hermetically sealed junction transistor intended for low-power audio applications in communications and other types of electronic equipment was announced by RCA. The tiny semiconductor is a p-n-p germanium type, sealed in an envelope ¼ inch in diameter and 11/16 inch in overall length.

Design and operating features of the 2N104 include a low base-lead resistance which minimizes ohmic losses, improves frequency response and insures high input-circuit efficiency; a maximum noise factor of 12 db, and, when used in a common-emitter circuit, a collector-to-base current amplification ratio of 44, a matched-impedance, low-frequency power gain of 40 db, and a collector-to-base alpha frequency cutoff of 13.9 kc. The collector dissipation of the 2N104 is approximately 35 milliwatts.

2N82

CBS-Hytron has announced a new p-n-p junction germanium transistor designed for high-temperature amplifier applications, the 2N82. It is hermetically sealed in a metal case 0.33 inch long and 0.225 inch in diameter.

Maximum ratings for the 2N82 are: collector dissipation at 71° C., 35 milliwatts; collector current, 15 ma; collector voltage, −20; ambient temperature range, −55 to +71° C.

24CP4-A, 24DP4-A

Two direct-view, rectangular glass picture tubes with spherical filterglass faceplates have been announced by RCA. They have an aluminized screen, 21¼ x 16¾ inches, with slightly curved sides and rounded corners, and a nominal projected screen area of 327 square inches.

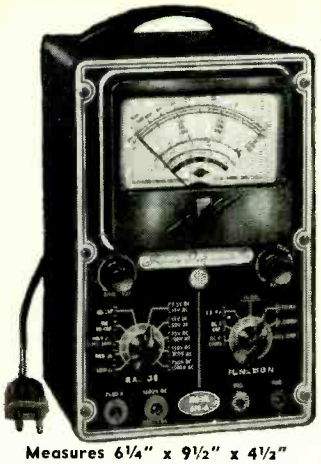
The 24CP4-A uses magnetic focus and magnetic deflection; the 24DP4-A low-voltage electrostatic focus and magnetic deflection.

The tubes have a deflection angle of 90° and a maximum overall length of only 21½ inches. Other design features include an external conductive bulb coating which with the internal conductive coating forms a high-voltage filter capacitor, and an ion trap requiring an external single-field magnet.

3RP1-A

A 3-inch cathode-ray tube, like the 3RP1 except that it has a flat faceplate to simplify use of an external calibrated scale and to minimize parallax in readings, has been announced by RCA.

Intended for general oscillographic use, the 3RP1-A has a small, brilliant, focused spot and high deflection sensitivity for its relatively short length, 9⅛ inches. It provides a high brightness trace when operated with a second-anode voltage near its maximum rating of 2,500. END



Measures 6¼" x 9½" x 4½"

Superior's new Model 670-A

SUPER METER

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

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: −6 to +18 +14 to +38 +34 to +58

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

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

$28.40 NET

Superior's new Model TV-11

TUBE TESTER

SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system,* the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover

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

$47.50 NET

SUPERIOR'S NEW MODEL TV-40

C.R.T. TUBE TESTER

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

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

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

EASY TO USE:

Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base *(Ion Trap Need Not Be on Tube).* Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

SPECIFICATIONS:

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

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only.....

$15.85 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied *then* send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-125, 3849 Tenth Ave., New York 34, N.Y.

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

Name .....

Address .....

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

☐ Model 670-A.....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.

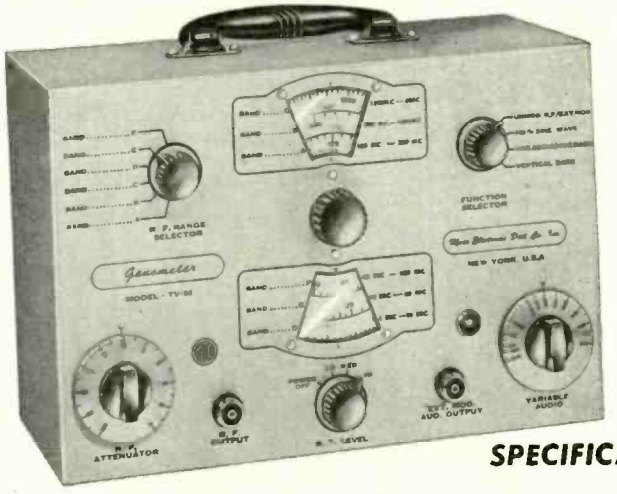
☐ Model TV-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.

The Model TV-50 GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A. M. Radio F. M. Radio Amplifiers Black and White TV Color TV



7 Signal Generators in One!

- R. F. Signal Generator for A.M.
- R. F. Signal Generator for F.M.
- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

SPECIFICATIONS:

R. F. SIGNAL GENERATOR:

The Model TV-50 Genometer provides *complete* coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. Accuracy and stability are assured by use of permeability trimmed Hi-Q coils. R.F. is available *separately*, modulated by the fixed *400 cycle sine-wave* audio or modulated by the *variable* 300 cycle to 20,000 cycle variable audio. Provision has also been made for injection of any external modulating source.

VARIABLE AUDIO FREQUENCY GENERATOR:

In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. This service is used for checking distortion in amplifiers, measuring amplifier gain, trouble shooting hearing aids, etc.

BAR GENERATOR:

This feature of the Model TV-50 Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50 employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

CROSS HATCH GENERATOR:

The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines *interlaced* to provide a stable cross-hatch effect. This service is used primarily for correct ion trap positioning and for adjustment of linearity.

DOT PATTERN GENERATOR *(For Color TV)*:

Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for *proper color convergence*. When all controls and circuits are in proper alignment, the resulting pattern will consist of a sharp white dot pattern on a black background. One or more circuit or control deviations will result in a dot pattern out of convergence, with the blue, red and green dots in overlapping dot patterns.

MARKER GENERATOR:

The Model TV-50 includes *all* the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions. Only .....

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied *then* send $11.50 and pay balance at rate of $6.00 per month for 6 months. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-125, 3849 Tenth Ave., New York 34, N.Y.

Please rush one Model TV-50. I agree to pay $11.50 within 10 days and to pay $6.00 per month thereafter. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....

Address .....

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

Technicians' News

SNOHOMISH ORGANIZES

"After years of indecision and frustration," reports the new publicity director, "a live-wire service and dealer's association has been established in Snohomish County, Washington."

Officers installed are Joe Mulholland, president; Bill Varn, vice president; Paul Zook, second vice president; Charles Ball, third vice president; Vernon Dowling, secretary-treasurer. A board of directors consisting of J. C. Wold, E. J. Ballew, Dave Coffey, Russell Jagers, Leif Johnson and Clarence Wagner was elected. Headquarters of the new organization is in Everett, Wash.

TISA OF CHICAGOLAND

Television Installation Service Association of Illinois has substituted the word "Chicagoland" for "Illinois" in its title. This was done in recognition of the great number of local associations now springing up in the state, including one other which has adopted the corporate name TISA. The veteran association, which was once practically the only one in Illinois, has therefore adopted a name associating it with the Chicago area.

TISA also adopted a number of other amendments to assist it in its work, including the creation of a third vice president, with Joe Issak as the first holder of the office. Delegate and alternate delegate to NATESA were made elective offices, with John Cecich and Sid Terman first elective delegate and alternate, respectively. Other amendments aimed at streamlining meeting procedure were also passed.

CONDEMN PHILCO PLAN

The FRSAP passed the following resolution unanimously:

"We, the duly elected delegates of the Federation of Radio Servicemen's Associations of Pennsylvania representing the service industry in the State of Pennsylvania, hereby condemn the Philco Corporation for their publicly announced plan to set up an official servicing company in Chicago to install, service and maintain Philco equipment . . .

"This move is completely contrary to the well advertised Philco policy of cooperating with the independent serviceman and represents an invasion of the independent servicing field."

The federation also agreed to support a series of convention shows in the

LAFAYETTE'S SPECTACULAR MONEY SAVERS

- Brand new fully automatic 3 speed record changer
- Dual turn-over cartridge with dual styli
- Automatic shut-off after last record

SALE! 26.50 Webcor

3 SPEED AUTOMATIC RECORD CHANGER Buy at Lafayette's LOW SALE PRICE

You'll find this famous Webcor Diskchanger not only in Webcor Fonografs but in radio phonograph combinations of other famous manufacturers. This is truly supreme excellence in record changing. Not only does it play all 3 speeds and all sizes of records, but it plays up to four hours automatically . . . then shuts itself off after the last record has played. The Webcor Diskchanger was designed for swift, silent record changing; smooth, accurate turntable speeds; and gentle treatment of your precious records. To obtain these qualities, Webcor has included such outstanding features as the: Balanced Tone Arm, Electrostatically Flocked (super-soft) turntable, Shpg. Wt. 16 lbs.

PK-49 ..... Singly, ea. **26.50**

WEBCOR WITH G.E. CARTRIDGE

STOCK NO. PK-46 Same as above but with G.E. RPX-050 Triple-play cartridge. List Price. $51.75 ..... NET **29.50**

Lafayette Greatest Tape Buy Ever!

1200 FT. REEL
Genuine Plastic Base
RECORDING TAPE
Shpg. Wt. 14 oz.

$1.89 per roll plus postage

LAFAYETTE made a terrific deal with one of the leading manufacturers of recording tape to supply us with their regular tape which sells for almost twice our price. WE GUARANTEE ABSOLUTE SATISFACTION OR YOUR MONEY BACK. The finest, professional-quality recording tape obtainable. Highest performance for thousands of playings. Red Oxide Base in a smooth, uniform coating; greater signal strength; with maximum fidelity; uniform frequency response from 40-15,000 cps.

In lots of 10 rolls - 1.75 ea

Masco CASCADIAN TV BOOSTER

Reg. Price ~~$42.50~~

SALE 9.95

Biggest Booster Buy Ever!

Famous Masco Cascode Booster!!

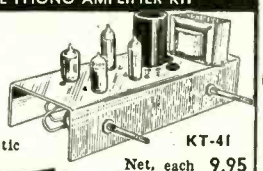
- Three tuned circuits—cascode!
- Golden Grid 6BZ7 Plus 6J6 Plus rectifier!
- 35 db gain (56 times!) average on all channels!

A sensational new tunable VHF booster utilizing a special low-noise circuit. Employs the new Golden Grid 6BZ7 tube so well known for its use in cascode circuits. Field pioneer and specifically designed for new low noise-high gain front ends. Brings superior reception to older type receivers. Single knob control for utmost simplicity of operation. Signal strength is increased at least 56 times—35 db!—average on all channels. Rack and pinion permeability for precision stability. Automatically switched on and off by TV set. Uses cross-neutralized 6J6 and 6BZ7 tubes for maximum gain and bandwidth. U/L approved. For 110 volts AC. Wt. 5 lbs.

Masco TVB-53. In lots of 3, Net **9.45** Singly, ea. **9.95**

HI-FI PUSH PULL PHONO AMPLIFIER KIT

Hi-quality 4 tube push-pull phono amplifier kit. Plenty of power — low distortion. 2-35C5, 1-12AX7, 1-35W4. Inverse feedback circuit. Separate tone and volume controls. Complete with tubes—output transformer—pictorial and schematic diagrams.



KT-41
Net, each 9.95

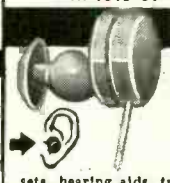
SALE! ASTATIC UHF CONVERTER

channels 14 thru 83
In Lots of 3.... **13.95**
Singly, each..... **14.45**

Below manufacturer's cost! Continuous vernier tuning—14 thru 83. Operates into TV receiver channels 2-3-4-5 and 6! Two stage preselector. Fully shielded spiral inductance tuner reduces oscillator radiation. Uses 6AF4 or 6T4 and IN82 crystal diode. High sensitivity—low noise performance!

ASTATIC UHF—Singly, each..... 14.45
In lots of 3, each..... 13.95

LAFAYETTE EXCLUSIVE! DYNAMIC EAR PHONE



A new lightweight plastic ear phone especially imported by Lafayette to bring you the high quality of a dynamic ear phone with the ease and comfort of an almost weightless unit—at a price less than half that of any comparable unit. Fits right into ear. Excellent sensitivity of 65 db. Ideal for use with miniature sets, hearing aids, transcribing, etc. DC resistance 2000 ohms, impedance 5000 ohms at 1000 cycles. Complete with 3 ft. plastic covered cord.

MS-72 ..... Net **1.95**

LOW IMPEDANCE MODEL FOR SILENT LISTENING OR VIEWING

Will replace speaker on any radio set or T.V for silent listening, by direct connection to secondary of output transformer. Impedance 8 ohms.

MS-100 ..... Net 1.95

FAMOUS ALARM-TIMER SWITCH

- BUZZ ALARM
- SLEEP SWITCH
- AUTOMATICALLY TURNS ON RADIOS, ETC.

We've done it again. We bought up the overstock of an equipment manufacturer to bring you this automatic 4-button timer at a giveaway price. Turns on radios, TV sets, toasters, etc. at any preset time within 12 hour period. Built-in SPST switch handles up to 15 amp 115 volts. Has sleep switch so you can go to sleep to music—it will automatically shut off radio at preset time up to 90 minutes. And it also tells time. Radium dial. For 110-120V 60 cycle. Shpg. Wt. 1½ lbs.

MS-105 ..... Net 5.70

REAR SEAT AUTO SPEAKER KIT

A — HEAVY DUTY 6" x 9" PM KIT — B

A complete kit for adding another speaker in the rear of your car. You get a 6"x9" PM speaker with a 2.15 oz. Alnico V magnet; a CRL PK300 three position switch so you can select either speaker alone or both together, dial plate with mounting bracket, knob and hardware; a plastic grille (illustration A) (your choice of brown, grey or silver), wire and wiring instructions. Simple to install. Shpg. Wt. 4 lbs.

SK-36 ..... Net 4.50

DELUXE 6" x 9" KIT

SK-37, with chrome plated metal grill (Fig. B).
Shpg. Wt. 5 lbs. ..... Net 5.75

5" Tweeter AND Crossover Network

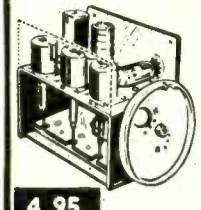
7.95

A specially designed 5" Tweeter and Crossover Network that will assure high frequency response when used with any speaker you now possess. You can now make your present speaker into a 2-way speaker system increasing the high frequency range up to 15,000 cycles. Diagram included. Shpg. Wt. 5 lbs.

STOCK NO. SY-14 ..... Net 7.95

SALE! RADIO RECEPTOR UHF CAVITUNER

Complete with 6 AF4, 6BZ7 and IN82



4.95

Tunes all UHF channels 14-82. Most advanced engineering, three cavities, two used as bandpass pre-selector, one controlling local oscillator. Features frequency stability, uniformly broad bandwidth, high selectivity, low noise, high gain. Completely shielded. Ideal for building convertors, etc. Size 3½" H x 4¾" W x 4⅜" D. Shpg. Wt. 4½ lbs.

TL-26...Lots of 3, ea. **4.45**
Singly, ea. **4.95**

MINIATURE CRYSTAL MICROPHONE

Here's a typical Lafayette special for the experimenter, student or dealer. An extremely sensitive and small crystal microphone used in hearing aids and other small apparatus. Can be used as lapel mike—miniature transmitter mike for concealed locations, etc. Its size and performance gives it joint versatility. Brand new. Size only 1⅜" Diam. x 5/16" deep. Imported to save you money.

MS-108 ..... Net 1.95

BINOCULARS NEVER BEFORE AT THIS PRICE

IMPORTED DIRECT

Prism-Coated Lenses

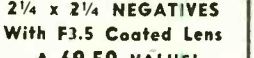
- All-Metal Construction
- Individual Focus
- Leather Case & Straps

F-86 —8X.25 I.F.	Net	17.45
F-105—8X.30 I.F.	Net	18.25
F-15 —7X.35 I.F.	Net	19.95
F-103—7X.50 I.F.	Net	21.95
F-117—10X.35 C.F.	Net	23.95
F-104—12X.50 I.F.	Net	32.50
F-118—16X.50 C.F.	Net	34.95

with order, Add 10% Fed. Tax

30 POWER TELESCOPE

- Weighs only 8 ounces.
- With leather case.
- All metal—chrome trimmed.



Precision machined body. Hard ground, hard coated, achromatic lenses. Sharp, clear, brilliant images. In the same manner as fine binoculars. Brings objects 30 times closer! Smooth, easy sliding focusing. Collapses to 7" — extends to 14½". As always you must be satisfied—or return for immediate refund. Shpg. Wt. 1 lb.

5.95

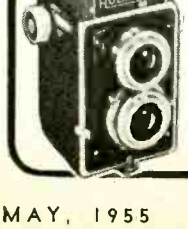
F-59 ..... NET 5.95

DUAL STYLUS — TRIPLE PLAY

11.95

DIAMOND and SAPPHIRE
(LP) (78)
LIST ~~$31.90~~
Replacement for All G.E. RPX-050 Triple-Play Cartridges!
Stock No. PK-29 Net **11.95**

TWIN LENS IMPORTED CAMERAS



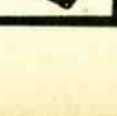
2¼ x 2¼ NEGATIVES
With F3.5 Coated Lens
A 69.50 VALUE!
only at Lafayette
Stock No. F-32 **29.95**
Shpg. Wt. 7 lbs.

- Built-in Flash Synchronization
- Fingertip Focusing
- Sportsfinder
- 9 Speed Shutter 1 to 1/200 Sec.
- Double Exposure Prevention
- Matched Coated Lenses are Coupled in Helical Mount
- Accepts 120 Roll Film

WESTERN ELECTRIC HEARING AID

Brand new, in original Western Electric's jeweler's case. Supplied with receiver, receiver cord, battery cord and plug (less batteries). Money back guarantee. Act now while they last! Uses Burgess XX30E PI and 8B batteries at $1.68 per set.

Reg. Price ~~185.00~~
Our Price **$14.95**



FREE send for it — RADIO CATALOG
GET LAFAYETTE'S NEW CATALOG PACKED WITH THE LARGEST SELECTION OF QUALITY ELECTRONICS EQUIPMENT AT BARGAIN PRICES.

Lafayette Radio — DEPT. JE

NEW YORK, N.Y.	100 Sixth Ave.
BRONX, N.Y.	542 E. Fordham Rd
NEWARK, N.J.	24 Central Ave.
PLAINFIELD, N.J.	139 West 2nd St.
BOSTON, MASS.	110 Federal St.

Include postage with order.

fall. They will be held in key cities on a rotation basis and will consist of displays and illustrated talks.

WANTS NO LICENSE

The Washington (D. C.) Appliance and Radio-TV Dealers Association has stated, in a notice to the administrator of the District of Columbia licensing division, it opposes licensing for TV or radio service dealers or technicians.

The association believes licensing will benefit neither the trade nor consumers. It is now working with the Better Business Bureau and the Electric Institute of Washington on a code of ethics which it is hoped will realize some of the advantages claimed for licensing, without the accompanying drawbacks. The code applies particularly to business methods and stipulates that all advertisements shall contain the firm's name, address and phone number; that there be no quotation of service charges in ads and no reference to "home repairs only" unless the firm is prepared to make all repairs in the home.

SYRACUSE EDUCATES

Members of the Syracuse (N. Y.) Television Technicians Association supply all their customers with a folder showing on one side a number of conditions which the customer can improve by adjustment plus some which require a service technician. On the other side is a short statement headed "Quality Television Service Cannot Be Bought at Bargain Prices" and giving facts about the association and its guarantee. The guarantee carries on its back a copy of the 16-point TTA Code of Ethics. Customers are asked to report all irregularities directly to the member involved and, if satisfaction is not forthcoming, directly to the association office.

The above was brought out in a letter written by Dr. Persia Campbell, special aid on consumers' problems to the Governor of New York, in connection with the New York State investigation into sales and service malpractices. The association requested representation at the proposed Governor's Conference on the subject.

NEW OFFICERS

San Antonio Radio and Television Association, Inc. elected the following officers for 1955: Thomas F. Boyd, president; Esteban Z. Viera, vice president; H. M. Willman, secretary; Wilbur L. Lehmberg, treasurer; Paul W. Carter and Porfirio Zepeda, directors. The association is pushing its TV clinic actively, and color TV clinics are being included.

TWO JAILED FOR FRAUD

A Brooklyn couple have been sentenced to 6 months in prison for fraudulent practices in their television repair work.

The pair were charged with billing customers for labor and parts not furnished; giving bonuses to employes for removing sets from customers' homes, and instructing repairmen to charge for a minimum of three components, whether or not they were needed. It was also suggested that they had installed poor-quality tubes for which new-tube prices were charged and sabotaged sets that needed no major repair work.

Defense counsel made a plea for leniency on the ground that both defendants were ill. The husband long confined to a wheelchair, was said to be suffering from diabetes, tuberculosis and partial paralysis, while his wife has a heart condition and partial paralysis. The judge pointed out, however, that they were not too ill to break the law and were able to carry on their business. A probation report brought out that they had continued under another name and had allegedly grossed $100,000 since their arrest last October. Under such circumstances, according to Assistant District Attorney Davidson, anything short of a jail sentence would constitute a license to continue in this "despicable abuse."

Two employes of the firm, originally named as co-defendants, were acquitted in a separate trial.

SHOOTS SET—AND SELF

Another case of taking a gun to a TV set is reported from San Rafael, Calif. This incident has the unique quirk that the shooter then turned the gun on himself.

According to his wife, Jewell, the viewer, William W. Cook, a railroad brakeman, was watching the set when it began doing a series of flopovers. Possibly overcome by "flicker effect," he picked up a gun and fired into the set. His wife fled to a neighbor. As she did, she heard a second shot. When deputies arrived, they found Cook on the floor with a bullet in his head.

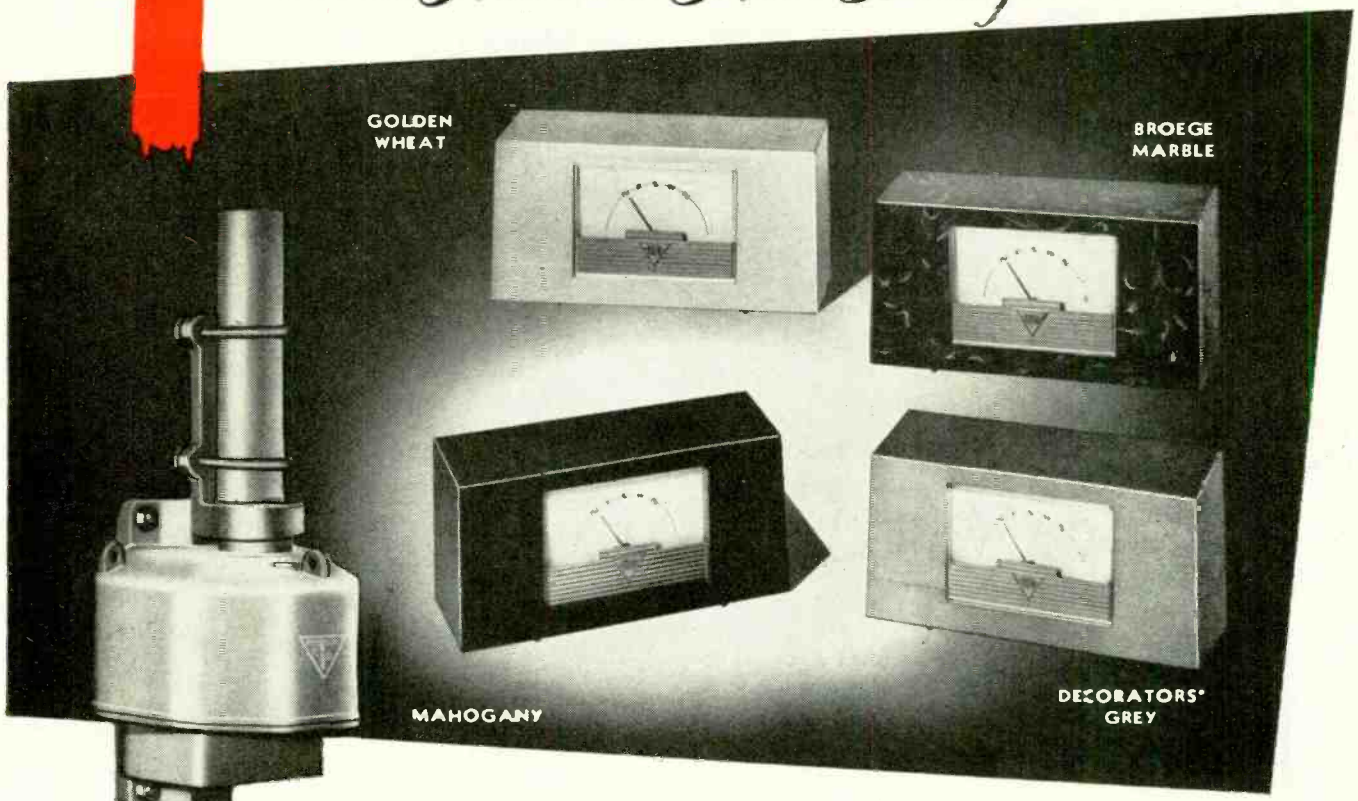
EMBLEM VALUABLE

The effect of the association emblem on service customers in Pittsburgh is so decisive that the Radio and Television Servicemen's Association of Pittsburgh has found it necessary to take steps to protect its use. The board of directors reports that arrangements have been made to remove the emblem from the shops of persons who are no longer participating members, and also to remove a number of decals known to have been obtained through unauthorized sources.

Steps have been taken to have the RTSA emblem registered. Binding legal forms are being drawn up, to be signed by all members. These provide for the association's retention of the title to all forms of the emblem used by members and for its convenient removal from windows, rubber stamps and letterheads—and for the turning in of membership cards and buttons—of those who cease to be members of the association. END

America's Most Dependable Rotator

NOW *America's Most Beautiful* .....



control cases available in four glorious colors...

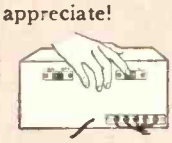
TRIO, manufacturer of the "Aristocrat", has set the pace in the design of a rotator control unit as beautiful as it is functional. Its sleek, unbroken lines are unmarred by switches or knobs and only the handsome, lighted dial identifies it as a rotator control unit.

A new TRIO plan enables the dealer to carry a complete line of the various colored cases without substantially increasing inventory costs. Thus the home-maker has choice of colors, even as late as the time of installation, because it takes only a moment to change the "works" from one case to another.

FACTORY ATTACHED AND TESTED CABLE

Every TRIO rotator is now supplied with either 65' or 90' control cable factory attached and ready for easier, faster installation. Each unit is bench-tested with its control cable, thus assuring trouble-free performance. These are features that servicemen like and appreciate!

Switch and directional control are located at top rear of case for handy finger-tip operation.



THE TRIO "ARISTOCRAT" ...CULMINATION OF SIX YEARS RESEARCH AND PRODUCTION

- Only rotator with 2 year warranty.
- Only rotator with control cases available in four glorious colors.

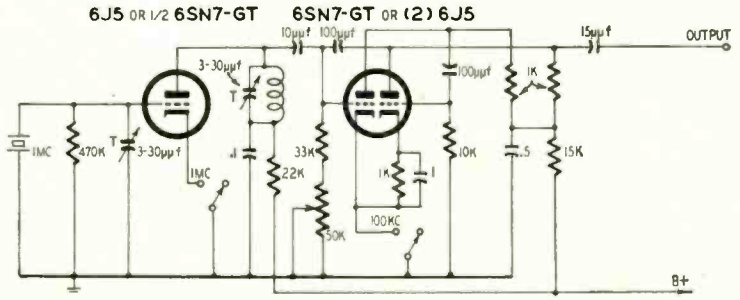
TRIO Manufacturing Co.
GRIGGSVILLE, ILLINOIS

Write FOR ILLUSTRATED, FOUR COLOR BROCHURE

radio-electronic Circuits

CRYSTAL CALIBRATOR

Dial calibration and frequency stability of many communications receivers are not as good as they must be for some applications so some of the better sets have built-in crystal calibrators. Amateur operating regulations of most countries specify that the licensee shall provide a suitable means of measuring the output frequency of the transmitter with sufficient accuracy to avoid out-of-the-band operation. Since most hams do not possess reliable frequency meters, the use of a crystal calibrator with a receiver is a simple and economical way to meet the regulations.



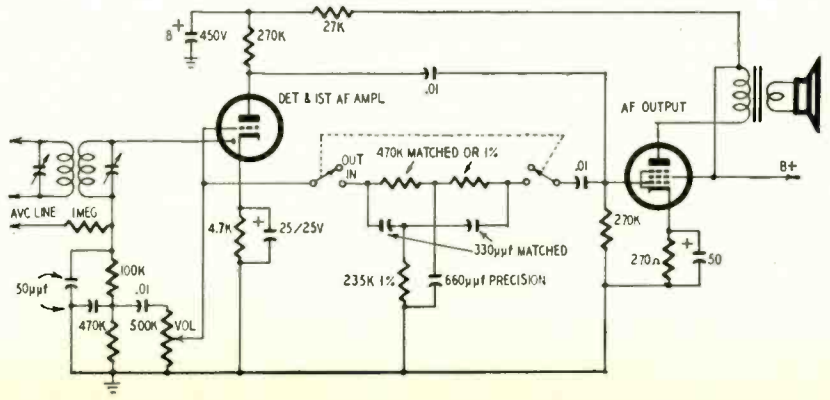
The diagram shows a crystal calibrator described by G3AHO in *The Short Wave Magazine* (London, England). The first stage is a 1-mc crystal-controlled oscillator and the second is a 100-kc multivibrator. Closing the switch in the oscillator cathode circuit produces marker beats 1 mc apart. Closing both switches produces markers that are exactly 100 kc apart.

The coil in the oscillator circuit may be the secondary of a broadcast antenna or r.f. transformer. To calibrate the unit, loose-couple the output lead to the receiver's antenna post, turn on the b.f.o., tune in WWV or any standard frequency transmission and adjust the trimmers in the oscillator grid and plate circuits for zero beat. Next, throw the switch in the multivibrator cathode circuit and adjust the 50,000-ohm control for *nine* markers between the 1-mc points on the receiver's main tuning dial.

This calibrator can be powered by a simple supply delivering 100 volts or so at about 20 ma. Connect its output lead to the receiver's antenna post or wrap it around the lead-in. You can install it in the cabinet of the set and operate it from the same power supply. Shielding may be required to prevent the calibrator's signal from overloading the set.

AUDIO PEAKING FOR CW

Amateurs having inexpensive communications receivers with poor selectivity can greatly improve CW reception by installing in their receivers a tuned audio circuit such as described in *The Short Wave Magazine* (London, England). The circuit is comparatively easy to install in such receivers as the S-38 (Hallicrafters) and SW-54 (National). The diagram shows a typical communications receiver audio circuit with tuned circuit added.

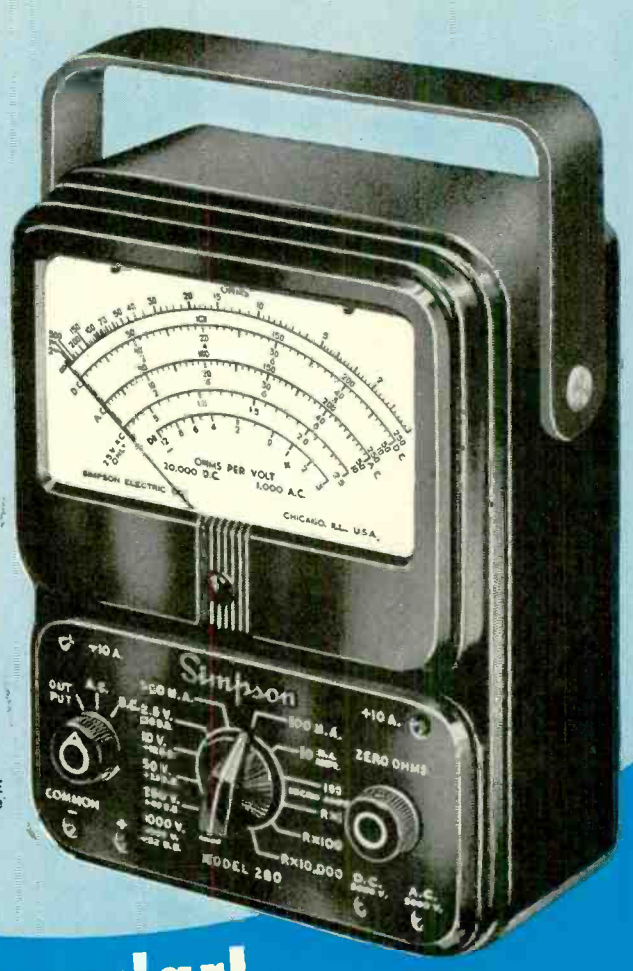


Simpson

MODEL

260

MULTI-TESTER



outsells all others combined!

More technicians are using the Model 260 than any other high-sensitivity VOM. Over half a million Model 260's have been sold to date! 20,000 Ohms per volt. You'll find it wherever quick, accurate, electrical checks are needed. It's so handy, so dependable, so sensibly priced. Ask your jobber to show you the Simpson Model 260. Only **$38.95,** including Adjust-A-Vue Handle. Carrying cases from **$6.75.**

world's most popular!

MODEL

262

the new vom with a 7" meter

20,000 Ohms per volt DC. 5,000 Ohms per volt AC. 33 RANGES

DC VOLTAGE: 0-1.6, 0-8, 0-40, 0-160, 0-400, 0-1600, 0-4000 volts (20,000 ohms per volt sensitivity)
AC VOLTAGE: 0-3, 0-8, 0-40, 0-160, 0-800 volts (5,000 ohms per volt sensitivity)
AF OUTPUT VOLTAGE: 0-3, 0-8, 0-40, 0-160 volts (0.1 microfarad internal series capacitor)
VOLUME LEVEL IN DECIBELS: −12 to +45.5 DB in 4 ranges. Zero DB Power Level, .001 watt in 600 ohms.
DC RESISTANCE: 0-500 ohms (4.5 ohms center); 0-5,000 ohms (45 ohms center); 0-50,000 ohms (450 ohms center); 0-500,000 ohms (4,500 ohms center); 0-5 megohms (45,000 ohms center); 0-50 megohms (450,000 ohms center)
DC CURRENT: 0-80, 0-160 microamperes, 0-1.6, 0-16, 0-160 milliamperes, 0-1.6, 0-16 amperes (267 millivolts maximum drop)
MODEL 262 complete with 2 test leads with removable alligator clips, 4,000 v. DC multiplier
Dealer's Net Price, including Adjust-A-Vue Handle. .**$59.50** Carrying Case. .**$9.95**
Accessory High Voltage Probe for 16,000 volts DC. .**$11.50,** 40,000 volts DC. .**$12.50**

Deluxe!

SEE THEM AT YOUR JOBBER, OR WRITE . . .

Simpson ELECTRIC COMPANY

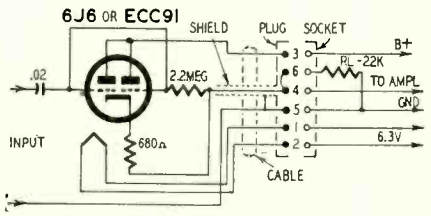
WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

5203 W. Kinzie St., Chicago 44, Illinois, Phone: EStebrook 9-1121
In Canada: Bach-Simpson, Ltd., London, Ontario

The resonant circuit consists of a parallel-T network connected in a negative-feedback loop between the input and output of the first a.f. amplifier. The voltage at the output of a parallel-T is infinitesimally small at its resonant frequency so feedback is very low at resonance and high at other frequencies. Thus, the amplifier gain is maximum at resonance and falls off sharply on each side. The switch should be a low-loss d.p.s.t. type mounted in a convenient spot on the chassis or cabinet.

CATHODE-FOLLOWER PROBE

In some instances the input impedance of a scope, wideband instrument amplifier or other device is not high enough to permit direct connection to some circuits under test. The input impedance of these instruments can be increased by raising the input grid resistance. This method has definite limits



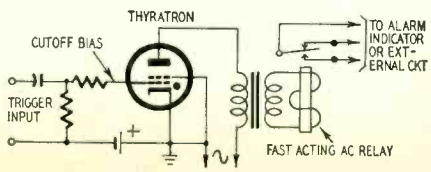
and when it is used is likely to decrease the high-frequency response of the instrument. The logical solution is to use a cathode follower—with its inherent high input impedance—between the driving circuit or circuit under test and the scope or amplifier.

The illustration shows the diagram of a cathode-follower probe that was described in *Wireless World* (London, England). The tube, a 6J6 or ECC91, is powered by the test instrument with which it is used. The connector—the socket is mounted on the parent instrument—is wired so the cathode follower's load resistor R_L does not shunt the input of the scope or amplifier when the probe is not in use and so its value may be varied to suit the various instruments that may be used with the probe.

Because the plate of the tube is at ground potential for a.c., there is no need to shield the probe against stray fields. But the outside of the case should be carefully insulated to avoid shocks and inadvertent grounding when working in close quarters.

QUICK-ACTING RELAY

When the relay in a capacitance or photoelectric controlled device is actuated by current flow in a thyratron, we generally use an a.c. supply on the tube with a d.c. relay in its plate circuit. A fairly large capacitor is usually re-



quired across the relay coil to prevent chattering. This capacitor increases the release time of the relay and prevents the device from responding to triggers or signals with relatively high repetition rates.

To provide fast action from a thyratron-controlled relay, H. D. Irvin of Enka, N. C., has developed a circuit using transformer coupling between the control tube and the relay to speed up its action. The circuit (see diagram) is described in patent No. 2,695,378.

The thyratron is normally biased to cutoff by a battery between grid and cathode. High-frequency a.c. signals or short-duration trigger pulses are fed into the input. The plate of the tube operates from an a.c. supply.

When the plate swings sufficiently positive, the positive signal pulses or the positive half-cycles of an a.c. control signal cause plate current to flow in the transformer primary. The unidirectional pulses in the primary produce nearly sinusoidal a.c. in the secondary. The relay is an a.c. type so its response to the on and off portions of the trigger signal is more rapid than that of a d.c. type where the release time is governed by the time constant formed by the coil resistance and the filter capacitor across it.

VIBRATOR CHECKER

Vibrators and transformers for 2-volt operation are not readily available so I have modified 6-volt units for use in radios, electronic photoflash units and similar portable equipment using 2-volt batteries. Fig. 1 shows a test circuit that I use to simplify adjustments of contact spacing and alignment in modified vibrators. This provides a rapid visual check with high accuracy. A switch is provided in this circuit so that the primary and secondary contacts can be checked separately.

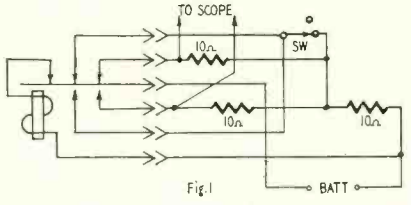


Fig. 1

The trace at *a* in Fig. 2 is typical of that obtained with the switch open to

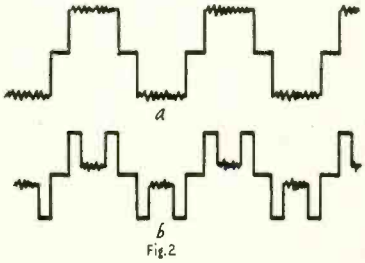


Fig. 2

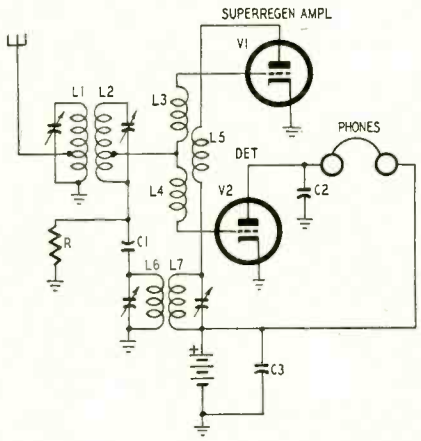
check the primary contacts. A trace like that at *b* is obtained with the switch closed to check the secondary contacts.
—*Alberto Raul Insua*

SUPERREGENERATIVE AMPLIFIER-DETECTOR

Superregenerative amplifiers and dedectors are seldom used because of their poor selectivity and sensitivity and because they radiate an interference signal that can be received over a wide area. In some instances, the signal radiated by a superregenerative amplifier or detector is strong enough to prevent others from receiving the desired signal. When tuned to airways, police, fire, or emergency bands, the average superregenerative set can cause interference that endangers life, health and property.

Coleman J. Miller of Catonsville, Md., has been assigned patent No. 2,686,258 covering a new superrengenerative receiver (see diagram) that features superior sensitivity and selectivity with a minimum of radiation.

L1 and L2 are inductively coupled to form an antenna transformer with tuned primary and secondary. The antenna and grid connections are tapped



down on the windings to minimize circuit loading and to insure high selectivity. L6 and L7 are windings on the interruption (quench or squelch) transformer. Both windings are tuned to the quench frequency. The grids of the amplifier and detector are biased by the voltage developed across R. C1 prevents the grid bias from being shorted out by L6.

L3 and L4 are the amplifier and detector grid coils, respectively, with feedback coil L5 closely coupled so it feeds energy from the amplifier plate to the grids of both tubes. The grids of V1 and V2 are fed in push-pull as far as the amplifier plate signal is concerned. When the grid circuits are balanced, the junction of L3 and L4 is at zero r.f. potential and there is no signal to be radiated via the antenna. Signals from the antenna are fed to the amplifier grid through L3.

The amplified signal appearing at the plate of the amplifier is coupled through L5-L4 to the detector grid. The audio signal appears in the plate circuit of the detector. Phones may be used for reception or the output may be amplified. END

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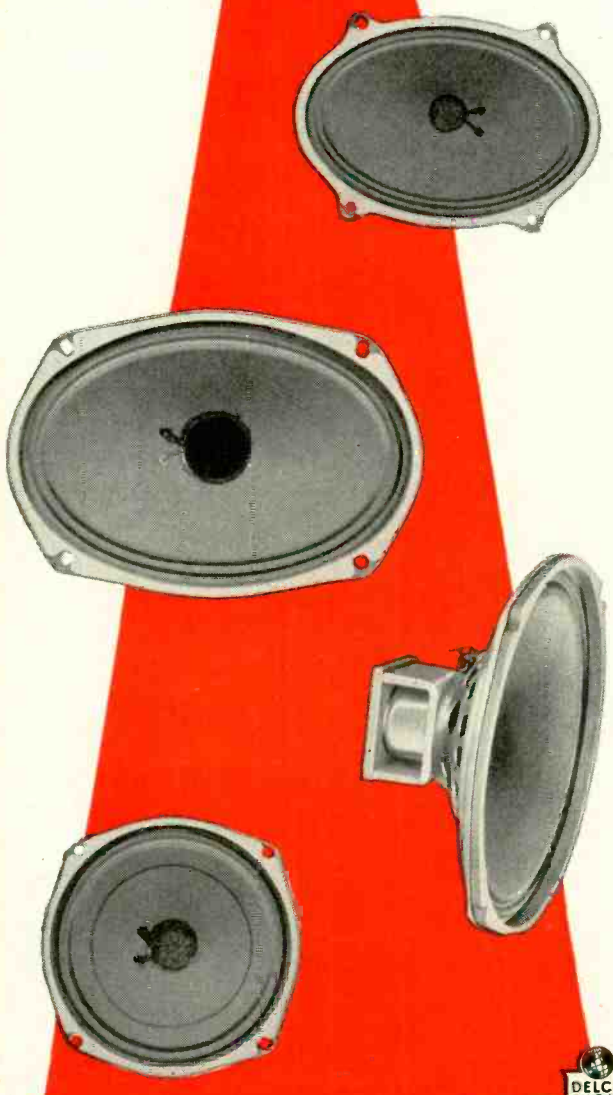
SPEAKERS



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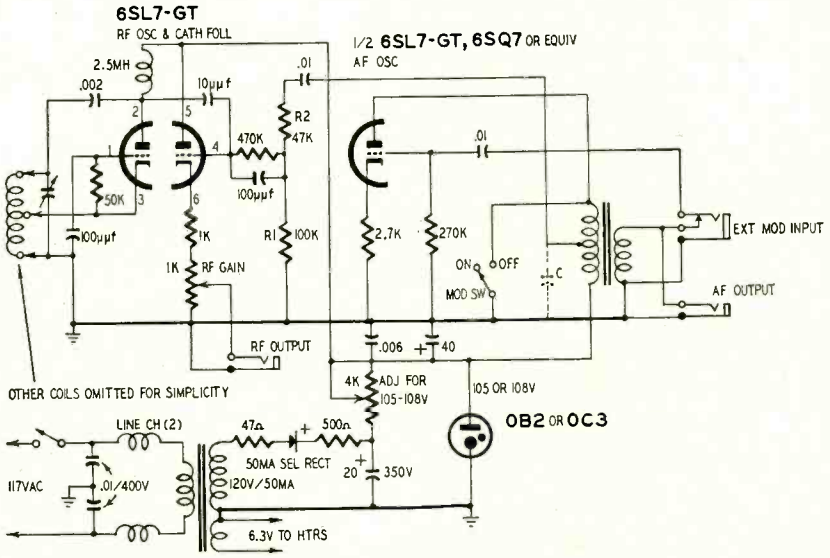
Question ? Box

MODERNIZING OLD SIGNAL GENERATOR

I have a Clough Brengle model OC signal generator that I want to modernize, using as many of the original parts as practical. I haven't much room for a power transformer so I'd like to use selenium rectifiers in a voltage-doubler circuit with a voltage regulator to stabilize the circuit. The r.f. chokes in the line are probably too small. Please suggest a larger size.—E. A. J., Bayonne, N. J.

The diagram shows the circuit of a modified version of the OC. The original circuit used a 36 pentode oscillator and a pair of 37's as the a.f. oscillator and line-voltage rectifier. The new circuit uses half of a 6SL7-GT as a triode grounded-grid Hartley oscillator with the other half of the tube being used as a cathode follower and modulator.

The a.f. oscillator is half of a 6SL7-GT, a 6SQ7 or a similar high-mu triode. Select a value for capacitor C that will give an audio note of 400 to 800 cycles. Begin with a value of around .005 μf.



Adjust modulation percentage to about 30% by varying the value of R2. If the modulation is still too high, substitute three series-connected 33,000-ohm resistors for R1 and connect R2 to the tap that gives the desired modulation level.

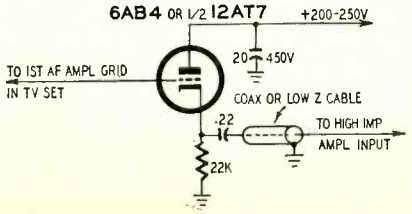
A transformer type power supply is used to provide the isolation that is recommended for all test instruments of this type. By eliminating the type 37 rectifier you will have room for a Merit type P-3045 or similar power transformer. The original line filter chokes are probably adequate since the power drain is about the same as in the original unit.

An a.f. output jack has been added to provide a convenient signal source for audio signal tracing.

CATHODE FOLLOWER FOR TV

My TV set is a series 108 Magnavox. I've tried feeding the output from the volume control to a Brook 12A4 amplifier but the highs are lost in the cable. Can I convert the 6W6-GT to a cathode follower or replace it with a suitable tube for this purpose?—R. A. B., East Orange, N. J.

The 6W6-GT audio output tube is in series with the 130–135-volt line supplying other vital circuits in the receiver so its circuit arrangement should not be disturbed. You can no doubt find ample space for mounting an extra tube socket for a 6AB4 or 12AT7 cathode follower connected as shown. Connect the cathode follower grid directly to the grid of the first a.f. amplifier and replace the speaker voice coil with a 5-ohm 10-watt resistor. You can now use coax or low-capacitance audio cable to feed the high-impedance input of the amplifier.



SCOPE SWEEP REVERSAL

Please print a diagram showing the connections for installing a sweep-reversal switch in a Heathkit model 0-9 scope.—L. T., Philadelphia, Penna.

The horizontal deflection plates in the scope are driven in push-pull so the direction of the sweep can be reversed by reversing the phase of the signals

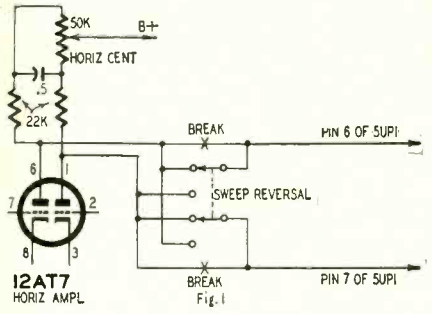


Fig. 1

fed to them. Fig. 1 shows the reversing switch connected between the plates of the 12AT7 horizontal amplifier and the deflection plates of the 5UP1. You can mount the switch so it can be reached

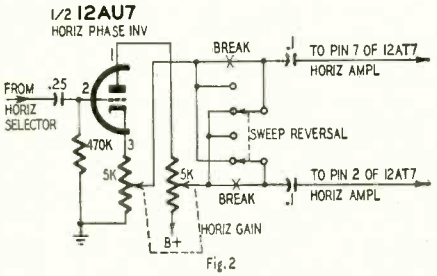


Fig. 2

through the access door in the rear of the cabinet or you can mount a rotary type switch near the rear terminal board and couple it to the front panel with a flexible shaft.

Fig. 2 shows the switch connected between the grids of the push-pull horizontal amplifier and the 180° out-of-phase outputs of the 12AU7 phase inverter. This method of making the connection is probably the most convenient because the switch can be mounted near the horizontal gain control.

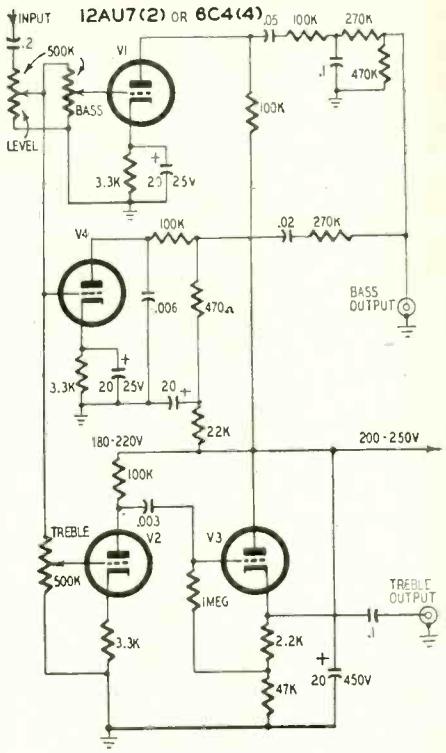
ELECTRONIC CROSSOVER

I have two amplifiers that I want to use with a 2-way speaker system. One will drive the woofer and the other will feed a tweeter. Please show a cross-over network and coupler that I can use between the preamplifier-equalizer and the amplifier inputs.—B. F., White Plains, N. Y.

You can use this circuit adapted from a Capehart-Farnsworth 400-G.

Operating voltage can be taken from the supply of one of the amplifiers. Bass amplifier V1 is relatively flat but the highs are removed with a low-pass filter in its output circuit. Treble amplifier V2 and cathode follower V3 handle the frequencies in the upper register. V4 may or may not be needed. It supplies a small amount of gain at the crossover frequency to prevent a dip in response at this point.

The response of the high-frequency amplifier can be restricted to the high



end by reducing the coupling capacitors to around .001 to .006 μf and entirely removing or greatly reducing the values of cathode bypass capacitors.

TUNING SPEAKER ENCLOSURE

I have just completed a bass-reflex speaker enclosure and would like to have directions for tuning it to match the speaker. How do I go about it and what equipment will I need?—H. A. N., Maplewood, N. J.

A bass-reflex enclosure is tuned by varying the area of the port. You need a v.t.v.m. or audio output meter and a variable-frequency audio generator.

Cut a piece of plywood a few inches wider and longer than the port. Remove the speaker from the enclosure and connect a resistor of 100–1,500 ohms in series with the voice coil. Take the speaker outdoors or point it upward out of an open window. Connect the voltmeter across the voice coil and feed the speaker either directly or through an amplifier. Keeping the generator output constant, slowly increase the frequency between 20 and 200 cycles while watching the meter for a sharp peak. This peak is the resonant frequency of the speaker.

Reinstall the speaker in the cabinet, close the port about halfway and repeat the frequency run. Be sure to keep the generator's output constant. The meter will now show two peaks—one higher and one lower than the speaker's free-air resonance point. If the peaks are unequal, move the plywood panel to vary the port area until the peaks have equal amplitude, then lock it in place. END

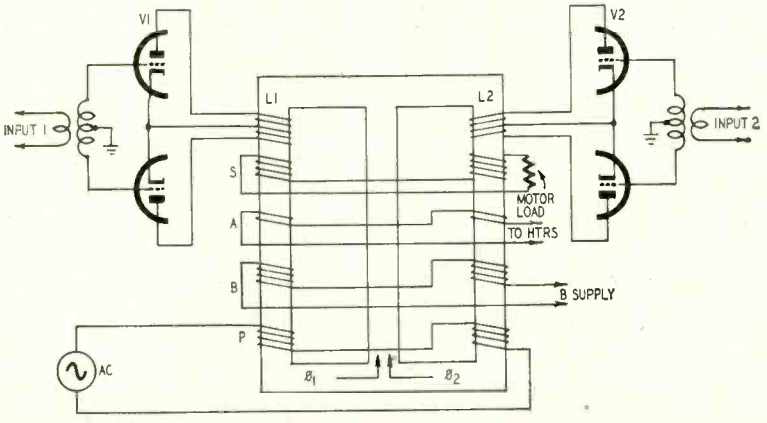
Patents

MOTOR CONTROL TRANSFORMER

Patent No. 2,686,292

F. Sutherland Macklem, Freeport, N.Y. (Assigned to Servo Corp. of America)

This transformer controls the speed and direction of a motor and also supplies a.c. to a power supply. There are five windings on each outer leg of the core (see diagram). They are P, primary; S, secondary; A and B, low- and high-voltage coils; L1 and L2, control windings. The primary current produces flux loops φ1 and φ2 through the core. The secondary, made up of two opposing windings, is energized by the *difference* in flux loops. Normally φ1 equals φ2, so the motor receives no power.



Control tubes V1, V2 are energized by coils L1, L2, respectively. These windings have opposite directions so the tubes are energized differentially. For example when the *upper* end of L1 goes positive, so does the *lower* end of L2. Therefore during such a half-wave, the upper triode of V1 and the lower triode of V2 conduct. In the absence of a signal to the tubes, their conductivity is equal. Thus equal currents flow through one half of each control winding. Since the effect of each flux loop is equal, φ1 remains equal to φ2 and the motor does not rotate.

When a differential signal is applied to the tubes, one passes more current and the other passes less. One flux loop becomes stronger than the other, so power is fed to the motor to drive it in a given direction. If the signal polarity is changed, the motor reverses.

The sum of flux loops φ1 and φ2 always remains constant, for when one increases the other decreases by the same amount. Therefore A and B always supply constant output to the power supply. These coils are wound in the *same* direction on each leg, so they are energized by the *sum* of the flux loops.

TAPE RECORDING

Patent No. 2,694,111

Michael Rettinger, Encino, and Kurt Singer, N. Hollywood, Calif. (Assigned to Radio Corp. of America)

The high-frequency response of a magnetic recording head drops with increased wear. This loss is the result of a decrease in *depth* of the magnetic gap.

It can be minimized by lowering bias current to the head in proportion to wear.

The circuit, not drawn here, is quite complicated. However, its principle is simple. A network is balanced for zero output when a new head is installed in the recorder. As the head becomes worn its inductance drops and increases the d.c. output from the balancing net-

work. The d.c. drives a d.c. amplifier toward lower conduction. Since this tube is in series with the bias oscillator and its B plus supply, there is progressive lowering of bias current with increased wear of the head.

MINIATURE DRY CELL

Patent No. 2,689,877

Leland G. Briggs, Blooming Grove, Wis. (Assigned to Ray-O-Vac Co., Madison, Wis.)

This cell does not have a center carbon pole as in a conventional dry cell. Easy to manufacture, the design permits stacking of multiple cells and protects against leakage.

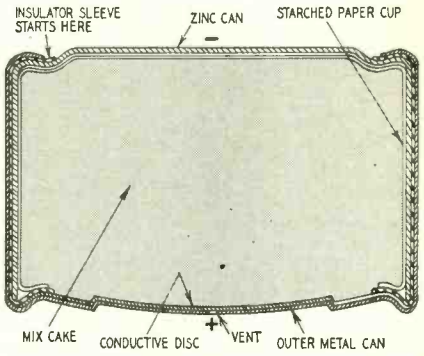


Fig. 1

The cell (Fig. 1) is made of two metallic cups, an upper zinc can and an outer can made of steel plated with nickel or tin. The first is the negative electrode, the second positive. They fit snugly into each other and are separated by a plastic sleeve. A starched paper cup inside these cans holds the mix cake containing ammonium chloride and zinc chloride plus a polarizer. A vent is at the bottom.

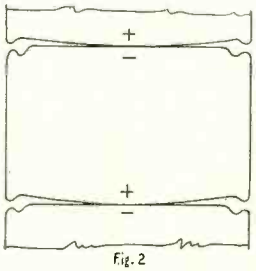


Fig. 2

A conductive disc made of carbon or graphite material seals the cell against liquids but passes hydrogen gas generated within the cell. The cells are shaped for easy stacking (Fig. 2).

ELECTROSTATIC AMPLIFIER

Patent No. 2,696,530

Quentin A. Kerns, Berkeley, Calif. (Assigned to the United States of America as represented by the Atomic Energy Commission)

This amplifier is smaller and simpler than other types. In addition, it consumes no control power and requires no extra parts. The control elements are special capacitors (C1 and C2) that substitute for ordinary types in a tank circuit. In these capacitors the dielectric is titanate, which has a very high dielectric constant which varies with the d.c. impressed across the capacitors.

Fig. 1 is a simple circuit illustrating this patent. The L-C tank is tuned to resonance with the r.f. supply. Therefore maximum rectified

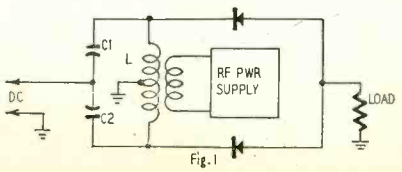


Fig. 1

current flows into the load, while the d.c. input is zero.

Now when d.c. is applied across C1 and C2 their capacitance changes. The tank goes off resonance and the load current drops in proportion to the d.c. signal that is fed across each capacitor.

For a more sensitive circuit, the titanate

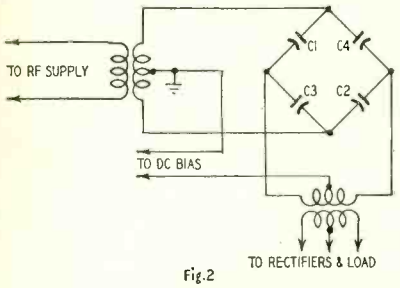


Fig.2

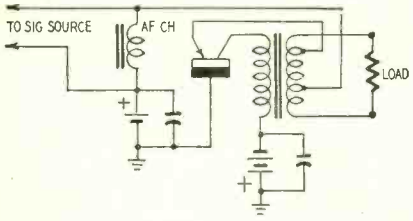
capacitors (C1 and C2) are used as opposite arms of a *bridge* network (Fig. 2). C3 and C4 are conventional fixed-value capacitors. Balance is obtained with some predetermined value of d.c. bias. If the bias is changed slightly in one direction or the other, the bridge null is disturbed and may be measured. The d.c. bias must be carefully controlled because of the great effect it has on the dielectric constant of the capacitors.

TRANSISTOR AMPLIFIER FOR LOW DISTORTION

Patent No. 2,691,077

Leslie L. Koros, Camden, N.J. (Assigned to Radio Corp. of America)

An emitter-driven transistor has a very low input impedance—usually only a few hundred ohms—that varies with signal. When more drive is applied, the transistor's conduction increases and its impedance (as seen looking into the emitter) drops still lower. This variation causes considerable distortion, especially in a power



amplifier.

Negative feedback, as shown in the diagram, can reduce distortion from 25% or more to only a few percent. Note that the load is placed across the secondary winding. The tapped portion of this coil is in series with the emitter. Consequently the emitter impedance is now only a fraction of the total input impedance. Any variations in the emitter impedance tend to be masked out.

Assume that a more positive signal is applied. The transistor passes more current and its collector goes more positive. Power is inducted into the secondary which is phased to *oppose* the original signal voltage. This, of course, is negative feedback. END

Suggested by John Keller, Martinsburg, Pa.

"He's an auto radio service technician. No one can get him out!"

try This one

PHONO JACK FOR TV SETS

The audio systems of many TV sets are easily adapted for use as amplifiers for record players. Fig. 1 shows the circuit arrangement usually found at the input to the first a.f. amplifier and Fig. 2 shows the circuit with a phono-TV switch and phono input jack added. The jack and switch may be Crosley

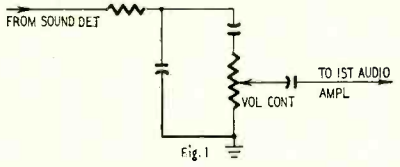


Fig. 1

part Nos. 136998 and 148260 or equivalents, respectively. They may be mounted on a small metal plate or chassis fastened in a convenient spot on the rear of the cabinet. The leads from the sound detector and volume control to the switch should be shielded to minimize hum pickup. Consult the cartridge manufacturer in cases where the pickup load impedance is important.

Connecting a record player to a set that has one side of the a.c. line tied

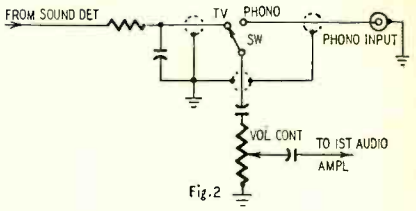


Fig. 2

to the chassis is not recommended. —*Crosley Service Department*

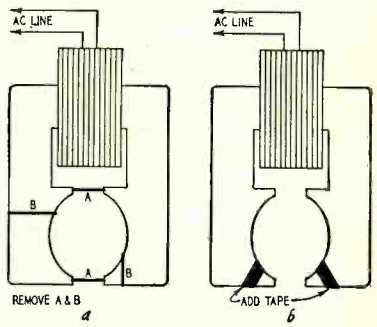
(If a crystal cartridge is connected directly to the TV set, it is advisable to install a simple equalization network in the phono input circuit. A suitable equalizer can be made as follows: Connect a 220,000-ohm resistor from the PHONO terminal of the switch to ground. Connect a 2.2-megohm resistor and 62-$\mu\mu$f capacitor in parallel and connect this network between the phono input jack and the PHONO terminal of the switch.—*Editor*)

INEXPENSIVE DEMAGNETIZER

A small a.c. electromagnet is nice to have around the shop. Not only is it handy for picking up—and letting go of—the box of assorted nuts and bolts that is forever being dropped, but in my case I use it to demagnetize the heads of a tape recorder. For best results these heads should be demagnetized every few weeks or months, depending on frequency of use.

The field of an inexpensive two-pole shaded-pole phonograph motor, with slight alterations, makes a small but effective electromagnet. Many a junk-box will yield such a motor. There are also a substantial number kicking around in cellars, attics, and second-hand stores.

The drawing at *a* represents the field of a small phono motor with the armature removed. Parts A and B are removed with a hacksaw. A is a metal bar which serves as a magnetic link for the motor and B is a heavy copper wire used as a short-circuiting ring. Tape is then wound around the ends of the motor core to keep the lamina-



tions from rattling. The final result is shown at *b*. No switch is included because the electromagnet is intended for brief periods of use.—*H. Burstein*

REPAIRING PLASTIC DIALS

I accidentally dropped a large blob of molten solder on the face of the meter of my v.t.v.m. It left a deep indentation that blurred about 20% of the dial scale. I had a choice of replacing the meter face or repolishing the old one. I chose the latter course and the results were entirely satisfactory.

First I sanded the surface with the finest sandpaper I could find (automotive wet-and-dry No. 400—equivalent to 10/0), sanding in a straight line, not a circular motion. When the surface was perfectly smooth, it was still as cloudy as ground glass. The next step was to apply ordinary silver polish with a soft cloth and to rub in a straight line at right angles to the direction used in sanding. The

whole operation took about 5 minutes and the meter face is as good as new. —*R. D. Verson*

SYRINGE AS SERVICE TOOL

The usual injectors for forcing cleaning chemicals into volume controls and tuners are very inefficient. They are too small to handle, hold too little fluid and do not exert enough pressure to force the fluid into crevices where it is needed most.

A much more efficient tool for the job is a veterinarian's syringe (Sears Roebuck, Wards and other mail-order houses sell them). It is quicker, easier to use and does a more efficient job. With it I can flush service chemicals into controls and eliminate noise that would normally make replacement necessary if the same thing were tried with the smaller chemical injector.

Use the finest needle available for the syringe because some of the openings in controls are very small.—*Joseph Amorose*

COLORED CRAYONS

I find it convenient to keep an assortment of colored wax crayons on the bench to code circuit terminals when i.f. or r.f. transformers have to be pulled. Touching the crayon to the hot terminal from which the lead has been unsoldered is all that is necessary.—*Robert E. Riddle*

RECORD-CHANGER HINT

When repairing a record changer, try slipping a tight-fitting rubber grommet over the center post. It will keep the turntable from falling off when the changer is turned over.—*Duval Fagala*

HASTENING TV SET WARMUP

Many times in TV servicing the complaint is that the set cuts off or sound or picture are intermittent after a warmup of a half hour or so. In the majority of these cases tubes are at fault. To save valuable time, hasten warmup by placing empty tube cartons over the suspected tubes. This will hold in the heat and will cut down a half-hour wait to five minutes.—*Charles Garrett*

CONSTRUCTION KINK

The two basic elements of many circuits are a rotary switch and a tube socket. A wafer type tube socket (octal) can be substituted for one section of a rotary switch, making a complete switch and tube unit easily mountable on front panel or chassis.

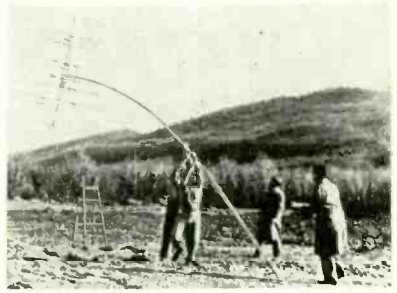
When a miniature tube is used, remove the rotor of one switch section and solder the tube socket lugs to the switch contacts. Switch contacts not in line with the tube socket lugs can be used as tie points.

This type of assembly is particularly useful where short leads and rigid mounting are required. This application is especially useful in high-frequency circuits.—*K. Bramham* END

Business

Merchandising and Promotion

Channel Master Corp., Ellenville, N. Y., produced a new color motion picture, "Up She Goes," which presents



the latest ideas in antenna installation. It will be shown to service technicians at installation clinics sponsored by Channel Master distributors throughout the country.

Cornell-Dubilier, South Plainfield, N. J., is now packaging its *Cub* capacitors in a compartment type, plastic, hinged-cover case which contains an assortment of the 76 most popular types.

Littelfuse, Inc., Des Plaines, Ill., designed a new display card for its dis-

tributors. The black-and-yellow card is marked on the back for proportional trimming.

Regency Division of I.D.E.A., Inc., Indianapolis, has developed a new counter display card for its *TR-1* transistorized radio.

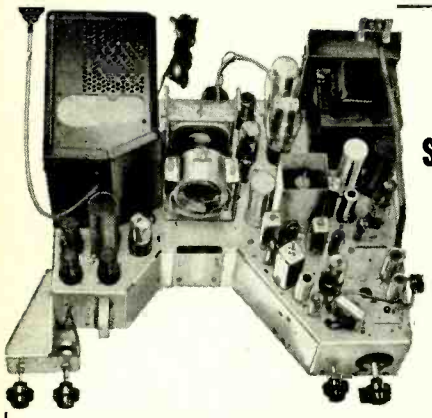
JFD Manufacturing Co., Brooklyn, N. Y., designed a seal commemorating its 25th anniversary which will appear on all advertising and packaging during 1955. The company recently com-

pleted a series of antenna forums in Canada, co-sponsored by local distributors. Si Holzman, JFD field engineer, conducted the meetings.

(*Continued on page* 143)

THE #630 TV RECEIVER remains unmatched for quality and performance • • • RCA designed and developed this set quality-wise *not* price-wise • • • The original 10" set retailed at $375.00 • • • Subsequent TV sets serve to prove the sacrifice of quality for price • • • what better proof can there be of its superiority than the fact that it is the choice of TV engineers and TV technicians! Herewith we offer you—YOUR BEST BUYS IN TV!—All you pay is the price shown • • • Excise taxes have already been paid by us.

SPECIAL for SCHOOLS and STUDENTS #630 STANDARD TV KIT Complete Set of Parts & Tubes (less Crt & wire) $79.41



Build your own

Super DeLuxe 31-TUBE #630 TV CHASSIS

#630 SUPER DE LUXE 31-TUBE TV KIT

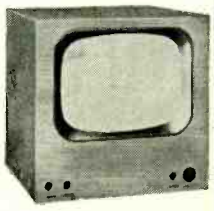
Engineered in strict adherence to the genuine RCA #630 plus added features • • • OPERATES 16" to 24" PICTURE TUBES • • • CASCODE TUNER • • • COSINE YOKE • • • LARGER POWER TRANSFORMER • • • KEYED AGC • • • 12" SPEAKER • • • CONDENSERS and RESISTORS at rated capacities and tolerances. You receive a COMPLETE SET OF PARTS AND TUBES. Everything needed is included, (less CRT and wire.) You will enjoy building it with "LIFE-SIZE easy to follow step-by-step ASSEMBLING INSTRUCTIONS" included with each KIT.

slashed to **$99.99**

CUSTOM-BUILT CABINETS FROM FACTORY TO YOU

3 LEADING STYLES in genuine mahogany or walnut (blond 10% extra) • Ready drilled for any #630 TV chassis and cutout for any 16", 17", 19", 20" or 21" picture tube at no extras in price • Also supplied with undrilled knob panel for any other TV set • EVERYTHING NECESSARY for an easy perfect chassis and CRT assembly is included • Each cabinet is delivered complete as pictured with mask, safety glass, mounting brackets, backboard, backcup, hardware and assembling instructions • Each cabinet is shipped in an air cushioned carton from FACTORY to YOU!

The VOGUE
Most Popular Table Model



H-25", W-26", D-22"

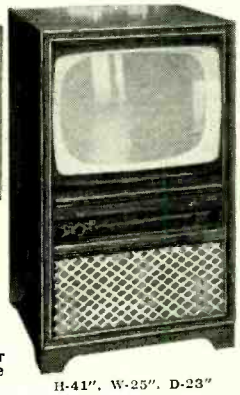
$35.91

VOGUE also available for 24" or 27" picture tube

H-31", W-27" D-23"

$59.54

The MANHATTAN
Style, Quality, Price



H-41", W-25", D-23"

$53.43

MANHATTAN
for 24" or 27" CRT $79.22
H-46", W-30", D-24"

The MAYFAIR
Exclusively modern, with an elegance of simplicity in styling.

H-41", W-26", D-25"

$88.70

Brooks **LIFE-SIZE TV INSTRUCTIONS** for building any #630 TV Receiver..... **$1.25** Postpaid

HINTS FOR BETTER PERFORMANCE on your #630 TV receiver..... **50c** Postpaid

Brooks **CASCODE MANUAL**, how to install Cascode Tuner in any make TV Set. ..... **25c** Postpaid

#630 SUPER DE LUXE TV CHASSIS

LICENSED UNDER RCA PATENTS

COMPLETE READY TO PLUG IN AND PLAY— Similar in characteristics and features to the TV KIT above • Manufactured especially for us by nationally known manufacturers • No efforts or expense have been spared in workmanship or materials, to make this #630 SUPER DE LUXE TV CHASSIS the Best obtainable for fringe areas, clarity and all-around-performance. Customers report reception better than 200 miles. Each set is factory aligned and air-tested • All parts carry the RMA three month guarantee • Our mass volume of business on this CHASSIS (numbering thousands of pleased customers) now makes it possible for us to reduce the price. (less CRT.)

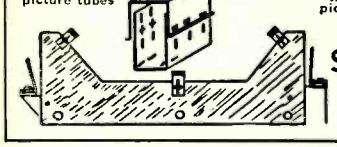
slashed to **$142.27**

We Also Sell The **TECH-MASTER** Complete Line of #630 TV CHASSIS. Catalog mailed on request.

UNIVERSAL Picture Tube MOUNTING BRACKETS

Fits All 12½" to 21" picture tubes

Complete — including band that holds picture tube



$4.97

PULSE KEYED AGC KIT

Finest, most accurate and the easiest Kit to install in a #630 or in any other make TV receiver. Improves performance, and insures a steady picture on all channels.

COMPLETE SET OF PARTS Including 6AU6 tube & Instructions **$2.99**

NATIONALLY KNOWN BRAND PICTURE TUBES

BRAND NEW in Factory Sealed Cartons—With a Full Year Guarantee

17" ±17BP4A **$22.66** | 21" ±21EP4B Aluminized **$32.21** | 24" 90° ±24CP4A Aluminized **$52.99** | 27" 90° ±27EP4A Aluminized **$74.31**

Modernize a #630 or any TV Set with a STANDARD CASCODE TUNER

For better all around performance

Complete with tubes and Brooks CASCODE MANUAL with step-by-step instructions and all extra parts needed. **$17.97**

#630 Parts in COMPLETE SETS

TV WIRE & SOLDER KIT, for any Set		$ .98
630-KIT, screws, nuts, rivets, washers, etc		1.69
TERMINAL STRIP KIT, set of 30		.69
VIDEO AND I.F. KIT, 19 items		4.99
VARIABLE CONTROL KIT, 9 controls		3.97
CARBON RESISTOR KIT, 107 resistors		4.98
WIREWOUND RESISTOR KIT, 4 resistors		1.76
BRACKET AND SHIELD KIT, 18 items		6.44
ELECTROLYTIC CONDENSER KIT, 6 cond		4.96
TUBULAR CONDENSER KIT, 38 condensers		3.63
CERAMIC CONDENSER KIT, 28 condensers		1.98
MICA CONDENSER KIT, 11 condensers		.97
COMPLETE SOCKET KIT, 25 sockets		1.57
COMPLETE SET OF TUBES, 29 tubes		24.64

PARTS For #630 TV SETS

PUNCHED CHASSIS PAN, cadmium plated		$3.96
COMPLETE SET OF KNOBS, incl. decals		.99
POWER TRANSFORMER, 295ma.	201T6	9.16
VERTICAL OUTPUT TRANS.	204T2	2.24
VERTICAL BLOCKING TRANS.	208T2	.98
TV FLYBACK TRANS.	211T5	2.97
TV FLYBACK TRANS, with AGC,	211T5	4.94
FOCUS COIL, 470 ohms,	202D2	2.93
DEFLECTION YOKE, Cosine 70°		3.45
TV 90° DEFLECTION YOKE		5.98
TV FLYBACK TRANS., for 90°		4.42
SYNCHROLOC TRANSFORMER	208T8	.98
FILTER CHOKE, 62 ohms		1.15
WIDTH CONTROL COIL, keyed AGC		.52
ION TRAP BEAM BENDER, single	203D1	.52

FREE WITH THESE PACKAGE DEALS

New Sensational STEEL CABINET, 12x8", 16 Drawers, 48 Sections with every $25 order

10-SIZE HEX. WRENCH WITH EVERY $5 ORDER

Every Assortment contains the most desirable types and sizes to enable you to get most repairs done with the least investment. All items are STANDARD, BRAND NEW and AMERICAN MADE.

100 ASSORTED TUBULAR CONDENSERS All Are Standard Brands & Desirable Sizes — $15.00 Value — Only **$3.69**

100	ASSORTED ½ WATT **RESISTORS**	$2.88
15	Asst. Radio Electrolytic **CONDENSERS**	$3.49
15	Assorted TV Electrolytic **CONDENSERS**	$4.97
100	ASSORTED MICA **CONDENSERS**	$3.72
100	ASSORTED CERAMIC **CONDENSERS**	$3.72
100	ASSORTED 1 WATT **RESISTORS**	$4.62
100	**ASSORTED SOCKETS** Octal, Loctal & Miniature	$2.79
100	**ASSORTED KNOBS** SCREW & PUSH-ON	$2.84
10	**VOLUME CONTROLS** ASSORTED, WITH SWITCH ¼, ½, 1, 2 meg. and others	$2.63

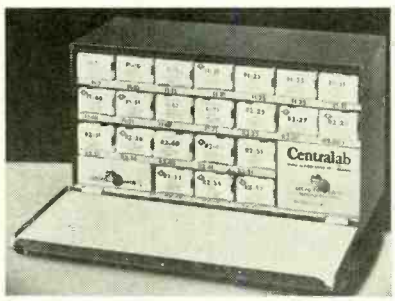
BROOKS RADIO & TV CORP., 84 Vesey St., Dept. A, New York 7, N.Y. TELEPHONE COrtland 7-2359

Belden Manufacturing Co., Chicago,

brought out a new display and stocking assortment for its plastic primary wire.

Winston Electronics, Philadelphia, in cooperation with its distributor, Almo Radio, sponsored two forums on test equipment in Philadelphia and Salisbury, Md.

Centralab, Milwaukee, Wis., is now furnishing its *Fastatch* dual concentric control system units in a handy



metal cabinet which contains a total of 22 of the most popular front and rear units in the line.

Calendar of Events

1955 Electronics Parts Show, May 16–19, Conrad Hilton Hotel, Chicago (closed show for parts distributors and allied personnel).

1955 Electronics Components Conference, May 26–27, Ambassador Hotel, Los Angeles.

Production and Sales

RETMA reported the retail sale of 7,317,034 TV sets and 6,430,743 radios, exclusive of automobile sets, during 1954. TV set sales established a new record. Figures for 1953 were 6,370,571 TV sets and 7,031,293 radios.

RETMA announced that 866,956 TV picture tubes sold by manufacturers during January, 1955, were valued at $17,662,000. This compares with 557,681 tubes worth $12,174,000 sold during January, 1954. The association also reported manufacturers' sales of 37,144,000 receiving tubes in January, 1955, as against 22,133,000 in January, 1954.

Mergers

Elgin National Watch Co., Elgin, Ill., purchased American Microphone Co., Pasadena, Calif. Elgin recently acquired Neomatic Inc., Los Angeles relay manufacturer which now operates as Elgin-Neomatic Inc. American Microphone will become a division of Elgin-Neomatic.

BUSINESS *(Continued)*

Baldwin-Lima-Hamilton Corp. purchased Ruge-de Forest Inc., Cambridge, Mass., electronics manufacturer as another step in its diversification program.

Industrial Hardware Manufacturing Co., New York City, announced plans to acquire Hugh H. Eby Co. and Wirt Co., Philadelphia electronic manufacturing firms.

New London Instrument Co., New London, Conn., purchased the assets of Atlantic Transformer Corp. and American Eastern Electronics Corp. which will be operated as divisions of New London Instrument.

Mack Trucks Inc. began a long-range diversification program with the purchase of White Industries and Radio Sonic Corp., New York manufacturers of electronic products.

American Electronics Inc. merged with Berlant Associates, Los Angeles, and will operate under the name of Berlant Instruments. Bert Berlant is president of the new company.

New Plants and Expansions

RCA established a new Aviation Systems Engineering Laboratory in Waltham, Mass.

Cornell-Dubilier, South Plainfield, N. J., opened a new Los Angeles division plant to serve its West Coast accounts. Paul M. Keufler was named general manager of the plant.

Jerrold Electronics Corp., Philadelphia, moved its executive offices to 23rd and Chestnut Streets, Philadelphia, separating them from the engineering and production facilities with which they were formerly located at 26th and Dickinson Streets.

Business Briefs

. . . **P. R. Mallory & Co.,** Indianapolis, recently produced its 50-millionth vibrator for automobile radios. The first vibrator was marketed by Mallory in 1931. The Vibrator Division is celebrating its 25th anniversary this year.

. . . **RETMA** announced that over 450 prizes have been donated as awards for winners in the radio listening contest for young people, sponsored by the Amateur Radio Activities Section of RETMA and the ARRL, and conducted by *Boy's Life Magazine.* Several books in the Gernsback Library have been donated as prizes.

. . . **Allen B. Du Mont Labs.,** Clifton, N. J., settled the patent suits which it initiated against Tel-O-Tube Corporation of America.

. . . **International Sight and Sound Exposition Inc.,** Chicago, which conducts the High-Fidelity Shows, announced that Kenneth C. Prince, exposition manager, had sold his stock in the corporation to S. I. Neiman, show president, who adds the post of treasurer of the corporation to his other duties. END

OPPORTUNITY ADLETS

Rates—45c per word (including name, address and initials). Minimum ad 10 words. Cash must accompany all ads except those placed by accredited agencies. Discount, 10% for 12 consecutive issues. Misleading or objectionable ads not accepted. Copy for July issue must reach us before May 15, 1955.

Radio-Electronics
25 W. Broadway, New York 7, N. Y.

HIGH-FIDELITY SPEAKERS REPAIRED. Amprite Speaker Service, 70 Vesey St., New York 7, N.Y.

"Buy Surplus Radio, Electronic Equipment direct from Government. List $1.00. Box 169AK, East Htfd 8, Conn."

SPEAKER RECONING: Guaranteed workmanship. C&M Recone Co., 255 Tioga St., Trenton 9, N.J.

TUBES—70% to 90% DISCOUNT. Government, manufacturers, jobbers, etc. surplus. Guaranteed 1 year. Free catalog on request. Cadillac Trading, Dept. AA, 231-07 Linden Blvd., Jamaica 11, N.Y.

GEIGER COUNTER KITS $34.50. Geiger Counter & Scintillator Diagrams Catalog Free. R. F. Chambers, 13833 San Antonio Dr., Norwalk, Calif.

DIAGRAMS FOR REPAIRING RADIOS $1.00. Television $2.00. Give Make, Model. Diagram Service. Box 672-RE, Hartford 1, Conn.

POSITION AVAILABLE. Electronics Engineer. Eng. Degree preferred but not required. Must be familiar with industrial electronics and instrumentation. Majority of time to be spent on product development and application of electronics to various testing devices. Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Michigan.

LETTER YOUR OWN UNIFORMS QUICKLY and Easily. No sewing. Shop name, phone, etc. Free sample, information. Doc's, Box 523, Brownwood, Texas.

F-M TUNER WORKS in your car. Home or in your pocket. $9.95. Also Radio Kits. Ekeradio, 646 N. Fair Oaks Ave., Pasadena, Calif.

HI-FIDELITY BARGAINS: English 7½ and 3¾ IPS TAPE DECK. Push button operation, electronic braking, silent drive with 3 four-pole shaded motors, fast forward and rewind position breaks oscillator circuit, accidental erasure impossible. YOUR COST $59.50. PREAMP WITH CONNECTING HARNESS FOR ABOVE, ONLY $39.75. AUTHORIZED DISTRIBUTORS OF THE FINEST HI-FIDELITY LINES. CHANGERS, TURNTABLES, BAFFLES, AMPLIFIERS, TUNERS, SPEAKERS, ETC. WRITE TODAY CONCERNING YOUR REQUIREMENTS. ALL SHIPMENTS PREPAID AND INSURED. DIAMOND AND SAPPHIRE STYLUS FOR RPX-050 ONLY $10.50. HEAVY SIMULATED LEATHER COVERED BASE FOR GARRARD. COLLARO OR BLANK BASE WITH HINGED COVERS TO PROTECT YOUR CHANGERS. ONLY $9.50. A FREE AUDIO CONSULTATION SERVICE. WRITE TODAY. FIDELITY UNLIMITED DEPT. RE, 63-03 39th AVE., WOODSIDE 77, N.Y.

TELEVISION JOBS—Names and addresses of companies to contact. $1.00 Fitzgerald, Dept. A-23, 815 Countryside Drive, Wheaton, Illinois.

"GRID LEAK DRIP PAN" Ash Tray Novelty. Fun! $1.00 Postpaid. Garner, Box 827, Wheaton, Maryland.

TUBES—TV, RADIO, TRANSMITTING, AND SPECIAL PURPOSE TYPES BOUGHT, SOLD AND EXCHANGED. Send details to B. N. Gensler W2LNI, 512 Broadway, N.Y. 12, N.Y.

"TOWERHOUSE" LOW LOSS High Gain Short Wave Antenna Completely Assembled 40 Meters $11.95 With 75 Feet Open Wire Lead In. Ham Kits All Bands, $4.95 Up. Joe Gibbons, K2EF, 18 Liberty St., Port Jervis, N.Y.

ALL MAKES OF ELECTRICAL INSTRUMENTS AND TESTING equipment repaired. Write for free catalogue on new and used instruments at a savings. Hazelton Instrument Co., 128 Liberty Street, New York, N. Y.

TV SETS $16.95. Tubes 23c. Jones, 1115 Rambler, Pottstown, Pa.

BUILD YOUR OWN ELECTRONIC ORGAN. Jim Kirk, 1552-B Church, San Francisco 14, California.

WANTED: AN/APR-4, other "APR", "TS-", "1E-", ARC-1, ARC-3, ART-13, BC-348, etc. Microwave Equipment. Everything Surplus. Special tubes, Tec Manuals, Lab Quality Equipment, Meters. Fast Action. Fair Treatment. Top Dollar! Littell, Fairhills Box 26, Dayton 9, Ohio.

MATHEMATICS SERVICE, problems, calculations. Electronics, mathematics. Reasonable rates. Mathematics Service, Box 6671, Orlando, Florida.

SPEAKER RECONING, low prices. Michigan Speaker Reconing Service, 930 Metropolis, Marine City, Michigan.

YOUR FCC FIRST PHONE license in a hurry. Nation's largest professional school offers brand new, streamlined course. Guaranteed coaching—nationwide placement. Full information rushed to you free (no salesman will call). Get the best—it costs no more! Northwest Radio & Television School, 1221 N. W. 21st Ave., Portland 9, Ore.

ALUMINUM TUBING, Angle and Channel, Plain and Perforated Sheet. Willard Radcliff, Fostoria, Ohio.

POWER TRANSFORMERS REBUILT—all makes. TV-Radio or Special. Red Arrow Radio, 924 Metropolis, Marine City, Michigan.

25-50% DISCOUNT, guaranteed. Factory Fresh LP records; 69c and up; pre-recorded tapes. Send 20c for catalogue. SOUTHWEST RECORDS, 4710 Caroline, Houston 4, Texas.

TELEVISIONS, WORKINGS, $30 UP. W4API, 1420 South Randolph, Arlington 4, Virginia.

TV FM ANTENNAS, ALL TYPES INCLUDING UHF. Mounts, accessories. Lowest prices. Wholesale Supply Co., Lunenburg 2, Mass.

16" HI FI ELECTRICAL Transcriptions Catalog 10c. Transcriptions, 166 Barkley, Clifton, N.J.

People

Don G. Mitchell, chairman of the board of Sylvania Electric Products, New York City, was elected president of the company to fill the vacancy caused by the death of H. Ward Zimmer. He will serve in this dual capacity for an indefinite period, it was announced.

A. R. Andrews was appointed vice president and general sales manager of Pyramid Electric Co., North Bergen, N. J., according to an announcement by Ralph M. Scarano, executive vice president and treasurer. Andrews had been a Pyramid sales rep since the company was organized, heading his own firm, Andrews & Andrews, Syracuse, N. Y.

Charles Butcher was promoted to manager of the Newburyport, Mass., receiving-tube operation of CBS-Hytron. He had been chief engineer at the plant.

John K. McDonough joined General Instrument Corp., Elizabeth, N. J., as vice president of its F. W. Sickles Division and director of sales for both the subsidiary and parent company. He will be assisted by Edwin A. Freed, who continues as general sales manager. McDonough was formerly an executive with Sylvania.

W. Walter Jablon joined Radio City Products, Easton, Pa., and its affiliate, Reiner Electronics Co., as sales manager. He is well known in the electronic industry, having served as a sales executive with David Bogen Co., Espey Manufacturing Co. and others.

Irving Greene joined University Loudspeakers, White Plains, N. Y., as advertising and sales promotion manager. He was formerly with Asco Sound Corp.

Harvey Finkel joined JFD Manufacturing Co., Brooklyn, N. Y., as general production manager after having served a tour of duty with the Army in the Far East. He is the seventh son of Julius Finkel, president of the company, to join the firm.

Obituaries

Richard F. Goetzen, sales manager of the Fidelitone and Permo Point Divisions of Permo, Inc., Chicago, and a pioneer in the needle industry, died recently.

Nathan Chirelstein, chairman of the board of Allied Electric Products, Inc., and its division, Sheldon Electric Co., Irvington, N.J., died recently.

Raymond W. Drust, Jr., son of the president of Hallicrafters Co., Chicago, and for some time a member of the firm himself, died after a long illness.

Personnel Notes

. . . **William S. Peters** was appointed manager of transistor sales for Raytheon Manufacturing Co., Waltham, Mass. He will operate from the company's Chicago area headquarters which will eventually be moved to Franklin Park, Ill. Peters formerly worked with hearing-aid manufacturers and helped guide the transition from tubes to transistors.

. . . **Frank J. Healy,** a vice president of Sylvania Electric Products, New York City, was elected a director of the company. **W. O. Spink,** assistant equipment sales manager of Sylvania, was promoted to equipment sales manager for the Electronic Products Sales Division.

. . . **Arthur G. Connolly,** patent counsel for Sprague Electric Co., North Adams, Mass., was elected to the board of directors. **Robert C. Sprague,** chairman of the board and treasurer of Sprague, was appointed a class-C director and deputy chairman of the board of the Federal Reserve Bank of Boston.

. . . **Eugene (Gene) Duffner** joined the sales force of JFD Manufacturing Co., Brooklyn, N. Y., as a special field representative working out of Chicago. He was formerly with Sears Roebuck.

. . . **Angel Vidal** joined Radio Receptor Co., New York, N. Y., as office manager of the Semi-Conductor Division.

PEOPLE *(Continued)*

He was previously with Tele-Tone Corp. and the Engineering Division of Radio Receptor.

. . . **Michael (Mike) Muckley** was appointed sales manager of the line of high-fidelity AM-FM tuners, amplifiers and audio equipment made by Espey Manufacturing Co., New York, N. Y. He was formerly sales manager of the company's Phonograph Division.

. . . **Eugene H. Rietzke,** president of Capitol Radio Engineering Institute, Washington, D. C., received a Marconi Memorial Gold Medal at the 30th anniversary dinner of the Veteran Wireless Operators Association in New York.

. . . **Wendell Tietsworth** joined Sonotone Corp., Elmsford, N. Y., as assistant sales administrator of the Tube Division. He was formerly with the G-E Tube Department.

. . . **M. L. (Larry) Judd, Don L. Davison and James H. Baine, Jr.,** were named district sales managers for Hallicrafters, Chicago.

. . . **John Adams,** assistant sales manager of Rola Co., Cleveland, Ohio, was promoted to sales manager.

. . . **Bob Middleton,** chief field engineer, Simpson Electric Co., Chicago, a frequent contributor to RADIO-ELECTRONICS and the author of two GERNSBACK LIBRARY books now in preparation, was elected to senior membership of the IRE. **Ed Conrad** rejoined Simpson as industrial sales coordinator.

. . . **Walter F. Marsh** joined LabTronics, Inc., Chicago, as vice president in charge of sales. He was formerly a sales representative.

. . . **Frank M. Folsom,** president of RCA, received a Good Citizenship Award for 1955 from the Philadelphia Chapter, Sons of the American Revolution, for his outstanding contributions to science, statesmanship and public welfare.

. . . **William Balderston,** chairman of of the board of directors of Philco Corp., Philadelphia, was re-elected to the National Industrial Conference Board, a nonprofit institution for business and industrial fact finding.

. . . **Robert S. Windt** was promoted to sales manager for radio by CBS-Columbia, Long Island City, N. Y. He was formerly promotion and publicity manager and will continue to supervise the company's publicity and public relations program.

. . . **Nelson P. Marshall** and **Pat J. Morrisey** were appointed general sales manager and field sales manager, respectively, for Sola Electric Co., Chicago. Marshall was formerly manager of Eastern Division Sales, and Morrisey of the Western Division. END

technical Literature

ATR WALL CHARTS

An auto radio vibrator wall chart incorporates complete cross-reference vibrator equivalents, specifications, base diagrams and popular replacement types.

An inverter–recorder selection chart covers all standard a.c. tape recorder models. It enables one to determine which inverter should be used for any given tape recorder, depending on where the tape recorder is to be used — in automobiles, trains, planes or d.c. districts.

American Television & Radio Co., 300 E. 4th St., St. Paul 1, Minn.

Any or all of these catalogs, bulletins, or periodicals are available to you on request direct to the manufacturers, whose addresses are listed at the end of each item. Use your letterhead—do not use postcards. To facilitate identification, mention the issue and page of RADIO-ELECTRONICS on which the item appears.

UNLESS OTHERWISE STATED, ALL ITEMS ARE GRATIS. ALL LITERATURE OFFERS ARE VOID AFTER SIX MONTHS.

SOUND PRODUCTS

Altec's 8-page *Jobber Sound Products* describes and illustrates sound equipment, among them microphone systems, amplifiers, loudspeakers and cabinets.

Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.; 161 6th Ave., New York 13, N. Y.

MAGNETIC AMPLIFIERS

Westinghouse's 20-page *Booklet No. 52-600* discusses the technical aspects of Magamp magnetic amplifiers and explains the basic theory underlying magnetic amplifier operation, gives information necessary for application and describes operating characteristics. Photographs, charts, graphs and circuit diagrams are also included.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

SLIDE RULE

Shure has reintroduced their *Reactance Slide Rule* which simplifies calculation of resonant frequency, capacitive and inductive reactance, coil Q and dissipation factor problems. The rule includes a complete set of instructions.

Shure Bros., 225 W. Huron St., Chicago 10, Ill. 50 cents.

AMPHENOL CATALOGS

Blue Ribbon connectors are described and illustrated in Amphenol's *Catalog R1.* Complete electrical and mechanical data are given on the connectors, in-

TECHNICAL LITERATURE *(Continued)*

cluding the new keyed shell and latch-lock can types that utilize the barrier polarization insert.

Catalog W1 contains 34 pages of cable illustrations and descriptions and includes the following: jackets, conductors and dielectric data, attenuation and power ratings, a complete listing of military RG/U nomenclature and a cable-connector selector chart; noisefree, ALJAK, miniature and triaxial cables as well as transmitting and receiving Twin-leads. *W1* is cross-indexed by Amphenol and military numbers and also contains information on cables and connectors for community TV systems.

American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.

TV PICTURE TUBES

The second edition of the CBS-Hytron *Reference Guide for Television Picture Tubes* lists all magnetically deflected picture tubes to date — monochrome or color — and includes those made by other manufacturers as well as their own. Basing diagrams and pertinent data for 242 tubes are given.

CBS-Hytron distributors.

PILOT LIGHTS

The subminiature pilot lights described in Dialight's brochure *Form L-157*, are all of the one-terminal type for use on grounded circuits. Five groups are included: indicator lights of the nondimming type; dimmers (mechanical or polaroid types); plastic dome, omnidirectional types with molded high-heat plastic tops; indicators with flat plastic lenses imprinted, and light shield assemblies for lighting dials and instruments. Photographs, dimensional drawings of parts and technical data are given.

Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y.

CARDWELL CAPACITORS

A 16-page *Catalog No. 823* describes Cardwell's fixed and variable air capacitors. Mechanical and electrical specifications on all standard models as well as information on miscellaneous accessories are given.

Allen D. Cardwell Co., Electronic Productions Corp., Plainville, Conn.

AUDIO GUIDE

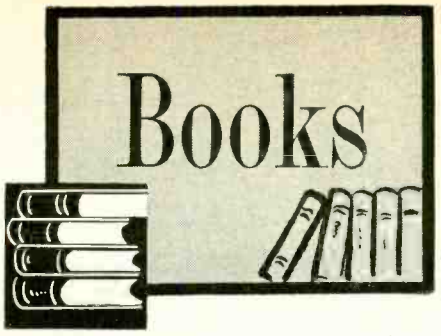
Leonard's *1955 Audio Reference Guide* contains 160 pages of high-fidelity listings. An 18-page introduction contains information dealing with the purchase and assembly of sound systems. Latest models of leading hi-fi component manufacturers with all essential specifications, pictures and dealers' net prices are included.

Leonard Radio Co., 69 Cortlandt St., New York 7, N. Y.

SELENIUM RECTIFIERS

A 6-page *Bulletin H-2* contains the latest information on International Rectifier's high-voltage selenium rectifier cartridges. It also includes reference curves, charts and circuits.

International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. END



ELECTROACOUSTICS, by Frederick V. Hunt, John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. 5½ x 8½ inches, 260 pages. $6.

Possibly the most important portion of this work is the first chapter, which runs to page 91. Called "historical context," it is a complete history of electrical and electronic events leading toward the discovery and development of electroacoustic transducers and communications systems. It begins with Stephen Gray's discovery of electrical conduction and continues to the bass-reflex enclosure.

The rest of the book deals with dynamic, electrostatic and magnetic transducer systems, electromechanical coupling considerations and analysis of transducer performance.—*FS*

HOW TO USE TEST PROBES, by Alfred A. Ghirardi and Robert G. Middleton. No. 165, Rider Publications. John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 5½ x 8½ inches, 172 pages. $2.90.

Probes seem such simple units that some technicians feel they need know very little about them. Although a probe does indeed contain few parts, it is important that the correct type be used for the application at hand and that the correct part values be incorporated. Furthermore, the technician must be able to interpret his results correctly.

The first chapters cover high-voltage d.c. and a.c. probes. These are followed by chapters on compensated wide-frequency types, rectifiers and demodulators. The authors show results obtained with improper loading or shielding. Photos and diagrams are supplied throughout, and the make-it-yourself reader is well taken care of. —*IQ*

RADIO-TELEVISION SERVICE PRICING GUIDE, by Robert T. Oelrich and Harold Justice. Oelrich Publications, 4135 N. Lawler Ave., Chicago 41, Ill. 6½ x 8 inches, 84 pages. $2.95.

This book represents an attempt to catalogue various radio and TV repairs into average price ranges. The authors chose Chicago as their sampling area, which may make the exact prices inapplicable in small suburban communities, for example.

No provision is made for the broad differences in many service jobs. For instance, tuner adjustment is listed at $1.25. However, no mention is made of the type tuner or the extent of the adjustment.

BOOKS *(Continued)*

On an important and variable item such as antenna installation, the authors wisely refrain from committing themselves on any price.

Time analyses tend occasionally to become unrealistic. One example is the working time on an ion-trap magnet. About 30 minutes is allowed to spot a weak magnet and an additional 15 minutes to replace it. The repairman who requires 45 minutes to change an ion trap could not last long in business.

Aside from the above weaknesses the book should be of considerable value as a general guide to the technician.—*JK*

THE RADIO AMATEUR'S HANDBOOK, 32nd Edition, by the Headquarters Staff of American Radio Relay League. 6 x 9 inches, 541 pages text plus 63-page vacuum-tube and semiconductor section, 148-page catalog section and index. American Radio Relay League, West Hartford, Conn. $3.

As the best known of all radio books becomes older, each annual edition tends more to resemble a true new edition rather than a completely revised book, as was the case in the earlier years. The 32nd edition has the same chapter arrangement as the 31st, with one small modification, and revisions of subsections are as far as the compilers go. New material appears in the high-frequency sections and, of course, in the tube supplement. In other words, such changes have been made as are necessary to bring it completely up to date. —*FS*

ELECTRONIC MUSICAL INSTRUMENTS, by Richard H. Dorf. Radio Magazines Inc., Mineola, N. Y. 6¼ x 9½ inches, 326 pages. $7.50.

This appears to be one of the best and most complete of the recent group of books on a portion of the electronic field which has been pretty much neglected till the last year or two. Beginning with four introductory chapters, the author goes on to describe nine electronic musical instruments in as many chapters. Much of the material in these—as well as in the following chapter on the Stroboconn—is familiar to our readers through the author's series "Electronics and Music" in RADIO-ELECTRONICS.

Following the material on American commercial organs and similar instruments such devices as the Theremin, Compton Electrone, Constant Martin organ, and Ondes Martenot, little known to the average electronic music student, are described. Three chapters are then devoted to instrument construction. Other chapters deal with servicing electronic musical instruments, tone generator circuits (electronic and nonelectronic) and tone coloring, amplification and control. The appendix contains on extensive list of electronic music patents and a bibliography of books and magazine articles. —*FS*

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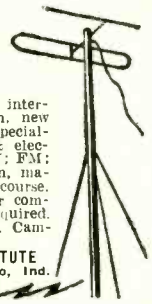

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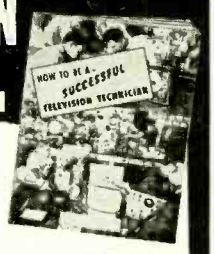

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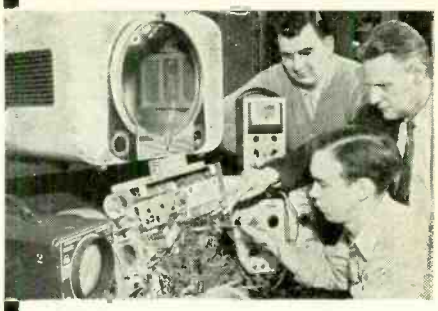

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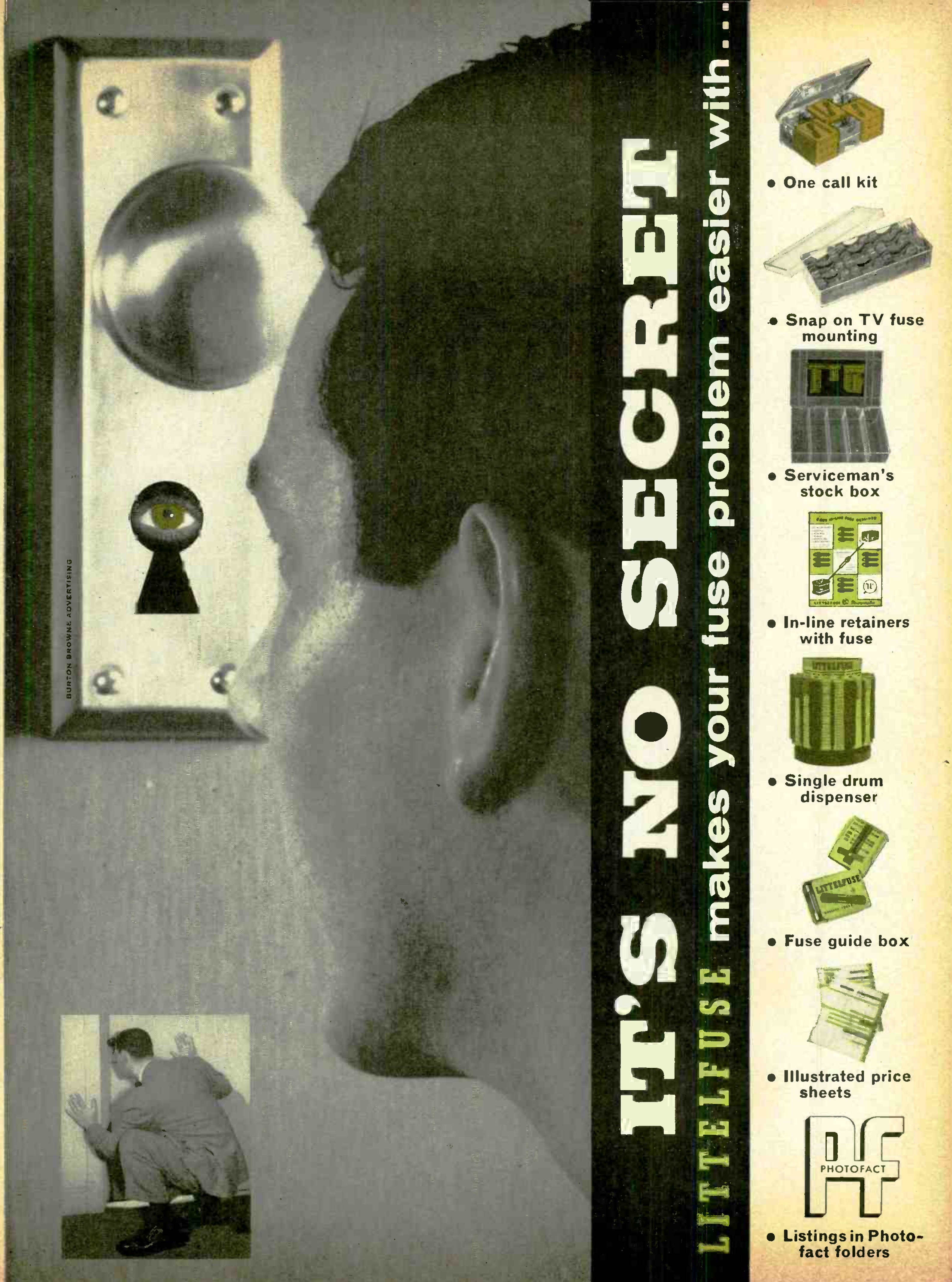
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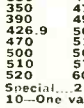

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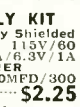

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1D8	.69	5Z3	.81	6F8	.86	12K8	.48	80	.65		
1E5	.69	5Z4	1.29	6J4	4.59	12SA7	.84	81	1.41		
1E7	.49	6A3	1.29	6J5	.46	12SC7	.78	82	1.20		
1F4	.49	6A4	3.15	6J6	.56	12SF5	.79	83V	1.22		
1F5	.59	6A5	2.98	6K4	2.77	12SG7	.91	84	.79		
1F7	.69	6A6	.81	6K6	.61	12SH7	.62	117L7/M7	2.50		
1G4	.69	6A7	1.09	6L6	.98	12SJ7	.54	117N7	1.59		
1G5	.69	6A8	1.09	6P5	.99	12SK7	.62	117P7	2.00		
1G6	.69	6AB4	.62	6R7	.81	12SL7	.62	117Z4	1.15		
1H4	.72	6AB5	1.65	6S4	.99	12SN7	.81	117Z6	1.09		
1H5	.72	6AC5	1.19	6SA7	.67	12SQ7	.54	502AX	1.49		
1H6	.69	6AC7	.68	6SC7	.74	12SR7	.46	503AX	1.49		
1L4	.48	6AF4	1.35	6SF7	.74	12X3	.90	505AX	1.79		
1L6	1.11	6AF6	1.18	6SG7	.62	12Z3	.89	512AX	1.45		
1LA4	1.01	6AG5	.71	6SH7	.46	14A4	1.05	531DX	1.89		
1LA6	1.01	6AG7	1.14	6SJ7	.69	14A7	.89	532DX	1.89		
1LD5	.98	6AH4	.87	6SK7	.54	14B6	.85	533AX	1.29		
1LH4	1.01	6AH6	.88	6SL7	.62	14C5	1.15	536AX	.99		
1LN5	.78	6AJ5	1.77	6SN7	.59	14F7	.95	538DX	.98		
1P5	.78	6AK5	.62	6SQ7	.56	14J7	1.35	539DX	2.19		
1C5	1.19	6AK6	.74	6T4	1.35	14Q7	.99	543DX	.99		
1R4	.96	6AL5	.48	6T7	.82	14X7	.91	544DX	.99		
1R5	.58	6AL7	1.22	6U7	.64	FG17	3.01	546DX	1.99		
1S4	.88	6AN8	1.25	6V6	.56	19	.89	571AX	2.49		
1R5	.58	6AQ5	.52	6W4	.98	19BG6	1.98	1612	1.98		
1S4	.88	6AQ6	.54	6X4	.42	19T8	1.98	1613	1.27		
1S5	.66	6AR5	.79	7A4	.78	19V8	1.96	1614	1.95		
1T4	.68	6AR6	2.74	7A8	.68	20	1.65	1616	.79		
1T5	.98	6AS5	.79	7AG7	.99	24A	.92	1619	.34		
1U4	.52	6AS7	3.48	7B6	.72	25A7	3.15	1620	5.01		
1U5	.54	6AT6	.42	7B8	.82	25AV5	1.25	1621	1.90		
1V2	.68	6AU5	1.15	7C4	.26	25BQ6	1.30	1622	1.60		
1X2A	.88	6AU6	.48	7C7	.68	25L6	.46	1623	1.15		
2A3	1.27	6AV5	.84	7E5	.64	25W4	.75	1624	1.05		
2A4	2.37	6AX4	.81	7E7	.72	25Y5	.84	1625	.44		
2A5	.78	6AX5	.77	7K7	1.21	25Z5	.75	1626	.16		
2A7	.89	6B4	1.12	7Y4	.64	25Z6	.60	1629	.22		
2B7	.89	6B8	.64	7Z4	.71	27	.69	1632	.68		
2V3	2.90	6BA6	.48	12A5	1.49	35A5	.71	1633	.98		

HI-FI SPEAKERS

Inbuilt network. 2 wires needed for HF & LF Response. Famous Hi Fi Speaker Mfgs. 15" Coaxical PM & 5" Tweeter 25 Watt/20-15500 cycles.
MODEL P25CO.....$19.50
12" Coaxical PM & 3½" Tweeter 12 Watt/45-15000 cy. Special $12.75; 3 for $35
8" Coaxical PM & 2½" Tw/8w/70-15Kc MODEL P8CO.....$7.98; 2 for $15
12" HI-FI PM 10w/35-14KC...$10; 2/$18
8" HI-FI PM 7w/45-14KC.....$7.25; 2/$13

HI-FI Audio Components
Phono Cart. & N'dles Gtd.

RPX050* Dual .001&.003 $6.98
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RPX041* (S) .001.....5.25
RPX040* (S) .003.....5.25
RPX053* (DD) Gold Treas*.....$28.98
*GE Original Boxed, S, S, S, Back Gtd.
RPJ010 Dual (S) .001 & .003 (GE)....$1.98
RPJ012 Dual (D) .001&.003 "Tetrad".. 18.99
RPJ013 Dual(DS).001&.003 "Tetrad" 10.99
RPJ003 or RPJ004 Sing D "Tetrad" 9.99
RPJ001 or RPJ005 Sing S (GE)..... 1.35
All Other Stylus & Needle Replacements
MG or 78 Single Sapphire Styli.....$1.15
MG and 78 Dual Sapphire $1.98; 7.50
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Repl'mt Xtal Cartridges Hi Output..... 2.39

HI-FI RECORDING TAPE
Finest, S, S, S, Back Gtd

PRECISION COATED & SLIT, Gtd Splice free, Quality Controlled. Plastic Base. Gtd Constant Output. Freq. 7½ IPS 40-15KC (Oxide Wnd In).
Sold Singly $1.80 Twelve Lot Special $1.58 ea.

NEW SONIC SOUND GENERATOR
115VAC INPUT

Agitates! Cleans Washes • Mixes
"TAB" SPECIAL $29.95
Write for Complete Details

THOR ELECTRIC SPEED DRILLS

200J ¼" Elec. Speed Drill w/Jacobs chuck, 2400 RPM/115VAC. Only.....$14.25
400J ½" Elec. Speed Drill w/geared chuck, 2400 RPM/115VAC. Special.....$29.95
Thor 5" Power Saw (90°+45° cut)....$22.35
Cummins 6¾" Maxsaw (90°+45°) $39.95

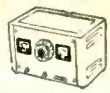
WILTON QUALITY UTILITY VISES

Model V107-2½" jaw width, max. open 2¼", Malleable iron casting.....$3.00
Model V106-3" jaw width, max. open 3", w/Swivel Base, Steel pipe jaws & wire cut off tool, Rugged.....$5.75
Swiss "Quickie" Wrench, 10 way. Fits 95% all sizes Sq & Hex Head nuts & bolts ¼" to 9/16". Gtd. Rustproof, Brkproof (Prepaid USA).....98c, 6/$5
Swedish Hand Saw, 24 to 30" long. Crosscut Finest Sandvick Steel.....$3.98

RADIO, TV & REFIG KIT

Time Saver Master Kit 17 pc includes every nut & screw driver used in Radio, Refrigerator & TV repair. Kit contains Hvy duty handle, Ratchet & extension drive. (2) Phillips & (3) screwdriver long blades, (8) Nut drivers ¼" to 9/16" (Deeply recessed for those long chassis screws). High Quality Tempered Steel. Case, Gtd to SATISFY. Special.....$5.98 ea; 3 for $17

THE "TABTRON" LINE
NEW HIGH CURRENT POWER SUPPLIES—ONE YEAR GTD



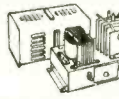
Variable 0-28VDC. Completely Built. Full Wave Selenium Rectifier, Transformer, Variac, Volt & Amp Meters, Switch, Terminals & Fuse. Std Housed In Heavy Duty Steel 115V/60cy Input. 110 & 220V† and 3 phase to order.

Stk No.	Con. Rating W-Meters
T28V5A	0-28 WVDC at 5 Amp $45.00
T28V5ACC	5 Amp (1% Ripple) 69.00
T28V5ACCC	0-28 VDC at 5 Amp 129.00 (0.01% Ripple)
T28V12A	0-28 VDC at 12 Amp 108.00
T28V12ACC	12 Amp (1% Ripple) 145.00
T28V12ACCC	0-28 VDC at 12 Amp 199.00 (0.01% Ripple)
T28V24A†	0-28 VDC at 24 Amp 135.00
T28V24ACC†	24 Amp (1% Ripple) 195.00
T28V24ACCC	0-28 VDC at 24 Amp 279.00 (0.01% Ripple)
T28V50A†	0-28 VDC at 50 Amp 260.00
T28V50ACC†	50 Amp (1% Ripple) 370.00
T28V100A	0-28 at 100 Amp 469.00
T28V100ACC†	100 Amp (1% Ripple) 650.00

Variable 75 to 135 VDC. Completely built. Ready to go. Includes F.W. Selenium Bridge Rectifier, Filter, 0-2" Rectangular Volt & Ammeter, Overload Cut-Out and Components as in above supplies. Dsgn'd for continuous service. Specify for 115 or 230 VAC/1 phase, 60 cy Input.

T120V5AC	75to135VDCat5Amp	$169.50
T120V5ACC	75to135VDCat5Amp (1% Ripple)	217.60
T120V10AC	75to135VDCat10Amp	215.50
T120V10ACCC	75to135VDCat10Amp (1% Ripple)	265.60

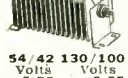
NEW! LOW PRICED HI CURRENT
Basic Supplies



Consisting of Transformer & Full Wave Bridge Rectifier mtd & wired with no frills. Ready to deliver constant DC Power. Input 115 VAC, others 115 & 230 VAC† and 3 phase.

Stk. No.	Cont. Rating	Basic
B28V5A	28 WDVC at 5 Amp	$35.00
B28V5ACC	5 Amp (1% Ripple)	49.00
B28V12A	28 VDC at 12 Amp	75.00
B28V12ACC	12 Amp (1% Ripple)	109.00
B28V24A	28 VDC at 24 Amp	110.00
B28V24ACC†	24 Amp (1% Ripple)	159.00
B115P5A	115 WDVC at 5 Amp	89.55
B115P10A	115 VDC at 10 Amp	189.75
B230P5A	230 WVDC at 5 Amp	187.55
B230P10A†	230 VDC at 10 Amp	282.75

NEW "TABTRON" SELENIUM
BRIDGE RECTIFIERS



Dated
ONE YEAR GUARANTEE
We mfg. Power Rectifiers to your specs. From 1 Amp up to and above 1000 Amps. Following list. Full Wave Bridge.

Curr. Cont.	18/14 Volts	36/28 Volts	54/42 Volts	130/100 Volts
1AMP	1.35	2.35	3.75	8.35
2AMP	2.00	2.75	5.35	10.30
3AMP	2.95	4.15	5.85	12.90
4AMP	3.50	7.35	11.35	25.00
6AMP	4.25	8.75	12.85	32.80
10AMP	6.30	12.85	19.50	41.50
12AMP	7.90	15.75	22.10	45.75
20AMP	13.05	25.05	37.25	78.50
24AMP	16.05	31.95	44.50	95.00
30AMP	19.50	37.60	56.50	110.00
36AMP	23.75	47.75	65.00	135.00
50AMP	31.00	61.50	Q	175.00

New Rectifier & Trans Combo

115V/60 cy inputs.

up to 14VDC at 12 amps	$ 19.98
up to 28VDC at 5 amps	15.65
up to 28VDC at 12 amps	29.98
up to 28VDC at 24 amps*	59.98
up to 28VDC at 50 amps*	117.98
up to 28VDC at 100 amps*	199.00

*Transformer has 115&230V PRI

HEAVY DUTY BATTERY "FAST"
Charger Rectifier

13-0-13V(CT) 100 Amp Fan Cooled or 34 Amp Air Cooled—Repl'mt 6V Booster Charger. Model CR16.....$10; 3/$27
16-0-16V (CT) Fan Cooled. For 12V/60A and 6V/100A Booster Chargers.
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Convert Your 6V "Fast" Chgr.

to 12V/50A as well as 6V/100A use Details and Rectifier..$22.00 ea.; 3 for $60

BCT 2/1A 2V Battery "TR" Chgr $3.98
BCT 6-12/2A 6&12V Batt."TR" Chgr $7.98

Now Power Your Gov't Surplus

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New Rectifier Xfmrs

Primary 115V 60 Cyc

5 Amp†	$8.65; 2/$15.75
12 Amp†	$16.65; 2/29.95
24 Amp*	$35.75; 2/69.95
50 Amp*	$59.00; 2/112
100 Amp*	$108.00; 2/$210

18 Volt, 2 Amps.....$1.98
†Sec 2X 18-15-9-0. Can be in Series or Parallel.
*Dual primary 115 & 230V 60cy

New Rectifier Chokes

CH1/1AMP/0.1HY/.14R/3#	$3.95
CH2/2AMP/0.1HY/.67R/3#	$5.95
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CH004/24A/.004HY/.025R/20#	$29.95

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Variable DC Power Supply

Full Wave rectification, 6000Mfd filter Condenser, fused. 6.3V or 12.6V at 2 amp. operates 115V/60cy.
Model 2DCF.....$12.98
As above except 5 Amp
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5DCF ACC/5A/1% Ripple.....$38.95

Money Back Guarantee (Cost of Mdse. Only) $5 Min. Order F.O.B. N.Y.C. Add Shpg. Charges or for C.O.D. 25% Dep. Tubes Gtd. via R-Exp. only. Prices subject to Change Without Notice. Phone Rector 2-6245. CABLE: "TABPARTS"

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PHONO-CARTRIDGE REPLACEMENTS

NOW SEALED-IN-PLASTIC

This is a big step ahead in cartridge merchandising and servicing! For greater protection and convenience, E-V Replacement Cartridges now come in individual new sealed-in-plastic Blister-Paks, with full model identification, interchangeability chart, and instructions—in colorful display box.

$70,000,000 CARTRIDGE REPLACEMENT MARKET

The exclusive new Blister-Pak in the E-V Basic 6 Preferred Types makes it easier to take E-V cartridges along on a service call for immediate replacement. Advanced engineering by E-V assures finer reproduction, longer record and needle life, easy installation, and more satisfied customers.

NEW E-V MODEL 47 DUAL-SLIDE CARTRIDGE FOR 78, 33-1/3, 45 RPM

Here is a unique new innovation in replacement cartridges! The dual-slide, dual needle Model 47 shown on the Blister-Pak at right makes it possible to replace hundreds of different specialized types with a single general-purpose cartridge — with design and operating features found only in wide range custom built cartridges.

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Make Cartridge Replacements Easier and More Profitable than Ever!

Colorful new 2-drawer metal display-dispenser makes it easier for service-dealers to stock and sell phono-cartridge replacements. Your E-V Distributor is ready to supply you with these merchandisers and other E-V sales aids.

SIZE 6x13x9¾"

FREE HANDY NEW QUICK-ANSWER Cartridge Interchangeability Guide

This complete, up-to-date cartridge interchangeability guide SA9 is available FREE to service-dealers. A simple turn of the wheel gives you the exact replacement for all current cartridges. Get it now from your E-V Distributor or write to Electro-Voice.

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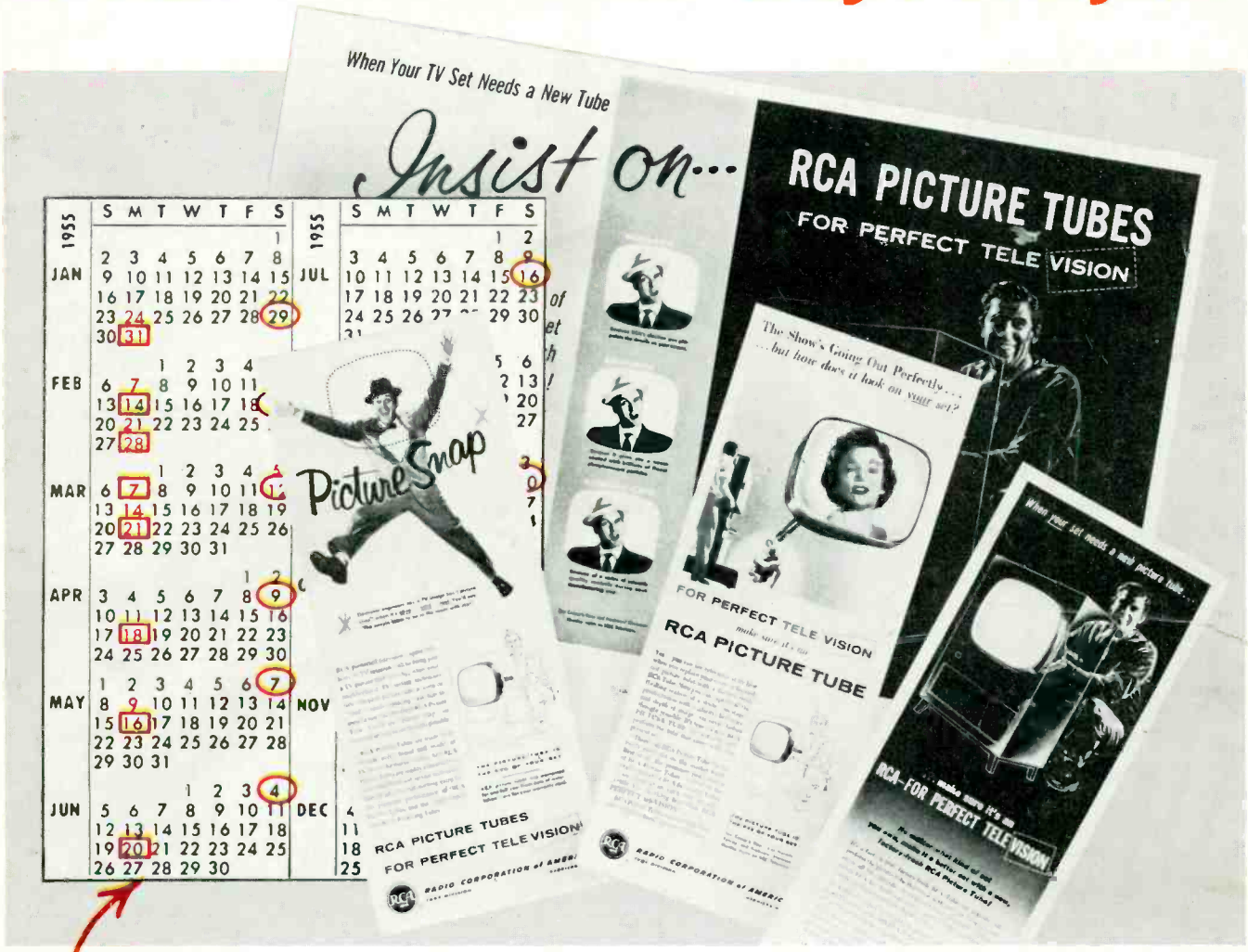
"Red Letter" days for RCA mean "BIG BUSINESS" days for you



Here's how RCA is telling Mr. & Mrs. America about RCA Picture Tubes in LIFE . . . in TV GUIDE

RCA consumer ads are reaching 30,000,000 prospective TV replacement tube buyers, over and over again in 1955—many of them are *your* customers and prospective customers.

And here's why more and more TV technicians find RCA Picture Tubes are fast becoming their easiest-selling and largest-volume line of replacement picture tubes:

- **Premium performance at no extra cost**
- **Full 12-month warranty to consumer**
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To minimize call-backs—to assure your customer of premium-performance, install a new RCA Picture Tube whenever replacement is indicated.

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TUBE DIVISION HARRISON, N. J.

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