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RADIO & TELEVISION NEWS

DECEMBER
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IN THIS ISSUE

MIDGET FM TUNER

CHOOSING YOUR HI-FI LOUDSPEAKER ENCLOSURE

100-WATT BANDSWITCHING HAM TRANSMITTER

SINGLE-SIDEBAND AUDIO TEST OSCILLATOR

A TRANSISTOR VIBRATION AMPLIFIER

SERVICING PRINTED WIRING IN TV RECEIVERS

HOW GOOD ARE YOUR TV INSTALLATIONS?

SERVICING GATED-BEAM DETECTORS

ALL-PURPOSE ENCLOSURE FOR 12" SYSTEMS

HI-FI ON A TEACART

(See page 121)

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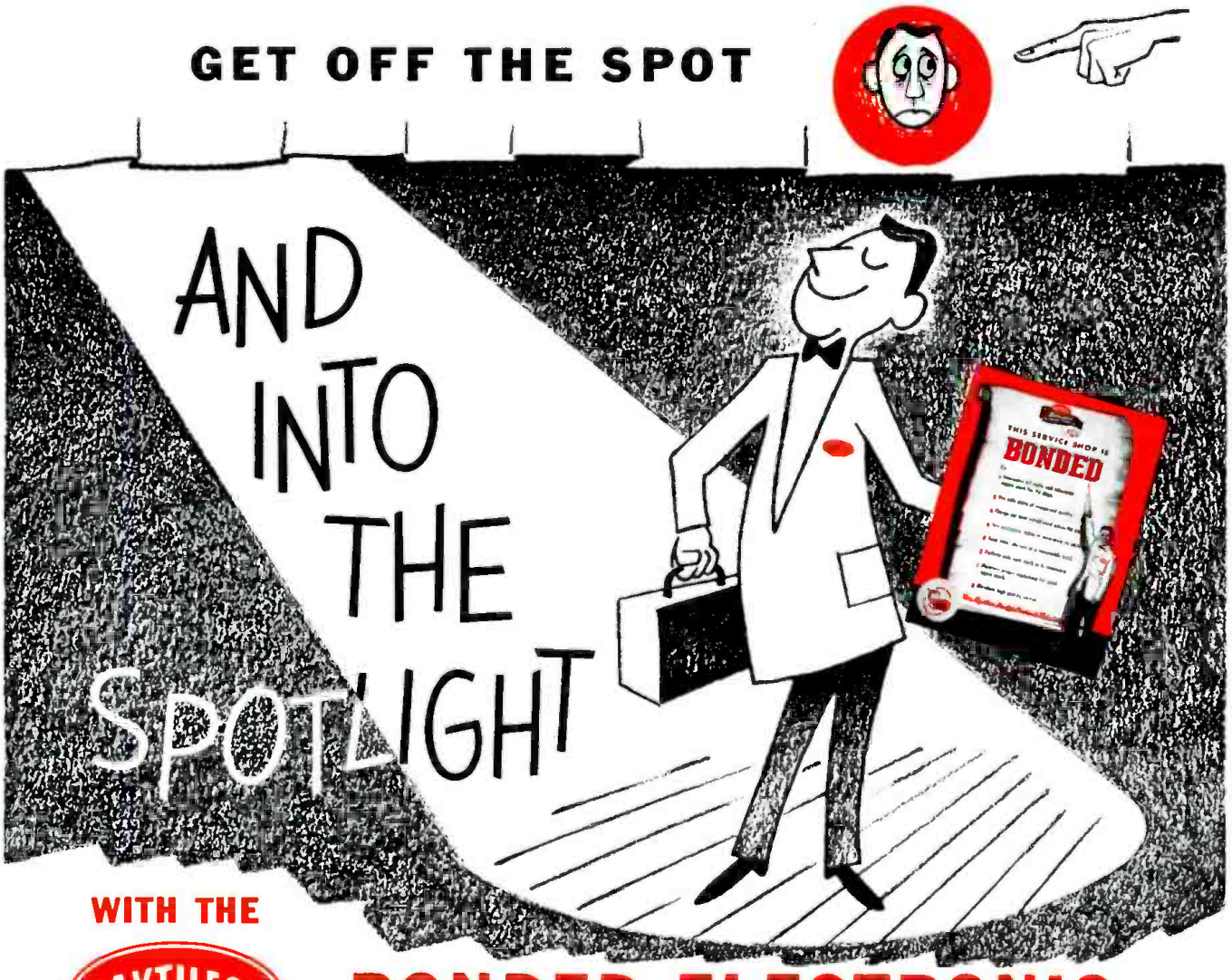

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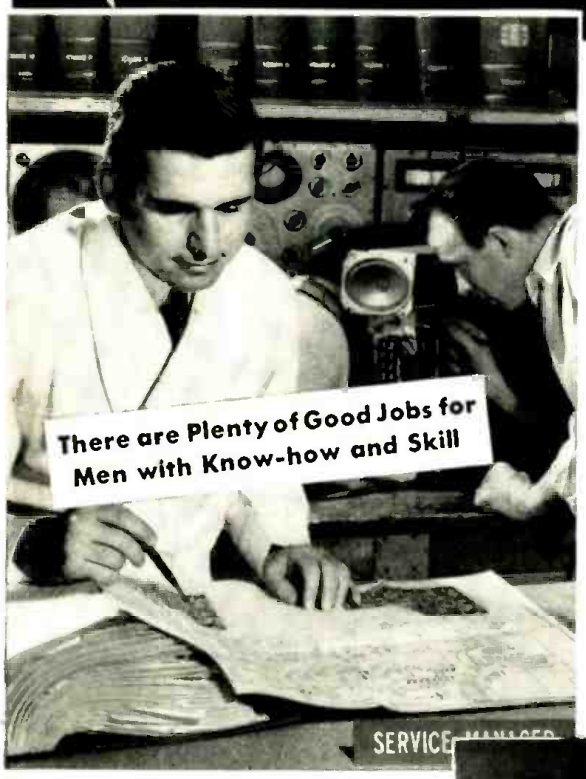

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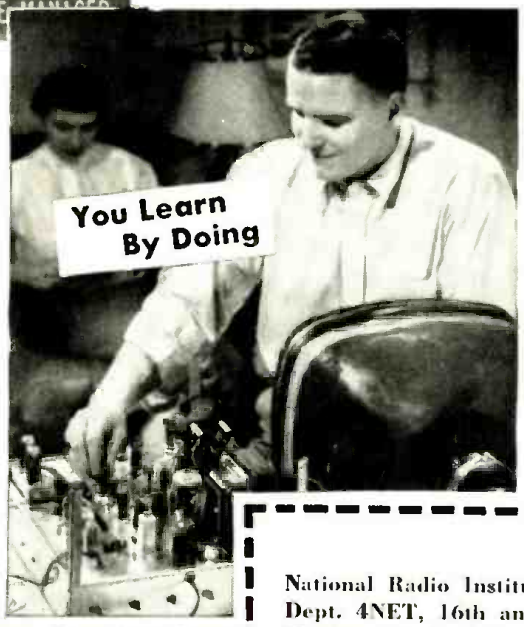

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CONTENTS

DECEMBER, 1954

Build Your Own TV Color Converter (Part 1)	*Jay Stanley*	37
Midget FM Tuner	*Robert J. Larson*	40
The Broadcast Recorder	*E. E. Berlant*	43
How Good Are Your TV Installations?	*John B. Ledbetter*	45
Choosing Your Hi-Fi Loudspeaker Enclosure	*Abraham B. Cohen*	46
All-Purpose Enclosure for 12" Systems (Part 2)	*Oliver Read*	48
A Semi-Automatic Tube Checker	*Phil Weiss*	50
Single-Sideband Audio Test Oscillator	*Edmund H. Marriner*	51
Servicing Gated-Beam Detector Circuits	*Matthew Mandl*	52
The "Globe Scout"	*Leo I. Meyerson, WØGFQ*	54
1954 TV Receiver Specifications		56
Servicing Printed Wiring in TV Receivers	*Walter H. Buchsbaum*	57
Certified Record Revue	*Bert Whyte*	60
The "Bass Ultraflex" Enclosure	*Daniel J. Plach & Philip B. Williams*	61
A Transistor Vibration Amplifier	*Louis E. Garner, Jr.*	64
A Compact 100-Watt Bandswitching Ham Transmitter	*Maurice P. Johnson, W3TRR*	66
New FM-Only Tuner	*D. R. Von Recklinghausen, J. W. Casey & V. H. Pomper*	71
Transistor Amplifier for Meters	*E. G. Louis*	74
Electronic Memory	*Ed Bukstein*	76
Mac's Radio Service Shop	*John T. Frye*	78
Highly-Sensitive Link-Coupled Loop Antenna	*L. S. Hannibal*	96
Hi-Fi on a Teacart		121
New TV Grants Since Freeze Lift		138
New TV Stations on the Air		138
Radio-TV Service Industry News		146
Radio & Television News Index (Vols. 51-52)		161

DEPARTMENTS

For the Record	*The Editor*	8	Technical Books	84
Spot Radio News		14	What's New in Radio	100
Within the Industry		28	Manufacturers' Literature	110
Short-Wave	*K. R. Boord*	70	New Audio Equipment	140

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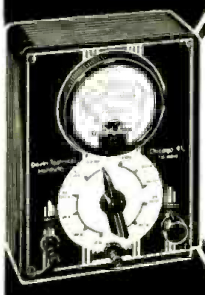

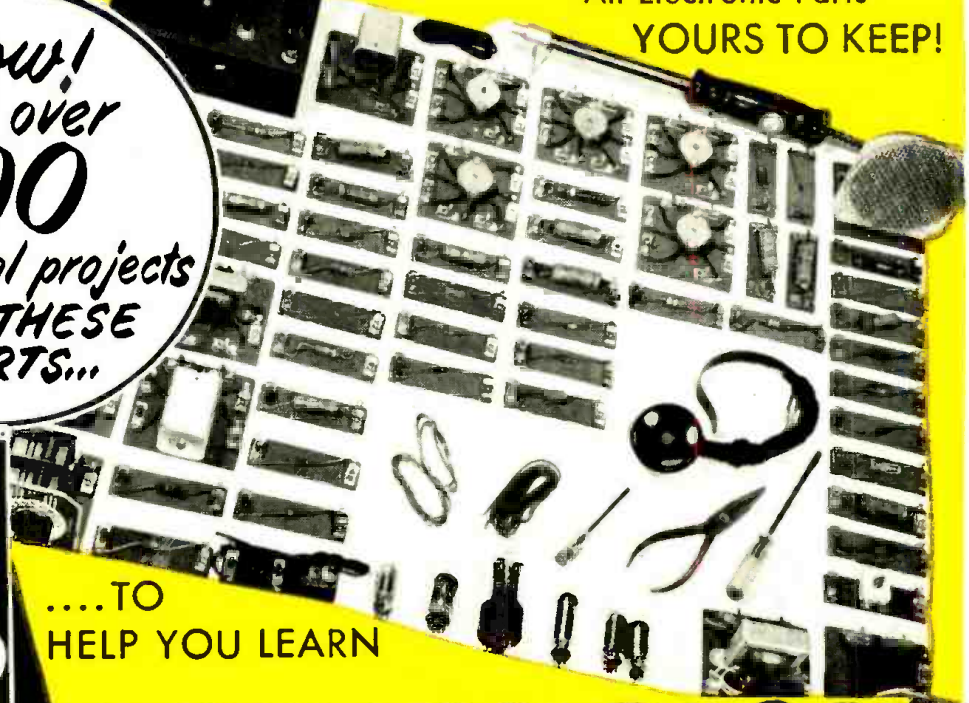

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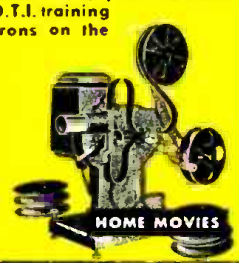

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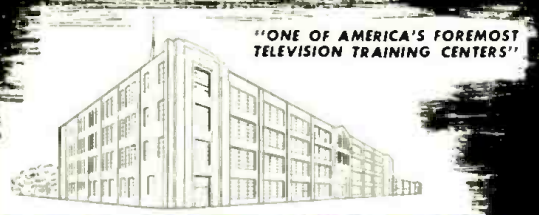

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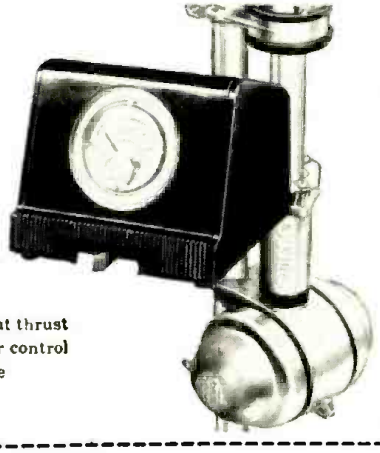

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For the RECORD

BY THE EDITOR

RADIO-TV SERVICE DEALERS THREATENED

THE almost perennial headache to the TV service profession again threatens the dealer and the technician—especially in large areas like New York City and its environs. Because of persistent complaints against prices charged for repairs and unethical practices by several service dealers, Mayor Wagner (NYC) acted to discuss the problem with Brooklyn's District Attorney who had been conducting a grand jury investigation of radio and television repair "rackets." The Mayor's aides were told to prepare new legislation designed to curb unethical practice in the TV service-repair profession.

The previous "licensing bill" introduced last January was killed by the city council committee. At that time it was charged that the servicing profession was a subject "of great abuse, with the result that the public has been and is being victimized by irresponsible sales methods, unethical and financially unstable service organizations, and inferior installation, maintenance and repairs."

The January bill proposed that all television service technicians be licensed and that they maintain standards set by an eight-man supervisory committee. This group was to be appointed by the Mayor. It was proposed that violators of the license bill be fined amounts of from $100 to $500 with license revocation, or six months in prison, or both.

The new legislation, we are told, is designed (in part) against the practice of removing a TV set from a home, taking it to a shop for repair, returning the set to the owner, and charging him for tubes and parts that are not replaced, etc.

Such legislation, in our opinion, would arouse the public to the point that *ALL* TV technicians would be branded as a bunch of bandits, crooks, and sharpies. It would become impossible for legitimate operators to economically handle major repair jobs at their service shops where essential (and bulky) test equipment is required for proper analysis and alignment.

This bill, if passed, would have serious repercussions on the entire service profession and would spread its ugly seeds to every city in the country. Legitimate service dealers would be forced to purchase a full set of shop test equipment for *each technician,* to be hauled out in expensive trucks to the customer's home and to his living room for major TV repair work.

Can you visualize this "shop" set up in a consumer's home with the attendant mess that will result? Even worse, it would only serve to further encourage the unethical service technician (and the bill won't stop him) to put on an "extravaganza" performance for the customer to witness as he tears a complicated TV receiver apart on the living room rug while performing his sleight-of-hand. It would be just as simple to replace a bad tube with a second-hand duplicate right before the customer as it would in his shop if this was his practice. And what could possibly prevent him from replacing components (at will) in the set right before the eyes of the customer? Some characters would really take advantage of the alleged "protection" of their license.

We know, from several years of radio servicing experience, that the average housewife resents repair work on anything in her home that causes mess, noise, or commotion. Little Junior takes care of those details without any trouble.

This new bill—if passed—would result in severe inventory problems for the small service dealer. Field technicians would have to chase back and forth for transformers, picture tubes, *et al* like a plumber, or would require a truckload of replacement components. Either would result in higher charges to the consumer. Who wins?

As we see it—nobody gains but the cash register of the city fathers. Do these same people license the car dealer and make him send a mechanic to our homes to rebuild the transmissions in our cars? Do they force the jeweler to send a watchsmith to our homes to fix crystals on our *Ingersolls?* The answer, of course, is obvious. But these same industries have escaped legislation for policing—even though they have had their share of shady characters. So why electronics?

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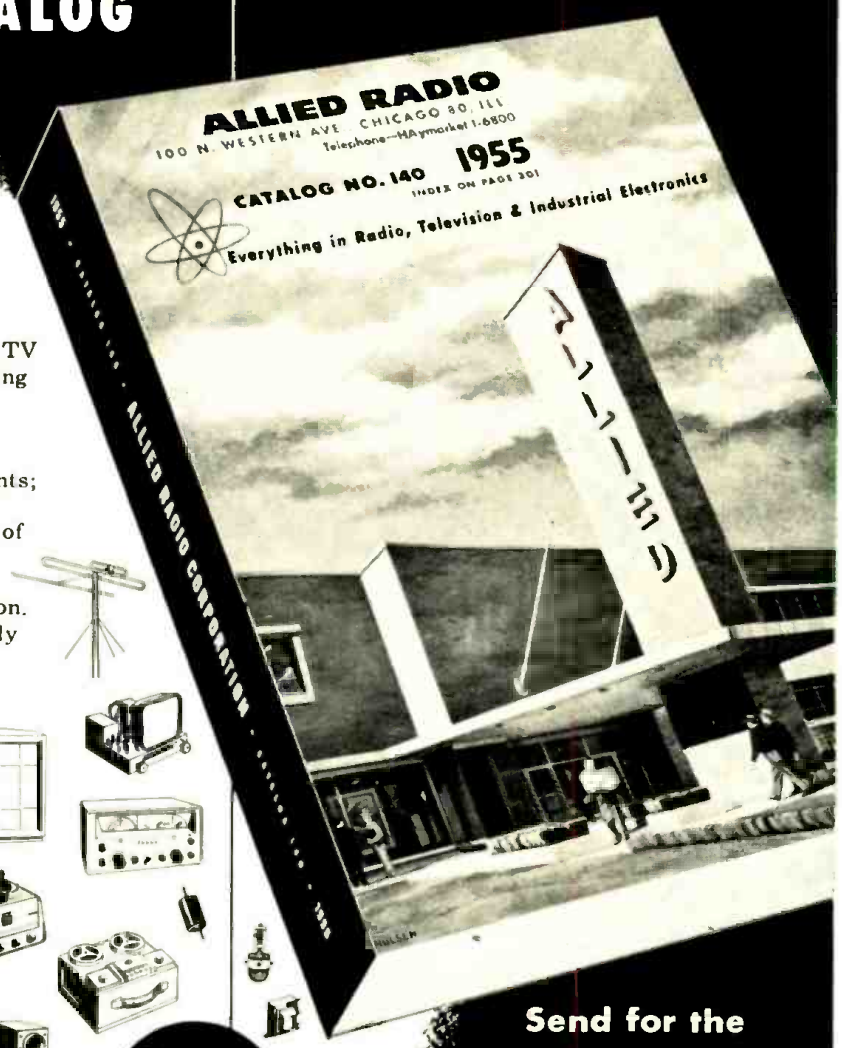

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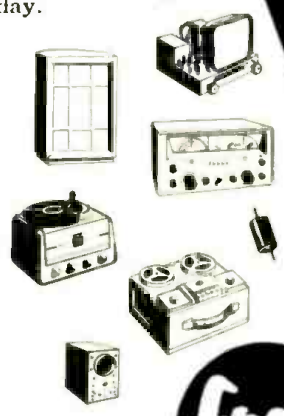

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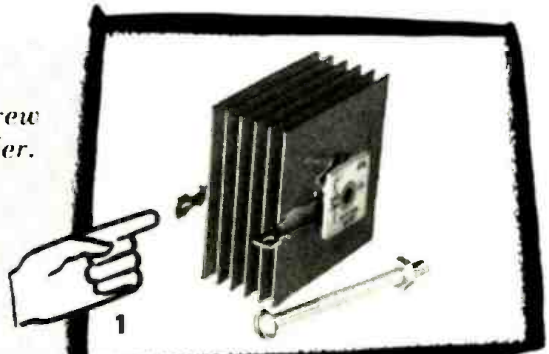

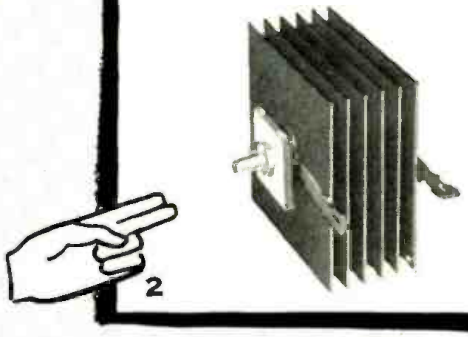

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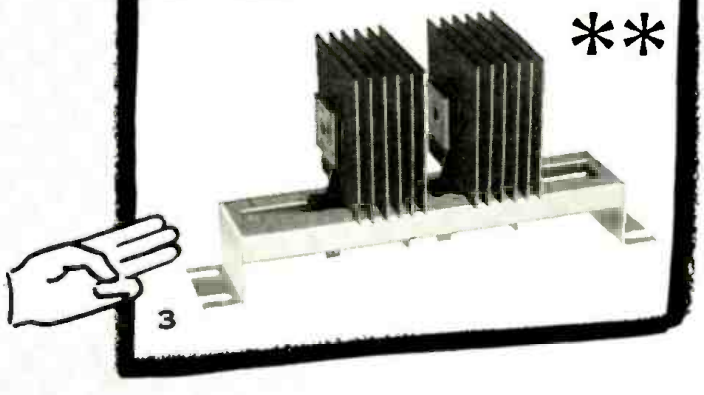

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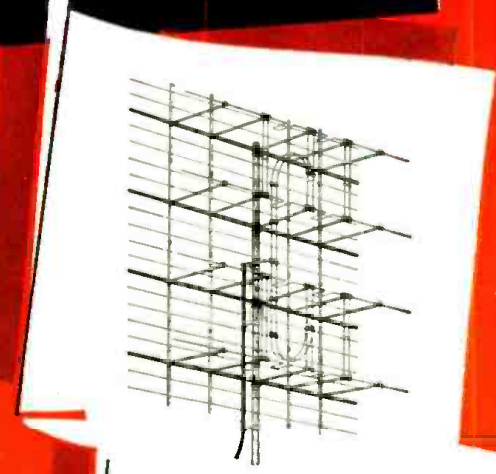

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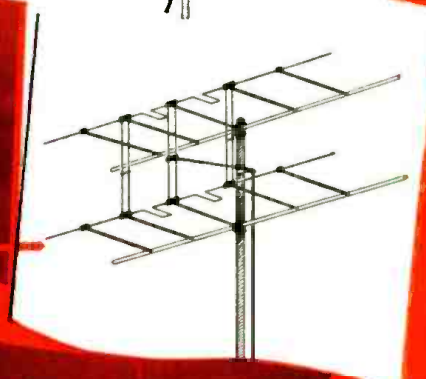

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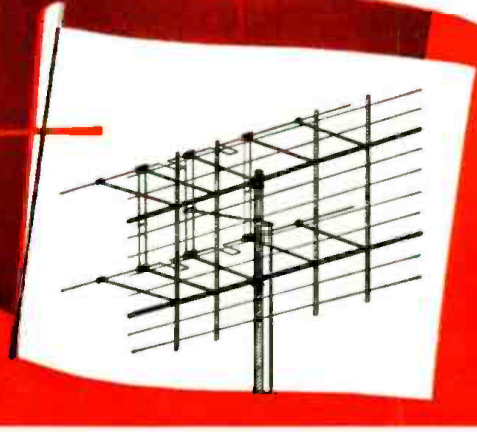

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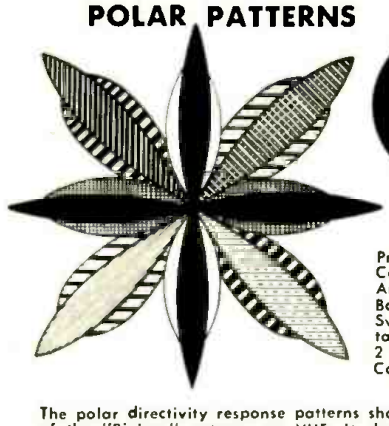
4. The antenna works on the revolutionary principle that the approaching wave front is elliptically rather than horizontally polarized.
5. The new specially designed 9 position electronic orientation switch, aside from changing directivity, maintains a consistently better impedance match over the entire UHF-VHF spectrum.
6. The above features combine to give the "Riviera" antenna greater usable gain at the TV set antenna terminals than the best of any competitive antennas using rotor motors.

This new wonder antenna, called the "Riviera", is already making history. Beyond any question of a doubt, and on an *unconditional* money back guarantee, it will positively outperform in the field under actual installation conditions, any and all competitive antennas on the VHF channels, with or without rotor motors.

POLAR PATTERNS



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Price includes: Complete Stacked Array • Stacking Bars • 9 Position Switch • Switch-to-set Coupler • 2 Stand-offs, 7½" • Complete instructions

The polar directivity response patterns show the major lobes of the "Riviera" antenna on VHF. It shows the fullness of coverage in all directions of this remarkable, patented antenna as it is turned through each of the nine switch positions. Each degree of shading constitutes a different switch position. This excellent directivity response, which can be switched at will, plus the extremely high gains, clearly indicate why the Riviera is such a superior performer.

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Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE FCC, officially without a chairman since early summer, in view of Commissioner George Sterling's retirement; now has one, George C. McConnaughey, former chairman of the Renegotiation Board. Named by the President, he will serve as a recess appointee until January, when Congress convenes. At that time, his nomination will be submitted to the Senate for confirmation; if approved he will remain on the Commission until June 30, 1957, for the unexpired portion of Sterling's term.

The new headman, a 58-year old attorney, has had extensive experience as an administrator on a number of government Commissions. For six years he was with the Public Utilities Commission, serving as a member and then as chairman. For several years, he was also chairman of the War Transportation Commission of Ohio.

Notification of the appointment was made by Presidential Assistant Sherman Adams, who phoned McConnaughey from the summer White House in Denver, Colorado. The oath of office was taken in the executive offices of Adams in the White House; it was administered by Supreme Court Justice Harold H. Burton, a fellow Ohioan.

Technically, the new FCC chief succeeds Rosel H. Hyde, who had been named chairman by the President on April 18, '53, for a one-year term. Hyde remains on the Commission and will complete his term.

ALTHOUGH THE RESIGNATION of Sterling had been expected for months, because of ill health, it was hoped that he would remain on the Commission. However, upon recommendation of his physician and at the request of his family, he decided to retire.

Everyone in Washington and throughout industry will miss the keen intellect of this brilliant engineer and able administrator. His career in Washington was an outstanding one. Before his appointment to the Commission, he served as chief engineer of that body, and during World War II, he organized the Radio Intelligence Division, and guided its operation. In addition, he served as the official security officer of the Commission. It was his familiarity with the broadcast industry and its engineering capabilities that made it possible to set up the efficient radio-silence system, known as Conelrad, in collaboration with the Office of Civilian Defense.

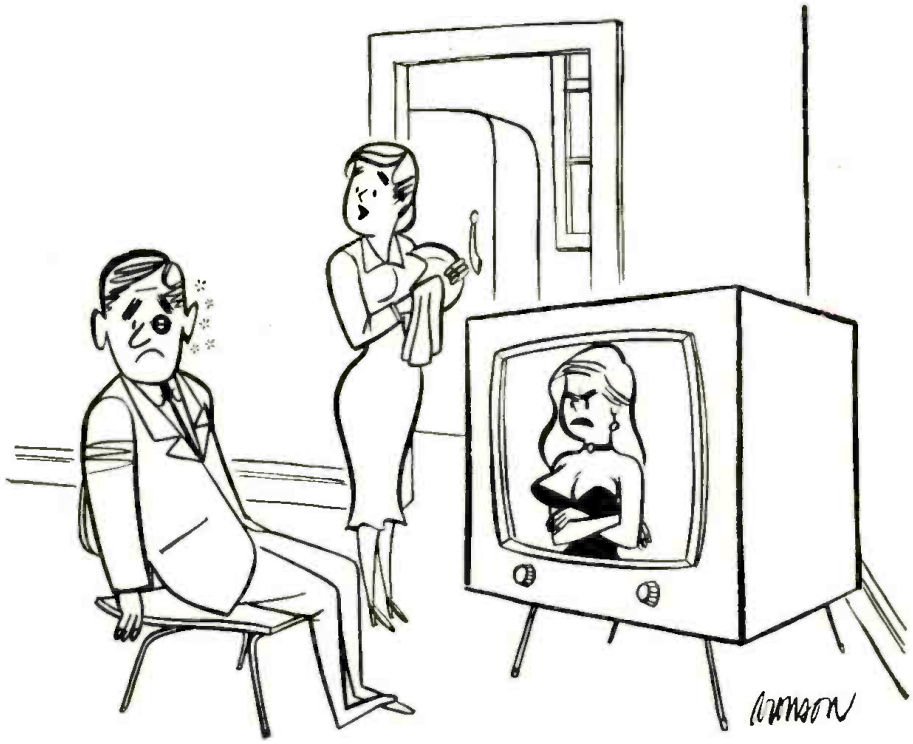
The genuine admiration of his colleagues was expressed in a glowing resolution and accompanying scroll, tendered during a special ceremony. Said the scroll, in part:

"This scroll commemorates the retirement of a beloved associate, who has proved unfailing in his loyalty to the public trust, and in his sympathy and understanding of his fellow man. . . . He brought to that office (the Commission and other Federal posts) an unprecedented experience in radio, which had its beginning in 1908, and as operator, engineer, author, and policy maker has played a prominent role in the development of the radio art. . . . His warmth, sincerity, and fundamental sense of fairness have earned him the respect and affection of all, and his distinguished career long will be an inspiration and example in the organization he served."

AN INGENIOUS ULTRASONIC photographing device, that may eventually accomplish what x-ray and fluoroscope cannot do, produce well-defined pictures of cancer and other diseases of the body's internal soft organs and tissues, has been invented by Dr. Douglass H. Howry, former Veterans Administration resident in radiology and now an instructor in radiology at the University of Colorado Medical School.

Known as the "Somascope," the instrument, in its present stage of development, can detect masses such as goiters, cysts, and tumors in the body's internal organs. In some cases, it has been found, the device helps distinguish between tumors which are dangerous or of no consequence to the patient's health.

The principles of sonar, radar, and TV have been combined in this outstanding development. From sonar, the unit borrows the principle of sending sound waves through the water and receiving echoes, or the up-and-down principle of ultrasonic sound transmission. From radar, the basis of back-and-forth scanning has been taken, and from television, the medical



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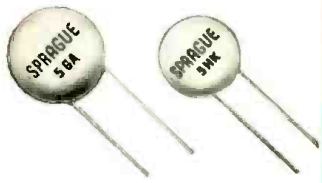

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*Distributors' Division of Sprague Electric Company

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aid has borrowed the principle of defining these up-and-down and back-and-forth impulses on a TV screen.

Since sonar requires water to function properly, the human subject is placed in a tub of water where ultra-high sound waves are produced. With the instrument aimed at the internal organ to be photographed, the flip of a switch produces a short impulse of electrical energy, almost as powerful as that coming from a 50,000-watt transmitter, but lasting only a quarter of a millionth of a second.

This high-voltage energy passes into a sound head of the instrument, which contains a barium-titanate ultrasonic crystal. Here the electrical energy is converted into sound waves which travel 5000 feet a second.

By the use of ultrasonic sound lenses, these waves are concentrated into a narrow beam of inaudible sound, one-sixteenth of an inch wide to improve definition, and are directed through the water into the object to be examined.

As these water-borne sound waves strike the surface of the object, the VA medical-electronics expert pointed out, an echo is reflected back to the sound head. The remainder of the sound pulse penetrates the object, and further echoes are reflected back by different tissues or other objects, with an intensity in proportion to the density of these structures. These echo waves are then picked up by the sound head, converted back into a train of electrical signals which are amplified and passed into the picture tube, producing a line of bright spots on the screen face. As soon as all of the echoes have returned, another electrical blast sends another series of sound waves out, and the process is repeated with another line on the TV screen. Thousands of pulses are generated in this manner every second.

The "Somascope's" under-water sound head, mounted on a revolving screw and sweeping back and forth across the object to be photographed, causes the sound beam to scan the object from rapidly-changing positions. This radar-scanning motion causes each pulse of waves to take a slightly different path through the object or tissue to produce a series of lines, one next to the other. In that manner, a two-dimensional picture is drawn in the exact shape and dimensions of the object being studied.

It was also disclosed that tissues with different consistencies have a marked difference in reflecting sound waves as, for example, fat; whereas x-ray best differentiates bone or air-filled organs, like the lungs.

Another advantage of this new instrument, it was revealed, is that it can rotate the picture on the TV screen from zero to ninety degrees. This makes it possible to see the tissue being studied as if it were a transparent block-like segment, viewed from any desired angle from above or from the front.

(*Continued on page* 135)

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Four hundred and six stations are on the air! Many more are building or in the plans stage; 32,859,915 sets are in use. Color TV is just starting to really come alive! This same phenomenal growth picture is repeated in every phase of business employing electronics — crime prevention, aeronautics, fire-fighting, communications, to name but a few. CREI has the plan to keep you moving upward, to help you assume your rightful place!

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The big companies know CREI men have what it takes! CREI grads are at work in America's biggest corporations, in positions ranging from technicians to engineers to top management. Companies such as United Air Lines, Canadian Broadcasting Corporation, Trans-Canada Airlines, Sears-Roebuck and Co., Bendix Products Division, All-American Cables and Radio, Inc., and Radio Corporation of America, are now paying for CREI training for their own technical staffs. Our placement bureau has more requests for CREI-trained men than we can presently supply.

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You start feeling the benefits of CREI training right away, either with your present connection, or with a future employer. You'll have all the training you need to secure your FCC commercial license.

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"—I know of no case in which a man who applied himself and completed the CREI course failed to better himself through promotion and increase in salary." . . . —Wendell L. Fraser, San Diego, Calif.

"—CREI has raised me to professional status as a radioman. Thanks to your instructors who always gave me needed help." —Victor Mentzer, Wilmington, Del.

"—I have been in radio and electronics for 24 years. I fully recommend CREI as the best school I have seen." —L. McManus, Montreal, Canada

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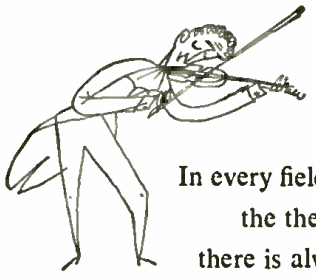
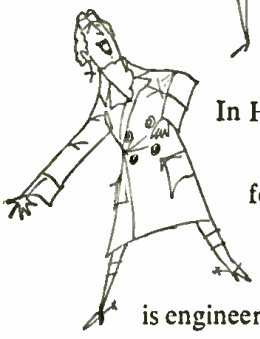


In every field of endeavor . . . manufacturing, the theatre, concert or contest . . . there is always one standout.



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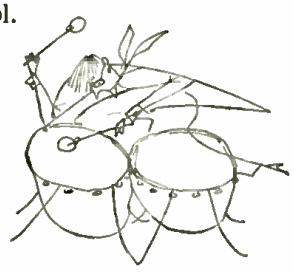

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40 years of success
training men at
home in spare time.

I Will Train You at Home
for Good Pay Jobs, Success in
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Practice Broadcasting with Equipment I Send

As part of my Communications Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at the left. You use it to get practical experience putting a station "on the air," performing procedures demanded of Broadcasting Station Operators. An FCC Commercial Operator's License can be your ticket to a better job and a bright future; my Communications Course gives you the training you need to get your license. Mail card below and see in my book other valuable equipment you build.

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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 furnish to build many circuits common to Radio and Television. With my Servicing Course you build a modern Radio (shown at right). You build a Multitester which you use to help fix sets while training. Many students make $10, $15 a week extra fixing sets in spare time starting a few months after enrolling. All equipment is yours to keep. Card below will bring book showing other equipment you build.

Television is Growing Fast Making New Jobs, Prosperity

More than 25 million homes now have Television sets and thousands more are being sold every week. Well trained men are needed to make, install, service TV sets. About 200 television stations on the air with hundreds more being built. Think of the good job opportunities here for qualified technicians, operators, etc. If you're looking for opportunity get started now learning Radio-Television at home in spare time. Cut out and mail postage free card. J. E. Smith, President, National Radio Institute, Washington, D. C. OUR 40TH YEAR.

AVAILABLE TO VETERANS UNDER G.I. BILL

Good Jobs, Good Pay, Success in Radio-TV! *SEE OTHER SIDE*

CUT OUT AND MAIL THIS CARD NOW

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This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive my 64-Page Book, "How to Be a Success in Radio-Television." Mail card now!

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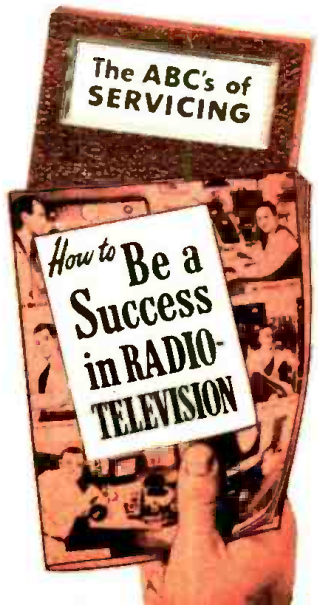

Train at Home to Jump Your Pay as a RADIO-TV Technician

J. E. Smith, *President*
National Radio Institute

The men whose messages are published below were not born successful. Not so long ago they were doing exactly as you are now . . . reading my ad! They decided they should KNOW MORE . . . so they could EARN MORE . . . so they acted! Mail card below now.

Get a Better Job—Be Ready for a Brighter Future in America's Fast Growing Industry

Training PLUS opportunity is the PERFECT COMBINATION for job security, good pay, advancement. When times are good, the trained man makes the BETTER PAY, GETS PROMOTED. When jobs are scarce, the trained man enjoys GREATER SECURITY. NRI training can help assure you and your family more of the better things of life.

Radio-Television is today's opportunity field. Even without Television, Radio is bigger than ever before. Over 3,000 Radio Broadcasting Stations on the air; more than 115 million home and Automobile Radios are in use. Then add Television. Television Broadcast Stations extend from coast to coast now with over 25 million Television sets already in use. There are channels for 1,800 more Television Stations. Use of Aviation and Police Radio, Micro-Wave Relay, Two-way Radio communication for buses, taxis, trucks, etc. is expanding. New uses for Radio-Television principles coming in Industry, Government, Communications and Homes.

My Training is Up-to-Date You Learn by Practicing

Get the benefit of my 40 years experience training men. My well-illustrated lessons give you the basic principles you must have to assure continued success. Skillfully developed kits of parts I furnish "bring to life" the principles you learn from my lessons. Read more about equipment you get on other side of this page.

Naturally, my training includes Television. I have, over the years, added more and more Television information to my courses. The equipment I furnish students gives experience on circuits common to BOTH Radio and Television.

Find Out About the Tested Way to Better Pay

Read at the right how just a few of my students made out who acted to get the better things of life. Read how NRI students earn $10. $15 a week extra fixing Radios in spare time starting soon after enrolling. Read how my graduates start their own businesses. Then take the next step—mail card below.

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Start Soon to Make $10 to $15 a Week Extra Fixing Sets

Keep your job while training. Many NRI students make $10, $15 and more a week extra fixing neighbors' Radios in spare time, starting a few months after enrolling. I start sending you special booklets that show you how to fix sets, the day you enroll. The multitester you build with parts I furnish helps discover and correct troubles.

SEE OTHER SIDE

I TRAINED THESE MEN

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"I received my license and worked on ships. Now with WEAN as control operator. NRI course is complete." R. Arnold, Rumford, R. I.

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"Doing Radio and Television servicing full time. Have my own shop. I owe my success to NRI." Curtis Stath, Fort Madison, Iowa.

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"Am chief Radio and Television serviceman for large repair shop. Pay very good; working conditions pleasant." P. G. Brogan, Louisville, Ky.

Got First Job Thru NRI

"My first job was with KDLR. Now Chief Engr. of Radio Equipment for Police and Fire Dept." T. Norton, Hamilton, Ohio.

My Training Leads to Jobs Like These

BROADCASTING
Chief Technician
Chief Operator
Power Monitor
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SERVICING
Home and Auto Radios
P.A. Systems
Television Receivers
Electronic Controls
FM Radios

IN RADIO PLANTS
Design Assistant
Transmitter Design Technician
Service Manager
Tester
Serviceman
Research Assistant

SHIP AND HARBOR RADIO
Chief Operator
Assistant Operator
Radiotelephone Operator

GOVERNMENT RADIO
Operator in Army, Navy, Marine Corps, Coast Guard
Forestry Service Dispatcher
Airways Radio Operator

AVIATION RADIO
Plane Radio Operator
Transmitter Technician
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Many NRI trained men start their own successful Radio-Television sales and service business with capital earned in spare time. Joe Travers, a graduate of mine, in Asbury Park, N. J., writes: "I've come a long way in Radio and Television since graduating. Have my own business on Main Street."

Giving coils a high IQ*...

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Each RF and IF coil is wound under the supervision of a skilled operator, and each is tested at several points along the production line. This painstaking care is what gives a high IQ to Delco Radio Coils.

*INBUILT QUALITY. The "Q" of a coil affects its performance in the circuit, and is of vital importance to the radio engineer. The "*I Q*" of all RF and IF coils used for servicing is of equal importance to you, and can mean real customer satisfaction. To assure high *I Q*, Delco Radio carefully controls the production of all RF and IF coils—both original equipment and replacement coils.

If you could visit the Delco Radio plant, you would see skilled operators sitting at expensive specially designed machines winding high-quality coils. On the production line, these coils are assembled with their powdered iron cores and shield cans. By controlling all steps of the production, Delco Radio gives its coils not only the required *Q*, but also the highest possible *I Q—Inbuilt Quality*. Delco Radio parts are available through your UMS Delco Electronics Distributor.

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DISTRIBUTED BY ELECTRONIC PARTS DISTRIBUTORS EVERYWHERE

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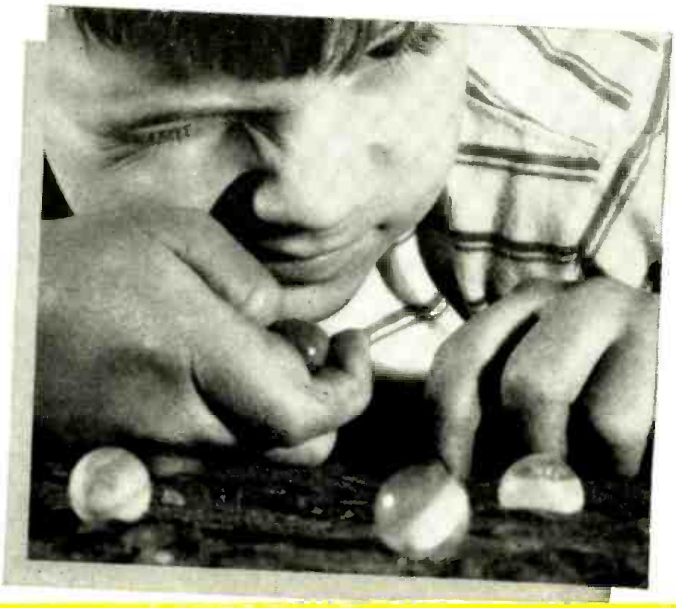
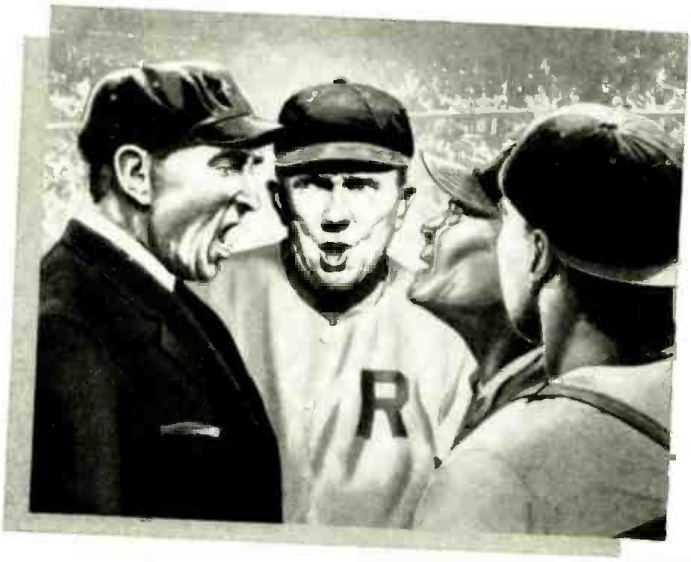
DIVISION OF GENERAL MOTORS CORPORATION, KOKOMO, INDIANA



=SERIOUS SERVICEMEN= DRAW A BEAD ON QUALITY,=



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GOOD JOBS AWAIT THE TRAINED RADIO-TV TECHNICIAN

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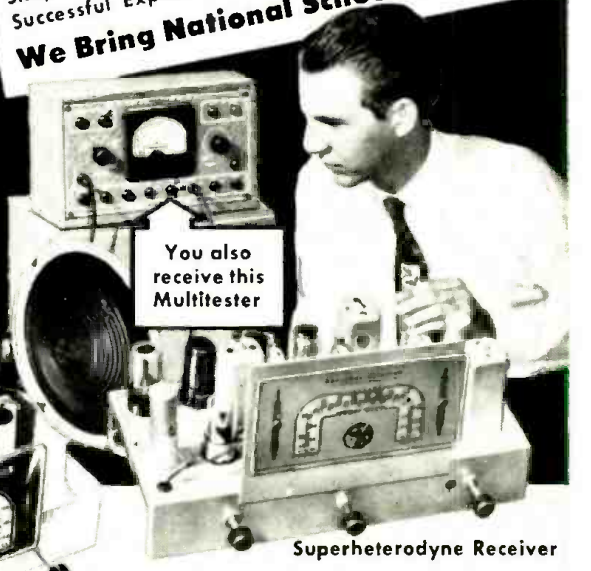
EARN WHILE YOU LEARN

Many National students pay for all or part of their training with spare time earnings. We'll show you how you can do the same! Early in your training, you receive "Spare-time Work" Lessons which will enable you to earn extra money servicing neighbors' and friends' Radio and Television receivers, appliances, etc.

MASTER ALL PHASES!

Get Master Shop-Method Home Training from an Established Practical Resident School with its own Training Shops, Laboratories, Studios — almost 50 Years of Successful Experience in Training Ambitious Men.

We Bring National Schools To You!



Superheterodyne Receiver

T. R. F. Receiver

Signal Generator

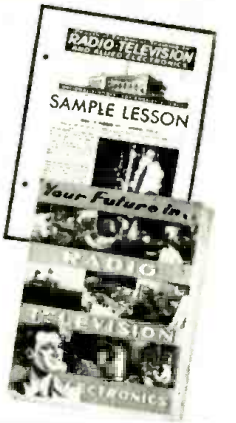
Audio Oscillator

LEARN BY DOING

You receive and keep all the modern equipment shown above, including tubes and valuable, professional quality Multitester. *No extra charges.*

FREE! RADIO-TV BOOK AND SAMPLE LESSON!

Send *today* for National Schools' new, illustrated Book of Opportunity in Radio-Television-Electronics, and an actual Sample Lesson. No cost—no obligation. Use the coupon now—we'll answer by return airmail.



National Schools Training is All-Embracing

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:

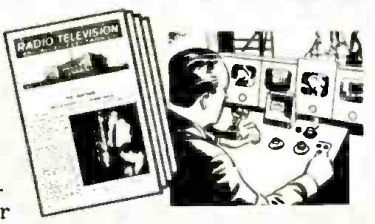
Business of Your Own • Broadcasting
Radio Manufacturing, Sales, Service • Telecasting
Television Manufacturing, Sales, Service
Laboratories: Installation, Maintenance of Electronic Equipment
Electrolysis, Call Systems
Garages: Auto Radio Sales, Service
Sound Systems and Telephone Companies, Engineering Firms
Theatre Sound Systems, Police Radio
And scores of other good jobs in many related fields.

APPROVED FOR VETERANS AND NON-VETERANS
Check coupon below

Both Resident and Home Study Courses Offered!

TELEVISION TRAINING

You get a complete series of up-to-the-minute lessons covering all phases of repairing, servicing and construction. The same lesson texts used by resident students in our modern and complete Television broadcast studios, laboratories and classrooms!



NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA • ESTABLISHED 1905
IN CANADA: 811 W. HASTINGS STREET, VANCOUVER, B.C.

GET FACTS FASTEST! MAIL TO OFFICE NEAREST YOU!

(mail in envelope or paste on postal card)

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4000 S. Figueroa Street, Los Angeles 37, Calif. — or — 323 West Polk Street, Chicago 7, Ill.

Send FREE Radio-TV Electronics book and FREE sample lesson. No obligation, no salesman will call.

NAME _____ BIRTHDAY _____ 19____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

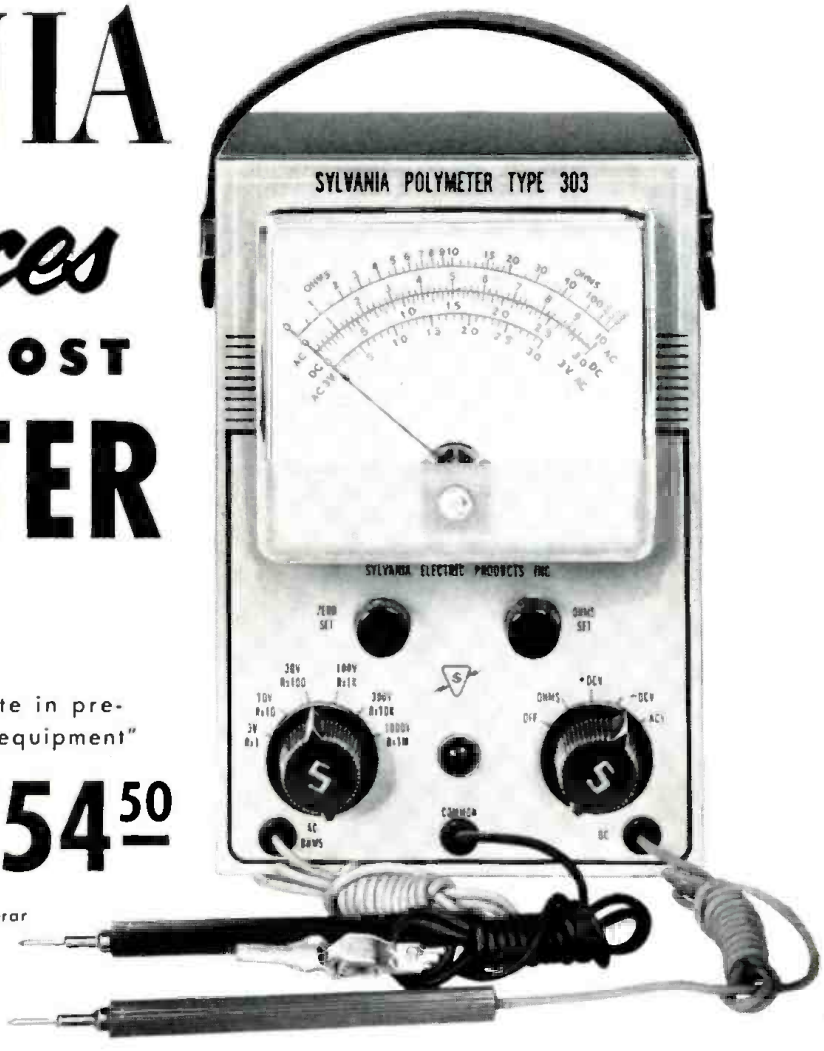
☐ Check here if interested in Resident School Training at Los Angeles.

VETERANS: Give Date of Discharge _____

SYLVANIA *Announces*

A NEW LOW COST

POLYMETER



The TYPE 303

"the ultimate in precision test equipment"

for only **$54.50**

Engineered by Sylvania — styled by Sundberg-Ferar

An outstanding POLYMETER of compactness and quality that was engineered for your every day use. This new low cost instrument is "a must" for all who are skilled in the field of electronics.

FEATURES THAT YOU NEED!

Designed to aid the serviceman in "on-location" servicing

- ✓ Six DC Ranges.
- ✓ Six AC Ranges.
- ✓ Six Resistance Ranges.
- ✓ Permanently Attached Leads.
- ✓ 10 Megohm Input Resistance.
- ✓ High Tolerance Components.
- ✓ Utility Size.
- ✓ Clear Plastic Meter Case.

Sylvania again leads the nation with a complete line of Polymeters to meet your every need. The Type 303, the "mighty-mite" of the line is a compact, portable unit in every sense. It was designed when the need of a highly accurate, low cost and extremely readable meter was called for by those who are daily engaged in making measurements on electronic equipment. This modestly priced instrument with permanently attached leads and clear plastic meter case assures speedy, accurate workmanship. The Type 303 is professionally styled to inspire customer confidence in your equipment and service.

Available through your SYLVANIA RADIO TUBE DISTRIBUTOR

SYLVANIA

TEST EQUIPMENT

Sylvania Electric Products Inc., 1221 W. Third St., Williamsport, Pa.

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catharine St., Montreal, P. Q.

RADIO • TELEVISION • LIGHTING • ELECTRONICS

VETERANS! NON-VETERANS!

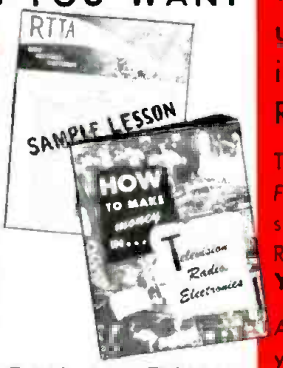
MY FREE LESSON

MAY CHANGE YOUR ENTIRE LIFE

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

THREE COURSES TO TRAIN YOU FOR THE JOB YOU WANT

RADIO-FM-TELEVISION TECHNICIAN COURSE — No previous experience necessary. You learn by practicing with the professional equipment I send you. Many of my graduates now have good paying technician jobs with such firms as RCA, NBC-TV, Dumont TV and numerous other TV Studios and plants.



FM-TV TECHNICIAN COURSE — Previous training or experience in radio required. You can save months of time if you have previous Armed Forces or civilian radio experience! Train at home with kits of parts, plus equipment to build BIG SCREEN TV RECEIVER. ALL FURNISHED AT NO EXTRA COST!

EXTRA TRAINING IN NEW YORK CITY AT NO ADDITIONAL COST — After you finish your home study training in either of these two courses, you get two weeks, 50 hours, of intensive Laboratory work on modern electronic equipment at our associate school in New York City, Pierce School of Radio & Television. **THIS EXTRA TRAINING IS YOURS AT NO EXTRA COST WHATSOEVER.** My courses are complete without this extra training, but it gives you added opportunity for review and practice.

TV CAMERAMAN AND STUDIO TECHNICIAN COURSE — Advanced training for men with radio or TV training or experience. I train you at home for an exciting high pay job as the man behind the TV camera.

VETERANS

My school fully approved to train Veterans under New Korean G. I. Bill. Available only to Veterans discharged after August 20, 1951. If eligible, CHECK COUPON!

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

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

ENOUGH EQUIPMENT TO SET UP YOUR OWN HOME LABORATORY

With the equipment I send you as part of your course you BUILD and KEEP a professional GIANT SCREEN TV RECEIVER complete with big picture tube (takes any size up to 21-inch) . . . also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes. My practical, easy-to-understand lessons have brought success to hundreds of men. You, too, can train for a **better-paying job or set up a business of your own if you act NOW!**

Radio Television Training Association

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

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

Just by clipping the coupon below and sending it to me today, you can open up a whole new future for yourself in America's fastest-growing field — Radio-Television-Electronics.

The very day I receive your coupon I will send to you Free a Sample Lesson and my New 36-page Book showing you "How to Make Money in Television, Radio, Electronics" by **STUDYING AT HOME IN YOUR SPARE TIME.**

At absolutely no cost or obligation you can see for yourself how you can begin how to prepare yourself for a better-paying career as a TV repairman, studio technician, cameraman or any one of the many promising jobs in the field that is bringing success and security to hundreds of men — many of them with no more than grammar school education and **no experience whatsoever.**

If you think I was exaggerating when I said, "My Free Lesson May Change Your Entire Life," just see what some of my graduates say about my training —

"RTTA training gave me the skill and know-how to do the work I love best and enjoy better things in life."
Harold Gimlen
Flint, Michigan

"If it had not been for you, your instructors and the school, I never would have had this opportunity."
J. A. Irwin
Radio-TV Repairman
Coburg, Ont., Canada

"I know I would not have achieved this progress if it weren't for the help and guidance from RTTA."
Edward Breault
Chief Radar Operator
National Guard
Central Falls, R. I.

These letters and many more like them are in my files. The TV Boom that brought good opportunities to these RTTA graduates is still on with no sign of letting up. Don't let opportunity pass you by. Write today for your Sample Lesson, new 36-page book, TV Job Opportunities List, and 48-state list of future TV stations — **ALL FREE!**

MAIL THIS COUPON TODAY!

Mr. Leonard C. Lane, President — Dept. T-12
RADIO-TELEVISION TRAINING ASSOCIATION
52 East 19th Street, New York 3, N. Y.

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)

Name _____ Age _____

Address _____

City _____ Zone _____ State _____

I AM INTERESTED IN:

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

VETERANS! Check here ☐ for Training under NEW G.I. Bill

NO SALESMAN WILL CALL!

He's using the telephone that lends an extra hand

"Sure . . . I'm looking up the figures right now!" From busy executives to clerks, people in business can work more easily and efficiently with Bell's new Distant Talking Telephone. Small white rectangle is the loudspeaker.

For people who want to keep *both* hands free when they telephone, Bell Telephone Laboratories engineers have devised a new telephone with a sensitive microphone in its base.

To use it, simply press a button. The microphone picks up your voice and sends it on its way. Your party's voice comes to you through a small loudspeaker. Both hands are left free.

The volume can be adjusted to suit yourself. If privacy is needed, you simply lift the handset; this shuts off the microphone and loudspeaker and you talk just as you would on a regular telephone.

This new development of Bell Laboratories increases the number of ways your local Bell telephone company can serve in businesses and homes.

Pencil points to microphone in base of new telephone. Left-hand button controls volume, center one turns set "on" and lights up while in use. The third is an "off" button.

Bell Telephone Laboratories

Improving telephone service for America provides careers for creative men in scientific and technical fields.

FREE

MONEY MAKING

FCC

Commercial·Radio Operator

LICENSE

INFORMATION

TELLS HOW—

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.

TV Engineering INCLUDED IN OUR TRAINING AND COACHING

Here is your guarantee

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, provided you first sit for this examination within 90 days after completing your course.

TELLS HOW—

OUR AMAZINGLY EFFECTIVE JOB-FINDING SERVICE HELPS CIRE STUDENTS GET BETTER JOBS. HERE ARE JUST A FEW RECENT EXAMPLES OF JOB-FINDING RESULTS:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license and am now employed by Civil Service at Great Lakes Naval Training Station as an Equipment Specialist."
Kenneth R. Leiser, Fair Oaks, Mtd. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky State Police." Edwin Healy 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

"I wish to thank your Job-Finding Service for the help in securing for me the position of transmitter operator here at WCAE, in Pittsburgh."
Walter Koschik, 1442 Ridge Ave., N. Braddock, Pa.

GETS AIRLINES JOB

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

TELLS HOW—

EMPLOYERS MAKE JOB OFFERS LIKE THESE TO OUR GRADUATES EVERY MONTH!

Letter from nationally-known Airlines. "We would also appreciate if you would place the following additional advertisement in your bulletin: 'Wanted—Superintendent of Communications . . . Salary $866.66 per month.'"

Letter from nationally-known airplane manufacturer. "We need men with electronic training or experience in radar maintenance to perform operational check-out of radar and other electronics systems . . . starting salary . . . amounting to $529.33 per month."

Letter from nationally-known Airlines. "We are contemplating placing . . . an Airline Ground Radio Engineer." Starting salary $385 per month.

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

Ours is the only home study course which supplies FCC-type examinations with all lessons and final tests.

ACT NOW! Get ALL 3 FREE

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	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, Cal.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell, 110 West 11th St., Escondido, Cal.	2nd Phone	23

CARL E. SMITH, E. E. Consulting Engineer, President

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Desk RN-71, 4900 Euclid Bldg., Cleveland 3, Ohio

Your FCC Ticket is recognized by most employers in the electronic field as proof of your technical ability.

MAIL COUPON NOW!

Cleveland Institute of Radio Electronics
Desk RN-71—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

B I want to know how I can get my FCC Ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the amazing new booklet, "Money-Making FCC License Information."

Be sure to tell me about your Television Engineering Course.

Name.....

Address.....

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

FOR PROMPT RESULTS, SEND AIR MAIL
Special tuition rates to member of the U.S. Armed Forces

Within the INDUSTRY

NATHANIEL B. NICHOLS, manager of *Raytheon's* research division, has been appointed assistant vice-president of the firm.

Mr. Nichols, an authority in the fields of servomechanisms and electronics automation, joined the Waltham firm in 1951. He helped to develop several of the company's unusual products, leading his scientific group through the investigative phases of work that eventually made possible the mass production of transistors.

He is a member of the IRE, Instrument Society of America, American Physical Society, American Chemical Society, AIEE, and other professional groups.

* * *

DOUGLAS Y. SMITH has been elected vice-president and general manager of *RCA's* Tube Division. He was formerly general marketing manager of the division . . . **RONALD E. VEDDER** is the new supervisor of sales training for the radio and television division of *Sylvania Electric Products Inc.* . . . The appointment of **J. J. LANGLOIS** as general sales manager has been announced by *General Dry Batteries, Inc.* of Cleveland. He was formerly associated with *Remington Rand, Inc.* for 28 years . . . **GENE MILLER** has been named to the post of advertising and sales promotion manager for *V-M Corporation,* phonograph, record changer, and tape recorder manufacturer . . . **B. V. K. FRENCH** has been appointed to the post of service manager for the *Regency Division* of *I.D.E.A., Inc.* He will be in charge of all technical writing and correspondence on service problems . . . **DR. V. K. ZWORYKIN,** television pioneer and inventor, has retired as vice-president and technical consultant for *RCA Laboratories* and has been elected as the first honorary vice-president in the Corporation's history in recognition of his epoch-making achievements in the fields of television and electronics. He was associated with *Westinghouse* before joining *RCA* in 1930 . . . **CARROLL W. HOSHOUR** has been named products manager for *Magnecord, Inc.* He will be in charge of sales engineering, quality control, product service, and technical sales promotion for all divisions of the company. He was formerly associated with *Raytheon* . . . **ARNOLD E. LINTON** has been appointed manager of the *RCA* tube manufacturing plant in Woodbridge, N.J. He joined the company in 1934 . . . **JACK MOORE** has been named sales manager of *Skyline Mfg. Co.,* Cleveland antenna manufacturer . . . **RALPH L. PALMER** is the new director of engineering for *International Business Machines Corporation.* He was formerly manager of the company's engineering laboratory at Poughkeepsie . . . *Krylon, Inc.* has named **DONALD K. BAXTER** to the post of sales manager. He was formerly a manufacturer's representative for the firm in the middle Atlantic states . . . *P. R. Mallory & Co. Inc.* has appointed **DOUGLAS M. CONSIDINE** to the post of sales promotion and merchandising manager. He was formerly associated with *Minneapolis-Honeywell Regulator Company* for fourteen years . . . **DOUGLAS H. CARPENTER,** chief antenna engineer for *JFD Manufacturing Company,* has been named chairman of the RETMA Antenna Committee . . . **WILLIAM A. GOTHARD** has been named president and general manager of *Gothard Manufacturing Company,* succeeding his father, **R. W. GOTHARD,** as active manager. The founder of the firm will supervise the firm's West Coast activities . . . **JULIAN K. SPRAGUE,** president of *Sprague Electric Co.,* has been named chairman of the Advisory Group on Electronic Parts of the Department of Defense . . . **FRANK ADAMS** has been named sales manager of the Mid-Atlantic division of *ORRadio Industries* with headquarters at 547 Hermitage Street in Philadelphia . . . **HAROLD J. ADLER** has been named chief engineer in charge of the color TV development program at *Lion Manufacturing Corp.* of Chicago. He was formerly associated with *Edwin I. Guthman & Co., Inc.* . . . **JOHN J. TRAVIESAS** has been upped to the post of general service manager of *United Motors Service,* succeeding **C. E. REINHARDT** who has retired.

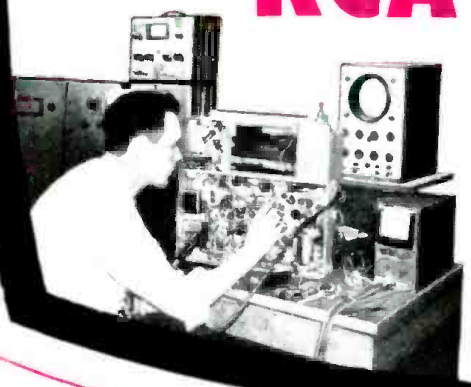
* * *

ELMER O. WILSCHKE has resigned his post as operating manager of *Altec Service Corporation* to become vice-president in charge of operations for *Fine Sound, Inc.*

Mr. Wilschke joined *Electrical Research Products, Inc.* in 1928 following an association with *Western Electric Company.* During the early days of sound motion pictures he served in various capacities in this country and abroad. Upon formation of *Altec* in 1937 he became manager of the company's division office in Philadelphia.

From 1941 to 1946, he was plants

Home Study Courses in
TELEVISION SERVICING
offered by
RCA INSTITUTES



Study Television Servicing—from the very source of the latest, up-to-the-minute TV and Color TV developments. Train under the direction of men who are experts in this field. Take advantage of this opportunity to place yourself on the road to success in television. RCA Institutes, Inc. (A Service of Radio Corporation of America), thoroughly trains you in the "why" as well as the "how" of servicing television receivers.

FIRST HOME STUDY COURSE IN COLOR TV SERVICING

Now you can train yourself to take advantage of the big future in Color TV. RCA Institutes Home Study Course covers all phases of Color TV Servicing. It is a practical down-to-earth course in basic color theory as well as how-to-do-it servicing techniques.

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

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

SEND FOR FREE BOOKLET

Mail coupon in envelope or paste on postal card. Check course you are interested in. We will send you a booklet that gives you complete information. *No salesman will call.*

RCA

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

HOME STUDY COURSE IN BLACK-AND-WHITE TV SERVICING

Thousands of men in the radio-electronics industry have successfully trained themselves as qualified specialists for a good job or a business of their own—servicing television receivers. You can do this too.

This RCA Institutes TV Servicing course gives you up-to-the-minute training and information on the very latest developments in black-and-white television.

As you study at home, in your spare time, you progress rapidly. Hundreds of pictures and diagrams, easy-to-understand lessons help you to quickly become a qualified TV serviceman.

There are ample opportunities in TV, for radio servicemen who have expert training. Mail coupon today. Start on the road to success in TV Servicing.

MAIL COUPON NOW

RCA INSTITUTES, INC.
Home Study Dept. RN-1254
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet on:

- ☐ Home Study Course in TELEVISION SERVICING.
- ☐ Home Study Course in COLOR TV SERVICING.

Name _____
(please print)

Address _____

City _____ Zone ____ State _____

manager for *Altec Lansing Corporation* in Los Angeles, returning to the *Service Corporation* in 1946 as assistant to the vice-president.

* * *

EUGENE E. BROKER has been named manager of the *Sylvania* radio tube plant at Shawnee, Oklahoma, succeeding Charles W. Hosterman who recently was named to the newly-created post of assistant general manager of the company's electronics division.

Mr. Broker joined the company in 1929 and served in various supervisory capacities in the filament department at the company's division headquarters in Emporium, Pa. until 1942 when he became supervisor of a feeder plant at Galeton, Pa.

He is a member of the American Management Association and a 25-year club member of the company. He will make his headquarters in Shawnee.

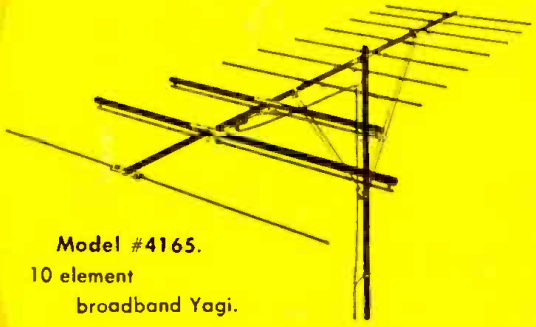
* * *

BLONDER-TONGUE LABORATORIES, INC. of Westfield, N.J. has expanded its production capacity with the opening of a second plant nearby. The company now has a total of over 50,000 square feet of space for the production of its master TV antenna systems and u.h.f. converters... **CONRAC, INC.** is building a new addition to its main manufacturing plant at Glendora, California. The new facility will provide 20 per-cent more production space for the company's line of custom TV receivers . . . **THE RADIO APPARATUS CORP.** has moved to new quarters at 7900 Pendleton Pike in Indianapolis. The company, which makes communications equipment, is an affiliate of **I.D.E.A., INC.** . . . **SIMPSON ELECTRIC CO.** of Chicago has purchased a 4-story building at 4307 W. Lake Street in Chicago. The new plant provides over 100,000 square feet and will be used for the manufacture of the company's new color TV test equipment and suspension type meter . . . **BOGUE ELECTRIC COMPANY** has opened a west coast office at 13415 Ventura Blvd., Sherman Oaks, California. Wm. J. Hopkins will head the new office . . . **RAY R. HUTMACHER ASSOCIATES, INC.** has moved into new and larger quarters at the Chicago International Building located at 6647 N. Oliphant. The firm was formerly at 644 N. Michigan . . . **GENERAL CEMENT MFG. CO.** and **TELEVISION HARDWARE MFG. CO.** of Rockford, Ill. are completing two new plant additions which will add 10,000 and 25,000 square feet to their plants #1 and #2 respectively . . . **SERVOMECHANISMS, INC.** has broken ground for the construction of its seventh plant at 12500 S. Aviation Blvd. at the Los Angeles International Airport. The plant will be ready for operation in the Spring . . . Two new buildings totaling 6000 square feet have been added to the Metuchen, N.J. plant of **GULTON INDUSTRIES, INC.**

(*Continued on page* 158)

A new standard in electrical and mechanical perfection in all 32 new YAGI antennas

Featuring the new WALSCO "Octopus" **Model #4110.** A combination Yagi-conical for superlative all-channel reception.

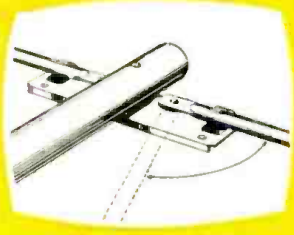


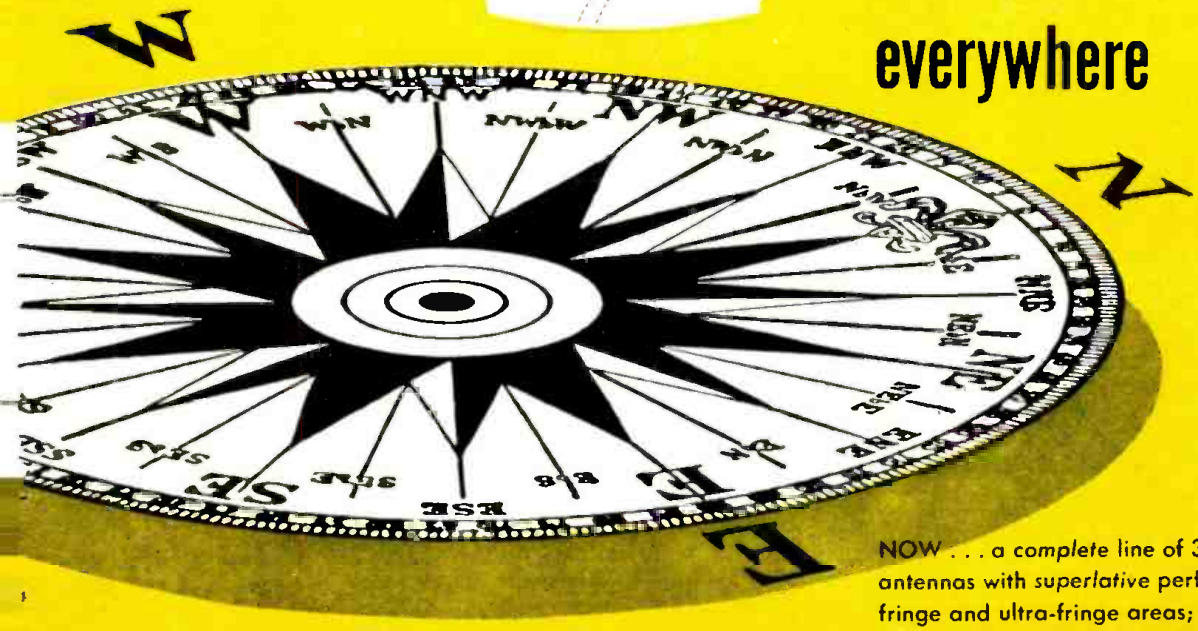
Model #4165. 10 element broadband Yagi.

WALSCO "futurized" YAGIS reach everywhere

Model #4160 series. 5 element, single channel Yagis.

Walsco's exclusive "umbrella" snap-out design provides perfect element alignment instantly.





NOW . . . a *complete* line of 32 "futurized" Yagi antennas with *superlative* performance . . . for fringe and ultra-fringe areas; for black and white and color on all present and future channels. No loose hardware . . . completely pre-assembled using Walsco's exclusive "umbrella" snap-out design. Nothing compares at any price!

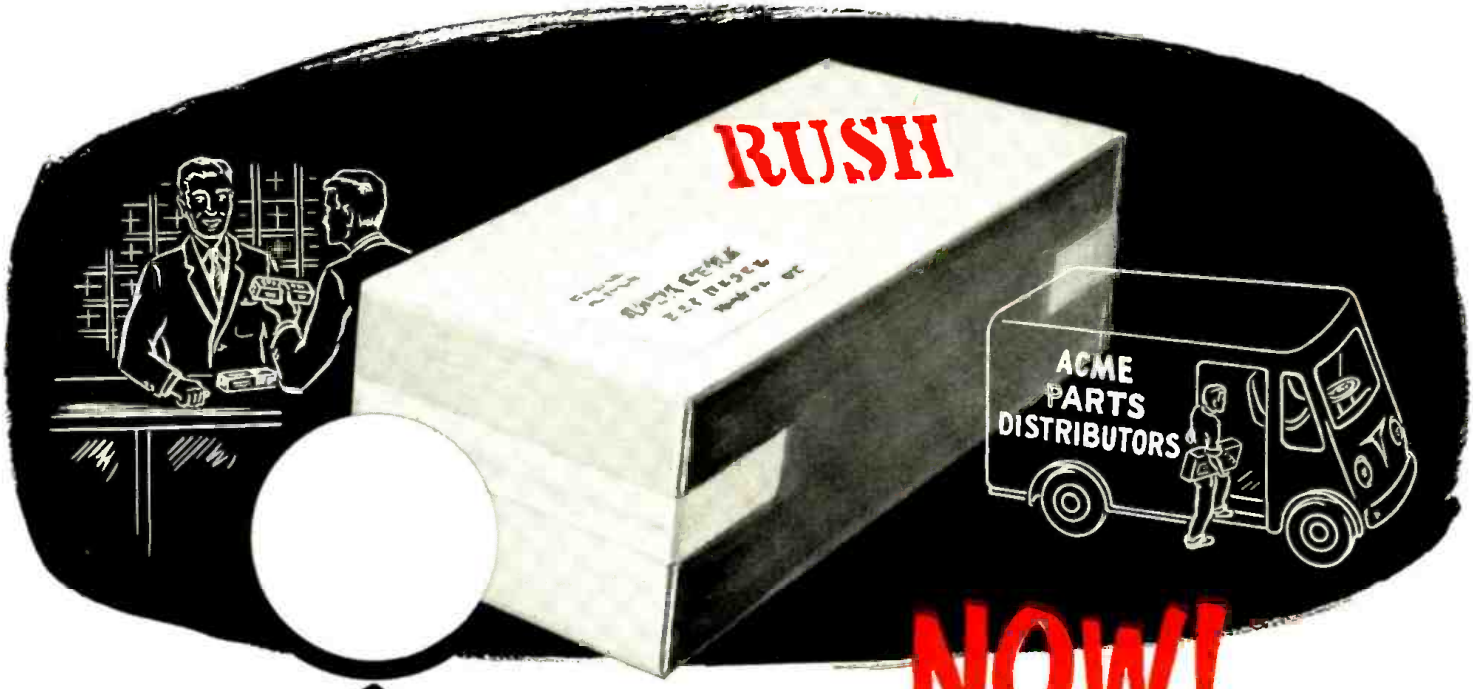
Write for complete information on all 32 "futurized" Yagi models

Walsco

ELECTRONICS CORPORATION

3602 Crenshaw Blvd. • Los Angeles 16, California

Overseas Distributor:
Ad Auriema, Inc. • 89 Broad St., New York 4, N.Y.



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Leading Distributors Stock Them!

for
SERVICE
EXPERIMENTAL
INDUSTRIAL
and MILITARY
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Now, for the first time, you can get these famous original equipment favorites in lots up to 1,000—fast and economically from local parts distributors. Previously sold to the world's leading manufacturers *only*, in huge production quantities, these Stackpole components are now available from selected distributors in the same quality that has made them favorites for over 25 years.

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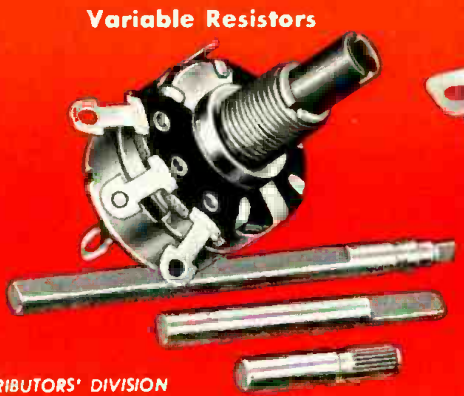

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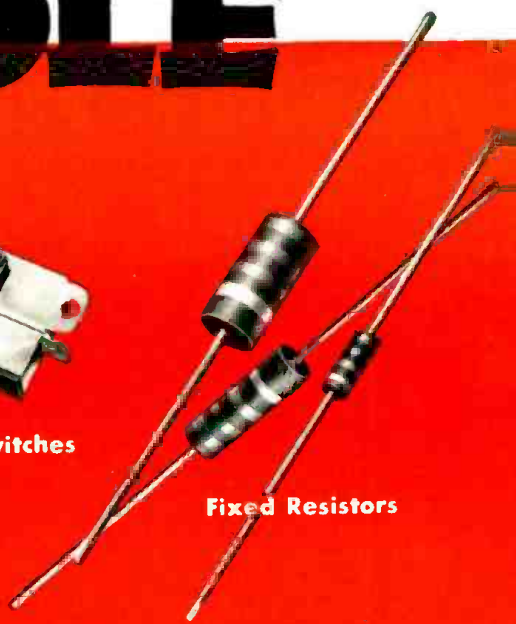

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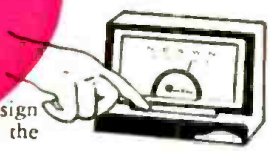

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Sealed power drive unit eliminates the former need of dismantling the antenna when servicing. Simply loosen 3 screws to remove the sealed unit.

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Supports direct dead weight load of largest stacked array. Resists downthrust and bending moment. Built-in thrust bearings. No extra parts to buy. No breakable offset bearings.

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Safely protects Roto-King en route . . . eases on-the-job carrying of units . . . comes in handy in the shop or around the home. A JFD merchandising extra at no extra cost.

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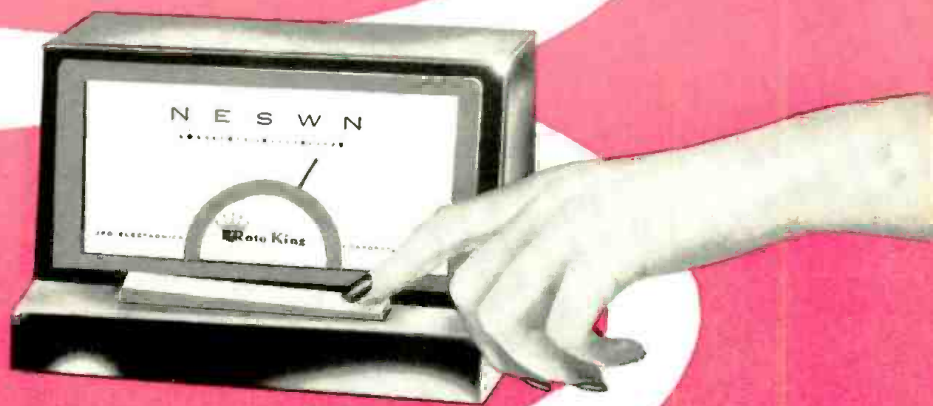

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PROVED PACE SETTERS— G.E.'s FIRST 6 SERVICE-DESIGNED TUBES!

NEW 1B3-GT
Does a superior job far longer. Special lead glass wards off electrolysis and air-leakage. New ring around filament stops "bowing" and the filament burnouts that result.

NEW 5U4-GA
Huskier. New mica supports, at both top and bottom. New straight-side glass bulb. New double-fin plate, new button-stem base with the many advantages of this construction.

NEW 5Y3-GT
New sturdiness, new long life. Mica supports now brace tube structure at both top and bottom. Double-fin heat-dissipating plate construction. New button-stem base.

NEW 6BQ6-GA
Runs far cooler, because of larger bulb. Handles higher pulse plate voltages. High-melting-point solder keeps cap-terminal in place when removing tube for testing.

NEW 25BQ6-GA
Runs cooler. Handles higher pulse plate voltages. Same extensive improvements as new 6BQ6-GA, including larger bulb, high-melting-point solder for cap-terminal, etc.

NEW SERVICE-DESIGNED 12SN7-GTA

Side-by-side X-ray pictures at right show that G.E.'s new SERVICE-DESIGNED 12SN7-GTA is smaller (28% less bulb height) than ordinary 12SN7-GT's . . . sturdier . . . with the many advantages which button-stem base construction offers.

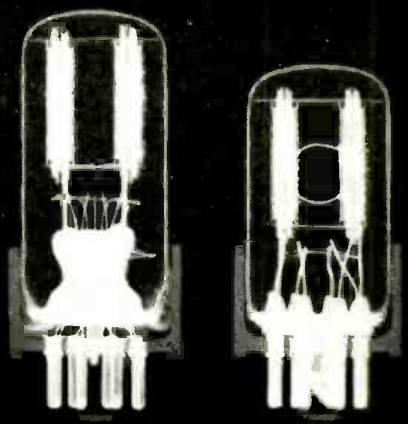
Comparison with the prototype's pressed-stem base, shows that the tube leads now pass through individual seals at bottom of envelope. Prevents loose bases . . . gives shorter leads and better lead separation . . . and brings about better heat conduction, reducing electrolysis and tube leakage. *You get a longer-lived tube than ever before.*

Tube ratings have been substantially increased. Compare below:

	Old 12SN7-GT	New 12SN7-GTA
Max plate voltage	300 v	450 v
Max plate dissip. per plate	3½ w	5 w

And the new 12SN7-GTA is specially tested for dependable operation in all synchro-guide and other circuits! *Every tube* gets a "chopper" pulse test, made at the lowest TV line voltages that will be encountered.

INSIDE STORY of more compact design, new button-stem base!



OLD 12SN7-GT NEW 12SN7-GTA

NEW SERVICE-DESIGNED 6AX4-GT

1. A new "pigtail" winding guards against heater-cathode shorts by interposing a separate insulated barrier between heater wire and cathode. This is much more efficient than other insulating methods used before. *Tube failures are greatly reduced.*

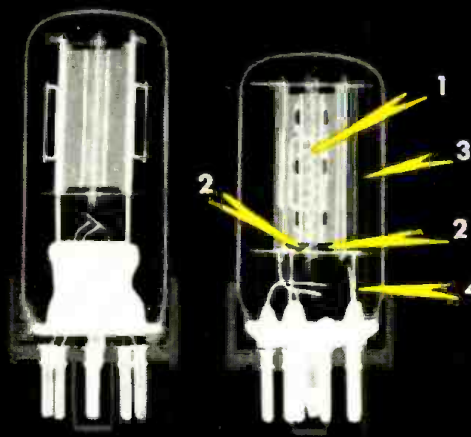
2. Two design features cut down on plate-cathode arc-overs. The plate is notched to avoid any contact with mica spacers in the critical plate-cathode areas. Also, micas are slotted to set up barriers to electrical conduction. Result: *fewer fuse blow-outs in horizontal-deflection circuits*—a common cause of call-backs.

3. Edge of the plate now is flattened out to dissipate electrostatic charge under high-voltage conditions. Stabilizes performance—prevents erratic operation of the tube.

4. New button-stem base adds strength, shortens tube leads, and improves heat conduction . . . increasing tube life. Helps to make possible a new bulb 18% shorter, more compact.

ANOTHER PLUS: new SERVICE-DESIGNED 6AX4-GT's are specially tested for arc-overs at maximum ratings. *Every tube* gets this important test!

INSIDE STORY, why shorts and arc-overs are reduced.



OLD 6AX4-GT NEW 6AX4-GT

NEW SERVICE-DESIGNED 6BX7-GT

1. New "flipper" (criss-cross) apertures in the mica spacers apply a firm 4-corner grip to the grid legs—keep grids locked in place top and bottom. This greatly reduces microphonics that result from changes in tube inter-element spacing . . . *helps prevent vertical picture jitter.*

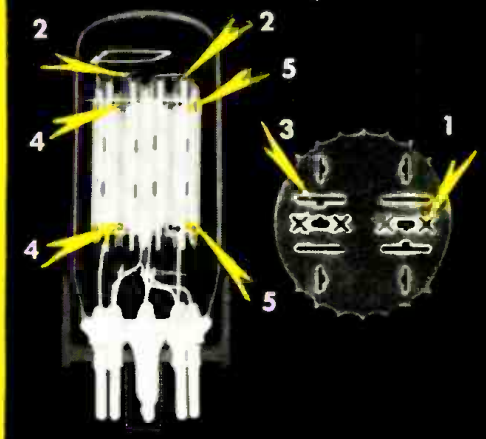
2. Covered "penthouses" (box enclosures) now shield cathode and heater from getter contamination that causes electrical leakage, disturbing the relationship of tube elements.

3, 4. Special slots in mica spacers, and notched plate design, further ward off inter-element arc-overs and leakage.

5. Barrels of the plates now are flared out at ends to avoid disturbing delicate grid wires when tube is assembled. Helps assure uniform tube performance.

ALSO: gold-plated grid wires minimize grid emission, a cause of picture shrinkage and fold-over . . . arc-over test of *every tube* assures dependability of SERVICE-DESIGNED 6BX7-GT's.

INSIDE STORY, why electrical performance is improved.



NEW 6BX7-GT

NEW 6SN7-GTA

Redesigned to give top performance in all synchro-guide and other TV circuits. Every tube gets "chopper" pulse test at low line voltages. Ratings substantially increased.

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BUILD YOUR OWN TV COLOR CONVERTER

Fig. 1. Receiving a color show on a large-size movie screen using the color converter described in this article with a black-and-white set.

By **JAY STANLEY**

Part 1: This color TV converter can be used with three projection units or a three-color picture tube and a second-hand black-and-white chassis.

WHEN black-and-white TV first became a reality, the whole thing was something of a deep, dark mystery to most radio service technicians of the era. But a few brave souls took the plunge, built their own sets, and had the thrill of getting out ahead of most of their competitors and in on the ground floor of a tremendous industry.

Color TV is off to a better start. Many manufacturers are offering courses and a lot of articles have been written about the subject so that the studious can, in a fairly short time, acquire some knowledge of color TV. But, as in all things, there is no substitute for experience with actual equipment on which you have no qualms about experimenting. The cost of present-day color TV sets is high enough to discourage a lot of service technicians (and most consumers) from owning such a receiver.

This article is a practical answer to that problem. Here is step-by-step data for building a color television system. Actually, the original chassis was designed and built by two Denver service engineers; Larry Costa and Paul Dontje.

The unit described in this article is a *color converter* which can simply be hooked onto a conventional (but carefully selected) black-and-white TV set. It can be used to drive a three-unit projection system, or with a bit more circuitry, a three-gun color picture tube.

A look at the block diagram in Fig. 2 and the circuit diagram of the color converter in Fig. 3 will reveal that it is surprisingly simple when compared to many color TV sets. The secret lies in the fact that the set uses a narrow-band system, with .6 megacycle bandpass limiting. This is possible because demodulation is on the *R-Y* and *B-Y* axes instead of the alternative *I* and *Q* axes. The *I* and *Q* system is a wide-band one.

Thanks to the narrow-band system, circuitry is much simpler. Likewise, setup, adjustment, and servicing are also much easier. Don't let the "narrow band" worry you. Color quality is impaired so little that it can only be discerned when a narrow-band and a wide-band set are operated side-by-side—and even then it is difficult to see the difference.

Before covering actual construction of the color chassis, let's trace a signal through this circuit to get an overall idea of how it works. As a starting point, we'll begin with the signal which normally drives the grid of the picture tube in the TV set—a signal which is the composite video output, carrying both the black-and-white and the color information. This signal can be supplied by any really good black-and-white set which has an i.f. bandpass of 4.1 megacycles or more—and maintains this bandpass right through the video amplifier stages. Many of the older TV chassis, built from 1947 to 1949 (split-sound sets), were capable of this bandpass when carefully aligned. The set used here was a *Philco* 1001 chassis, but an *RCA* 630 or an *Admiral* 30A1 (and some others) will work just as well. These are obtainable second hand from many TV dealers.

The composite signal goes to the grid of V_1, the first video amplifier on

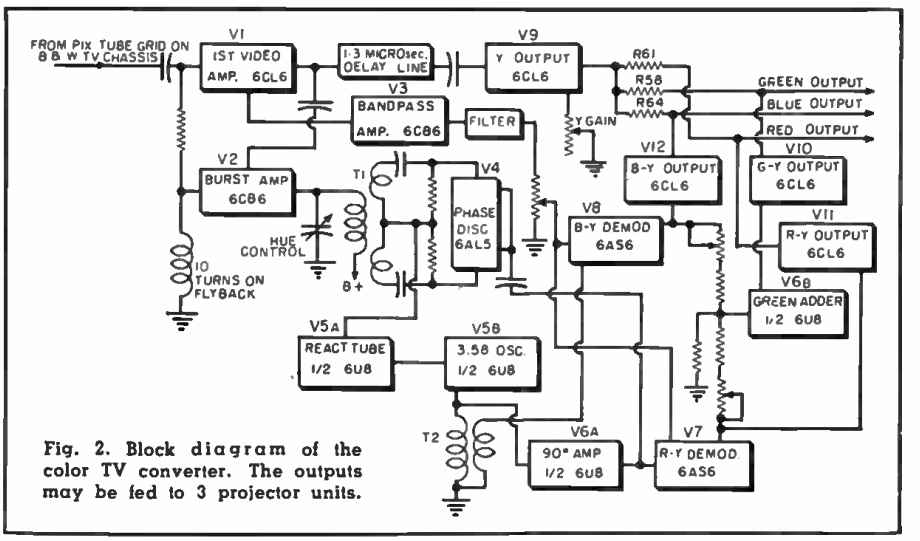
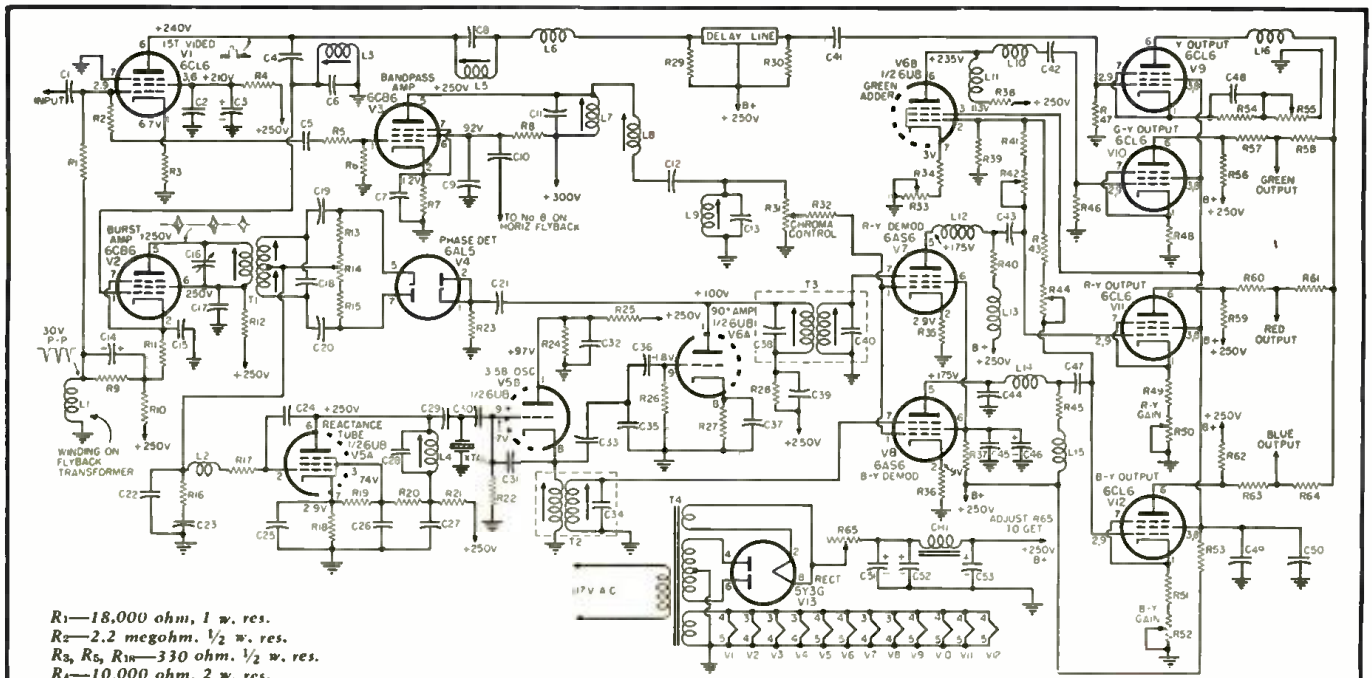


Fig. 2. Block diagram of the color TV converter. The outputs may be fed to 3 projector units.



R_1—18,000 ohm, 1 w. res.
R_2—2.2 megohm. ½ w. res.
R_3, R_5, R_{18}—330 ohm. ½ w. res.
R_4—10,000 ohm, 2 w. res.
R_6, R_{16}, R_{21}, R_{40}, R_{58}, R_{61}, R_{64}—15,000 ohm. ½ w. res.
R_7, R_{27}, R_{32}, R_{34}, R_{35}, R_{36}, R_{49}, R_{51}, R_{54}—100 ohm, ½ w. res.
R_8—82,000 ohm, 1 w. res.
R_9—12,000 ohm, 1 w. res.
R_{10}, R_{13}, R_{15}—220,000 ohm, ½ w. res.
R_{11}—220 ohm, 1 w. res.
R_{12}—2200 ohm. ½ w. res.
R_{14}, R_{42}—100,000 ohm pot
R_{17}, R_{28}, R_{29}, R_{30}—1000 ohm, ½ w. res.
R_{19}—10,000 ohm. 1 w. res.
R_{20}—22,000 ohm, 2 w. res.
R_{23}—2200 ohm, 1 w. res.
R_{22}—150,000 ohm, ½ w. res.
R_{24}—10,000 ohm, ½ w. res.
R_{25}—18,000 ohm, 2 w. res.
R_{26}—100,000 ohm, ½ w. res.
R_{31}—500 ohm pot
R_{33}, R_{50}, R_{52}—2000 ohm pot
R_{37}, R_{38}—10,000 ohm, 5 w. res.
R_{39}, R_{56}—4700 ohm. ½ w. res.
R_{41}—22,000 ohm. ½ w. res.
R_{43}—39,000 ohm, ½ w. res.
R_{44}—33,000 ohm, ½ w. res.
R_{45}—500,000 ohm pot
R_{45}—15,000 ohm, 1 w. res.
R_{46}, R_{47}—1 megohm, ½ w. res.
R_{48}—150 ohm, ½ w. res.
R_{55}—1500 ohm pot
R_{57}—8200 ohm, 1 w. res.
R_{59}, R_{62}—4700 ohm, 1 w. res.
R_{60}, R_{63}—8200 ohm, ½ w. res.
R_{65}—550 ohm, 25 w. adj. res. (Adjust to give 250 v. from power supply "B+" output.)
C_1, C_{41}, C_{42}—.1 μfd., 400 v. cond.
C_2, C_{25}—.01 μfd. button ceramic cond.
C_3, C_{16}, C_{52}—20/20/60 μfd., 350/350/450 v. elec. cond. (Sprague TVL 3725)
C_4—4.7 μμfd. ceramic cond.
C_5—150 μμfd. ceramic cond.
C_6—22 μμfd. silver mica cond.
C_7, C_{15}, C_{17}, C_{20}, C_{27}, C_{32}, C_{37}, C_{39}, C_{45}, C_{48}, C_{49}—.01 μfd. disc ceramic cond.
C_8, C_{44}—47 μμfd. silver mica cond.
C_9—470 μμfd. mica cond.
C_{10}—.001 μfd., 1600 v. paper cond.
C_{11}, C_{18}—250 μμfd. silver mica cond.
C_{12}—14.7 μμfd., made up of two condensers: a 10 μμfd. and a 4.7 μμfd. ± 5% ceramic cond.
C_{14}—2 μfd., 150 v. elec. cond.
C_{16}—3.5 to 20 μμfd. midget-type variable cond. (Phase control)
C_{14}—10 μμfd. silver mica cond. (In trans. can)
C_{19}, C_{30}—.01 μfd., 400 v. cond.
C_{21}—10 μμfd. silver mica cond.
C_{22}—.02 μfd. paper cond.
C_{23}—.22 μfd., 400 v. paper cond.
C_{24}—2.2 μμfd. ceramic NPO cond. ±5%
C_{25}—5 μμfd. NPO cond. ±5%
C_{29}, C_{30}—100 μμfd. silver mica cond.
C_{31}—47 μμfd. ceramic NPO cond. ±5%
C_{33}—500 μμfd. silver mica cond. ±10%
C_{34}—27 μμfd. silver mica cond. (In trans. can)
C_{35}—.002 μfd., 600 v. cond.
C_{36}—100 μμfd. silver mica cond. ±10%
C_{38}—100 μμfd. silver mica cond. (In trans. can)
C_{40}—390 μμfd. silver mica cond. (In trans. can)
C_{43}, C_{47}—.1 μfd., 400 v. paper cond.
C_{50}, C_{51}, C_{53}—40/10/80 μfd., 450 v. elec. cond. (Sprague TVL 3792)
Xtal—3579.5 kc. crystal (Peterson PR Z-2)
L_1—See text
L_2—20 μhy. r.f. choke
L_3—90 t. #36 en. closewound on Miller 1470A form (Cromco L-6)
L_4—105 t. #36 en. closewound on Cambridge Thermionic ½ x 2" form (Cromco L-1)
L_5—4.5 mc. trap, 75 t. #36 en. closewound on Miller 1470A form (Cromco L-5)
L_6, L_{16}—120 μhy. peaking coil
L_7—29 t. #30 en. scramblewound 3/16" on ¼" Cambridge Thermionic form (Cromco L-2)
L_8, L_9—78 t. # 36 en. scramblewound 3/16" on Cambridge Thermionic ⅜" x 1" form (Cromco L-3)
L_{10}, L_{12}, L_{14}—1000 μhy. peaking coil (Cromco P-1000)
L_{11}, L_{13}, L_{15}—500 μhy. peaking coil (Cromco P-500)
CH_1—1 hy., 300 ma. filter choke
T_1—90 t. #40 d.s.c universal wound, 5/32" wide (pri.); 60 t., each, universal wound, 5/32" wide (sec.) wound on coil form from Miller 1466 i.f. trans. (Cromco T-1)
T_2—18 t. #30 en. closewound (pri.); 90 t. #36 en. closewound (sec.) wound on form from Miller 1466 i.f. trans. (Cromco T-3)
T_3—60 t. #30 en. closewound (pri.); 26 t. #26 d.c.c. and en. closewound (sec.) wound on form from Miller 1466 i.f. trans. (Cromco T-4)
T_4—Power trans. 370-0-370 v. @ 275 ma.; 6.3 v. @ 7 amps.; 5 v. @ 3 amps. (Stancor P-6315 or equiv.)
Delay Line—See text
V_1, V_9, V_{10}, V_{11}, V_{12}—6CL6 tube
V_2, V_3—6CB6 tube
V_4—6AL5 tube
V_5, V_6—6U8 tube
V_7, V_8—6AS6 tube
V_{13}—5Y3G tube

Fig. 3. Complete schematic diagram and parts list for the TV color converter designed to be used with a black-and-white set.

the color chassis. See Fig. 3. The luminance or Y signal is picked up at the plate of the first video amplifier in the color chassis, passes through a 3.58 megacycle trap (L_5-C_8), and is fed to a 1.3 microsecond delay line, which insures that the luminance information and the color signals arrive at the output at the same time. From the delay line, the signal goes to the grid of the Y output tube (V_9). From the plate of this tube, the signal goes through the matrix resistors, R_{58}, R_{61}, and R_{64}, where the Y signal and the color-minus-Y signals are mixed to provide green, red, and blue output.

The color-burst signal is also obtained from the plate of V_1 and is fed to the grid of the burst amplifier, V_2. This tube is keyed on only during retrace, the keying being accomplished by means of a 10-turn coil wound on the flyback transformer in the black-and-white TV set chassis. (See Fig. 4.) By this means, the color burst, which is on the back porch of the horizontal sync pulse, is amplified—but no other 3.58 megacycle signals get through.

The output of the burst amplifier goes to the phase discriminator transformer T_1, the secondary of which is also supplied with a comparison signal from the plate of the 90-degree amplifier, V_{6A}. The output of the phase detector is a d.c. correction voltage which is fed to the reactance tube, V_{5A}; this tube, in turn, controls the frequency and phase of the 3.58-megacycle oscillator, V_{5B}. In this way, the local 3.58 mc. oscillator is locked in exact phase and frequency with the transmitted color burst to supply the synchronous demodulators with the missing color subcarrier, the sidebands of which only are transmitted—the carrier being suppressed at the transmitter.

From the cathode of the 3.58 megacycle oscillator, the signal takes two paths. A signal directly from the cathode goes to the 90-degree amplifier which shifts its phase 90 degrees for proper demodulation in the R-Y demodulator. The secondary winding of transformer T_2, however, feeds the

B-Y demodulator directly with no phase shift.

The *B-Y* demodulator and the *R-Y* demodulator receive their color signals from the bandpass amplifier (V_3) and filter, which has a bandpass of 1.2 megacycles (from 2.9 mc. to 4.1 mc.) and passes *only* the color subcarrier sidebands. This automatically drops out the low-frequency *Y* signal.

In the *R-Y* and *B-Y* demodulators, the missing carrier is restored and demodulated to produce the *R-Y* and *B-Y* signals. The *B-Y* signal, taken directly from the plate of V_{9a}, goes to the grid of the *B-Y* output tube, V_{12a}. The output of this tube, in combination with some of the *Y* signal, supplies blue.

The *R-Y* signal from the plate of the *R-Y* demodulator goes to the grid of V_{11}, which, in similar fashion to that of the *B-Y* output stage, supplies the red output signal.

The output of the *R-Y* and *B-Y* demodulators is fed to the grid of the green adder, V_{8B}, through a set of resistors. This tube is simply a phase inverter at which the negative signals from the demodulators combine in proper proportion and invert to form the positive *green-Y* signal. This is fed to the *G-Y* output for addition with the luminance signal as described previously for the other two colors.

The outputs terminate in jacks along the end of the chassis, making the three color signals and the *Y* signal readily available for different experimental hookups. Most of the controls are inserted on the rear of the chassis since many of them are setup controls which are left alone once adjusted. Two controls, chroma and phase, are used for minor adjustment during reception, and it is desirable to make them readily available. No "color killer" controls or circuits are needed—simply turning down the chroma control puts the set in shape to receive black-and-white.

In actual construction of the converter, the first step is to round up the needed parts. The careful builder can, by following the data given in the parts list, "roll his own" coils. A real help in doing this is the setup shown in Fig. 5 which provides approximately the same loading as the converter circuits. This allows the coils to be wound with considerable accuracy without actually inserting them in the circuit. The signal generator should preferably be a 3.58-mc. crystal oscillator. A standard d.c. voltmeter will give a clear-cut indication of resonance. This circuit, however, will indicate when the signal generator is tuned to one-quarter or one-half of the resonant frequency, so if a variable frequency oscillator is used, always switch to the next higher band to make certain that you are actually on the fundamental. The physical layout for the windings of T_3 is shown in Fig. 6.

For those who want to buy coils already wound, the designers of the color converter, Costa and Dontje, will supply coils, and their part numbers are given in the parts list under *Cromco*. Write to *Cromco*, in care of P. Dontje at 7020 W. 38th Ave., Wheatridge, Colo.

The color chassis measures 10 x 14 x 3 inches. The layout is purposely crowded in order to keep leads short and point-to-point. No trouble has been experienced from stray capacity, even though some of the signal carrying leads are longer than were desired.

The chassis illustrated in Figs. 7 and 8 has a cut-out for a *Norelco* video amplifier chassis, to allow use with a single-projection unit and a color wheel. The chassis will eventually be used in this fashion although, at present, three *Norelco* projection units are utilized. There are a couple of other extra holes on the chassis for parts which circuit development later proved unnecessary.

In building, all transformers and tube sockets were mounted first, also terminal strips, filter condensers, and controls. Following usual construction practice, heaters were wired in, and then "B+" voltage leads complet-

(*Continued on page* 91)

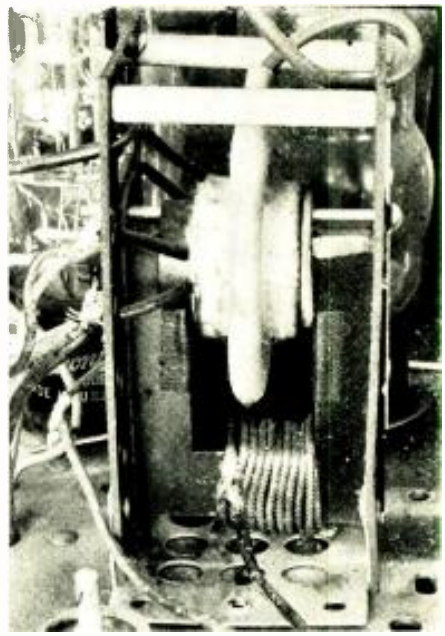


Fig. 4. A ten-turn winding on the flyback transformer keys the burst amplifier on for the proper operation of the 3.58 megacycle color synchronization circuits.

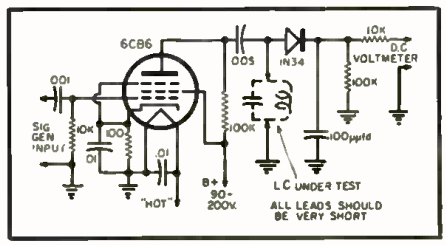


Fig. 5. A test setup which is useful in preparing the coils used in converter.

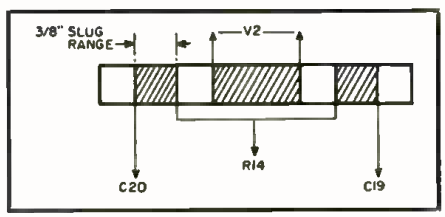


Fig. 6. The physical layout of the phase discriminator transformer windings.

Fig. 7. Top view of the color converter. Note where the crystal is mounted so as to minimize temperature variation effects.

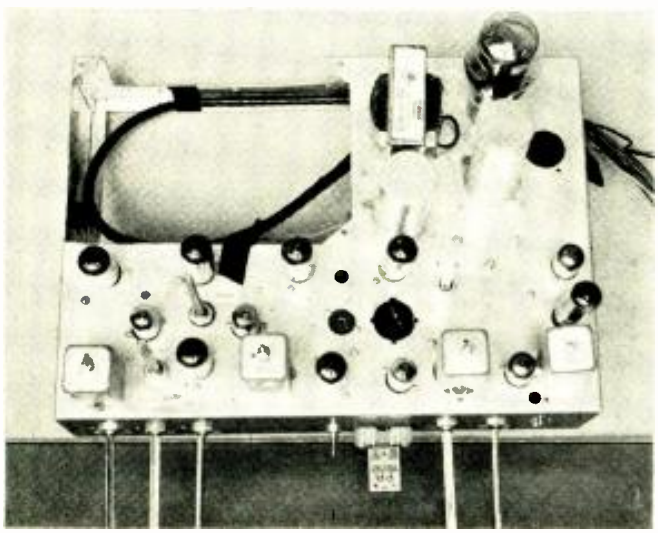
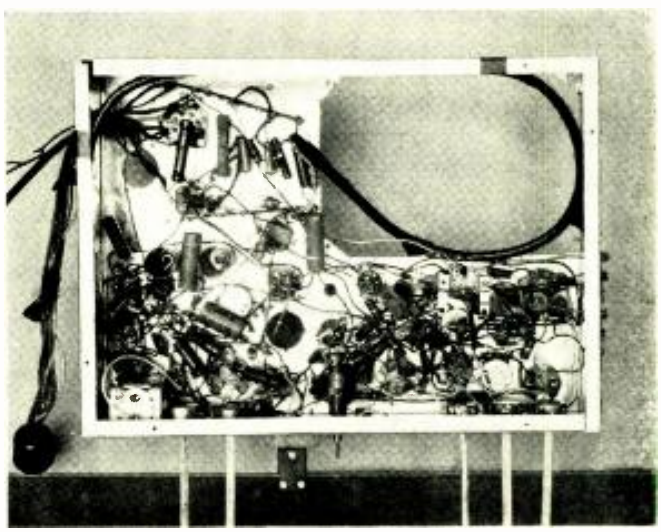
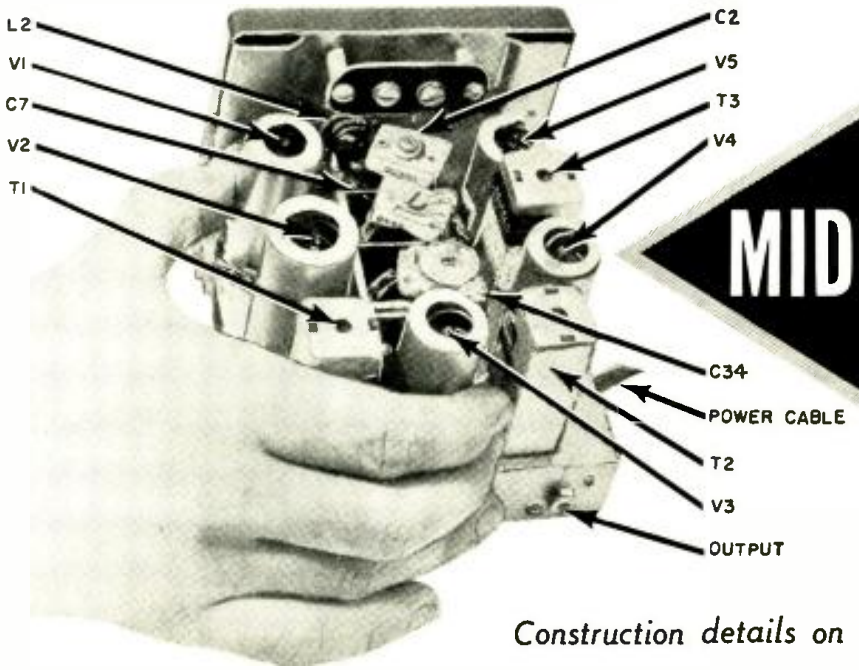


Fig. 8. Bottom view of the converter chassis. The black cable running around the cutout is the delay line in the Y circuit.





Top chassis view of the 4" x 4½" x 3½" tuner with parts identified.

MIDGET FM TUNER

By
ROBERT J. LARSON
Design Engr., Jensen Mfg. Co.

Construction details on a unit which can be used with a car radio, AM or TV set, hi-fi system, or in p.a. work.

RADIO listeners in most of the larger cities are missing a lot if they have no means of receiving some of the excellent programs to be found exclusively on our FM band. There is little need to mention here the noise-free, wide-range reception possible with this method; one has only to compare the relative fidelity of the AM and FM channels of some of the stereophonic musical programs being broadcast in many cities to hear the difference.

For those who would like to build a tuner for FM, here is a little unit which will be ideal for any of the following applications:

1. An FM tuner for use with presently owned high-fidelity amplifier and speaker systems.
2. FM reception in an automobile.
3. Use with a tape recorder as a source of wide-range programs and good music.
4. Connection to an existing AM-only radio receiver to permit FM reception.
5. Connection to a TV set for FM reception.
6. Use with a music system in a store or restaurant to provide background music.

Perhaps even more applications will occur to readers after perusing this article.

The entire tuner, shown in the photographs, measures only 4 by 4½ by 3½ inches high, enabling it to be tucked away within the cabinet of existing equipment. Construction is simple and no special mechanical or electrical parts are required. The total cost for parts should be about thirty dollars. The power supply is not included on this chassis, since, in many cases, power may be taken from the associated amplifier or radio. Power requirements are fairly modest as the tuner draws about 30 milliamperes at 150 volts d.c. and 1.65 amperes at 6.3 volts for the heaters. When adding this tuner to an AM receiver it is usually possible to switch off all but the audio tubes and use the additional power supply current thus made available to energize the FM tuner. This has been done successfully with the author's automobile receiver. More about this later in the article. Many hi-fi amplifiers have the extra power available for use with preamplifiers.

For those applications in which the extra power cannot be robbed from accessory equipment a suggested power supply is shown in the inset diagram of the schematic. The components for this supply will easily fit on another chassis the same size as that used for the tuner. The aluminum chassis used for the tuner measures 4 x 4⅛ x 1 inch and is made by *ICA*. Since two sides of the chassis are open the builder may decide to bend his own if materials and tools are available. The tuner uses five high gain tubes: a 6CB6 is used as a pentode r.f. amplifier, feeding a 6X8, which contains a pentode mixer and triode oscillator. Two more 6CB6's are used as 10.7 mc. i.f. stages, followed by a 6AL5 ratio detector. The tuner employs automatic gain control, causing the plate current to vary between 15 and 30 milliamperes, depending upon the signal strength of the station tuned in.

The cathode bias resistor in the 6CB6 r.f. stage is purposely left unbypassed in order to quell a tendency of the stage to oscillate. The r.f. stage is used mainly to isolate the oscillator from the antenna to minimize radiation, and to reduce the presence of images. In the 6X8 mixer, note that the suppressor grid and screen and plate bypass connections are made to the cathode. This causes the oscillator voltage to appear effectively only on the signal grid, resulting in a highly efficient mixer stage. The use of a single tube here saves valuable space on the small chassis.

Midget 10.7 mc. i.f. transformers made by *Miller* are used in the i.f. stages. These little coils give adequate bandwidth without the use of swamping resistors across the transformer windings, resulting in a high gain per stage. The ratio detector provides, in addition to about one volt of audio, a negative voltage which is used for automatic gain control on all preceding stages of the tuner. About five volts are developed on local stations. R_{12} and C_{31} form a 68-microsecond roll-off network to equalize the pre-emphasis broadcast by all FM stations. Ideally, this time constant should be 75 microseconds, but it was desired to incorporate a slightly rising high-frequency response in the tuner to compensate for the attenuation caused by the shielded cable used to connect the tuner to the amplifier.

The parts layout, as shown in the top chassis photo, provides for short leads and allows the shaft of the tuning capacitor to be centered on the front panel. No volume control is included since in most installations this control is found on the associated equipment. The tuning dial used will depend on the space available. It is suggested that a dial with a large tuning ratio be used, as tuning is more critical than with AM tuners. When installing this little tuner in an AM receiver cabinet it may be possible to arrange the dial cable to turn both the AM and FM tuning capacitors simultaneously.

Shields should be used on all tubes to minimize interference of signals entering at the 10.7 mc. intermediate frequency. A grounding lug is used under one of the screws securing each tube

socket and should be soldered to the central grounding post on the tube socket; all grounds associated with each stage should then be made to this central connection. Mica-filled sockets were used on the first two stages of the tuner to increase gain and minimize drift.

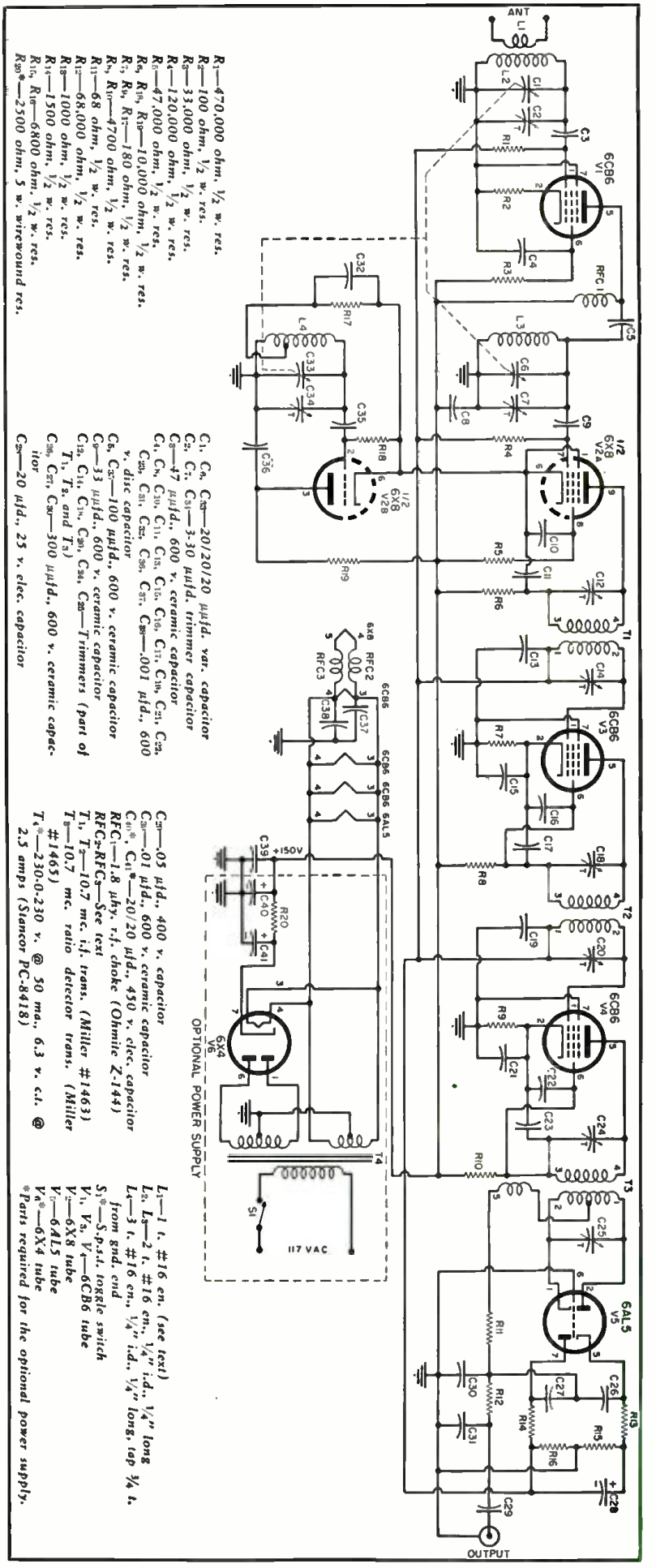
Underneath the chassis a sheet copper partition is used between the r.f. and oscillator/mixer sections of the tuner. One end of the partition is soldered to the grounding lug near the tube socket and the other end is soldered to one of the tuning capacitor ground lugs which projects through the chassis. In addition to shielding, this partition provides a low inductance connection between the capacitor and the coil, which is soldered directly to the copper partition. The r.f. coil, L_2, and the three trimmer capacitors are mounted on top of the variable tuning capacitor. The antenna coil, L_1, is placed adjacent to the grounded end of L_2 and is supported by a terminal strip fastened to the back of the tuning dial.

Like all equipment used at very high frequencies, this tuner requires some special wiring techniques. All leads should be as short as possible—point to point wiring is used. The new .001 μfd. disc ceramic capacitors are excellent since the two leads are only about 3/16-inch apart and fit nicely onto the miniature tube sockets. None of these capacitors should have leads over ¼-inch long. Buy a few extra disc ceramics because it is sometimes necessary to bypass both ends of certain long runs of wire on the chassis. This procedure is taken up again later.

The converter filament choke, RFC_2 and RFC_3, is made by winding number 26 enameled wire over an *Ohmite* Z-144 choke. Notice the direction of winding on the choke and wind the number 26 wire over it in a single layer in the same direction. The extra winding is cemented in place with 912-B coil dope or *Duco* cement. Two Z-144 chokes may be used in the filament circuit; this bifilar winding saves space.

Probably the most interesting part of this project is the final alignment and adjustment. You will need a vacuum-tube voltmeter and a signal generator. The author used *Heathkit* instruments. For the initial tests, connect the tuner to a suitable power supply. A quick check should show about 2 volts at the cathode of each stage except the ratio detector. Then connect the v.t.v.m. to measure the a.g.c. voltage (across R_{16}). Inject a 10.7 mc. unmodulated signal to the grid of the mixer stage and peak the interstage i.f. transformers for a maximum v.t.v.m. reading. If a reading cannot be obtained, try connecting the signal generator to the grid of the first i.f. tube in order to peak up T_2 and T_3. After these two transformers are aligned it will be possible to obtain a reading by reconnecting the signal generator to the mixer grid. The ratio detector is aligned by using the zero center feature of the v.t.v.m. and connecting to one end of R_{12}. The ground lead of the v.t.v.m. is connected to the tuner chassis. Adjust the top slug of T_3 so that the voltage across C_{30} (or C_{31}) is zero at 10.7 mc. and adjust the bottom slug so that an equal voltage swing is obtained on each side of 10.7 mc. as the signal generator dial is rocked back and forth across the intermediate frequency. These two adjustments interact with each other so this procedure will have to be repeated several times.

If the a.g.c. voltage remains at several volts when the signal generator is disconnected, one of the stages is oscillating. This occurrence is to be expected, and is nothing to become ex-



R_1—470,000 ohm, ½ w. res.
R_2—100 ohm, ½ w. res.
R_3—33,000 ohm, ½ w. res.
R_4—120,000 ohm, ½ w. res.
R_5—47,000 ohm, ½ w. res.
R_6, R_{15}, R_{19}—10,000 ohm, ½ w. res.
R_7, R_9, R_{17}—180 ohm, ½ w. res.
R_8, R_{10}—4700 ohm, ½ w. res.
R_{11}—68 ohm, ½ w. res.
R_{12}—68,000 ohm, ½ w. res.
R_{13}—1000 ohm, ½ w. res.
R_{14}—1500 ohm, ½ w. res.
R_{16}, R_{18}—6800 ohm, ½ w. res.
R_{20}*—2500 ohm, 5 w. wirewound res.

C_1, C_6, C_{33}—20/20/20 μμfd. var. capacitor
C_2, C_7, C_{34}—3-30 μμfd. trimmer capacitor
C_8—47 μμfd., 600 v. ceramic capacitor
C_4, C_9, C_{10}, C_{11}, C_{13}, C_{14}, C_{16}, C_{17}, C_{19}, C_{21}, C_{23}, C_{25}, C_{31}, C_{32}, C_{36}, C_{37}, C_{38}—.001 μfd., 600 v. disc capacitor
C_5, C_{35}—100 μμfd., 600 v. ceramic capacitor
C_6—33 μμfd., 600 v. ceramic capacitor
C_{12}, C_{15}, C_{18}, C_{20}, C_{24}, C_{28}—Trimmers (part of T_1, T_2, and T_3)
C_{26}, C_{27}, C_{30}—300 μμfd., 600 v. ceramic capacitor
C_{28}—20 μfd., 25 v. elec. capacitor
C_{29}—.05 μfd., 400 v. capacitor
C_{39}—.01 μfd., 600 v. ceramic capacitor
C_{40}*, C_{41}*—20/20 μfd., 450 v. elec. capacitor
RFC_1—1.8 μhy. r.f. choke (*Ohmite* Z-144)
RFC_2-RFC_3—See text
T_1, T_2—10.7 mc. i.f. trans. (*Miller* #1463)
T_3—10.7 mc. ratio detector trans. (*Miller* #1465)
T_4*—230-0-230 v. @ 50 ma., 6.3 v. c.t. @ 2.5 amps (*Stancor* PC-8418)
L_1—1 t. #16 en. (see text)
L_2, L_3—2 t. #16 en., ¼" i.d., ¼" long
L_4—3 t. #16 en., ¼" i.d., ¼" long, tap ¾ t. from gnd. end
S_1*—S.p.s.t. toggle switch
V_1, V_2, V_4—6CB6 tube
V_3—6X8 tube
V_5—6AL5 tube
V_6*—6X4 tube
*Parts required for the optional power supply.

Schematic diagram of Midget FM Tuner. An optional power supply is shown within the dotted box.

cited about. Here is where those extra disc ceramic capacitors are useful. Experiment with placement of these bypasses. In the author's tuner, oscillation of the first i.f. amplifier was removed by placing a bypass at both ends of the lead running from the screen to terminal 3 on T_2. Try bypassing both sides of the filament to ground. Try bypassing both ends of C_{2a} to ground. It's safe to bypass anything except a grid or plate lead. If all else fails, try removing the capacitor between cathode and ground. This introduces degeneration and reduces the gain, however.

Alignment of the r.f. stages is easy if there is a station in your area at each end of the FM band. If not, the signal generator can be used. Since signal generator output in the 88 to 108 mc. range is usually a harmonic of some lower frequency signal, the dial calibration should be checked against some accurately calibrated receiver which tunes the 88 to 108 mc. FM band. Connect an amplifier system or earphones to the audio output jack and the antenna to L_1. Connect the v.t.v.m. to read the a.g.c. voltage developed across R_{16}. If the coils have been wound correctly you should be able to tune in some stations. Adjustment of C_{3i} should bring the stations to their proper place on the dial. If the FM band is crowded into too few degrees of tuning dial rotation, spread the turns of the oscillator coil, L_4, apart and realign with C_{3i}. Conversely, to decrease the bandspread squeeze the turns of L_4 together and decrease the capacitance of C_{3i}.

When a satisfactory spread of stations is obtained, the mixer and r.f. stages may be adjusted. The author has found the following method of tracking adjustment to be useful in many v.h.f. receivers. Tune in a signal at the high frequency end of the dial and adjust the mixer trimmer, C_7, for maximum a.g.c. voltage. Then tune in a signal at the low end of the dial and readjust the trimmer for maximum signal. If it was necessary to increase the capacitance at the low end of the band, squeeze the turns of the mixer coil, L_3, together and try the high and low frequency signals again. A decrease in capacitance indicates that the coil turns should be spread apart. The process is repeated several times until maximum output is obtained at both ends of the dial with one setting of the trimmer. The same procedure is used in adjusting C_2 and L_2 in the r.f. stage.

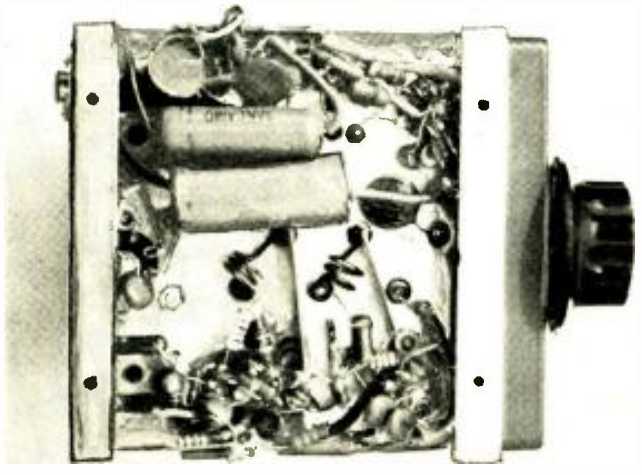
After alignment, the tuner may be connected to the amplifier or radio in its permanent connection. When connecting to an AM radio, connect the output of the tuner across the volume control of the radio in order to be able to control the volume of the tuner as well. An automobile installation is complicated by the extra noise reducing procedures which are usually required. The antenna is somewhat of a problem also, as a horizontal FM dipole exhibits directional characteristics which sometimes cause the station to fade as the automobile turns a corner. After some experimentation the author found the best antenna to be the regular whip used by the car radio in spite of the fact that the transmitting and receiving antennas are cross polarized. Best reception occurred with the whip extended about two feet. Ignition noise, which was troublesome on some of the weaker FM stations, was considerably reduced by the use of resistor type spark plugs. If the tuner is to be used exclusively in an automobile, it is helpful to reduce the capacitance of C_{2a} to 10 microfarads. This decreases the recovery time of the a.g.c. on the rapidly varying signals encountered when the automobile is in motion. The high fidelity FM transmissions may be heard to greater advantage by the use of a better speaker on the car radio. Although the usual oval automobile speaker is adequate for AM listening, better bass and treble response can be quite simply obtained by using one of the new compact loudspeaker cabinets which are now available. The author uses a *Jensen "Portable Duette"* in the rear seat of his car. The speaker is provided with about forty feet of cable so that it may be used at a distance from the car at the beach or on picnics. This arrangement also provides entertainment while washing the car since it is not necessary to keep the windows open to hear the radio.

An interesting use of this tuner is made when it is used to receive the FM portion of stereophonic radio broadcasts. Several of our leading radio stations are now broadcasting musical programs in this manner. On WMAQ, in Chicago, two microphones are used in the studio, one being connected to their AM transmitter and the other to their FM. In the listener's home, two tuners, two amplifiers, and two speakers are used to recreate the original acoustical atmosphere. For those interested in receiving these broadcasts, it may be advantageous to include an AM tuner circuit on the same chassis with the midget tuner described here.

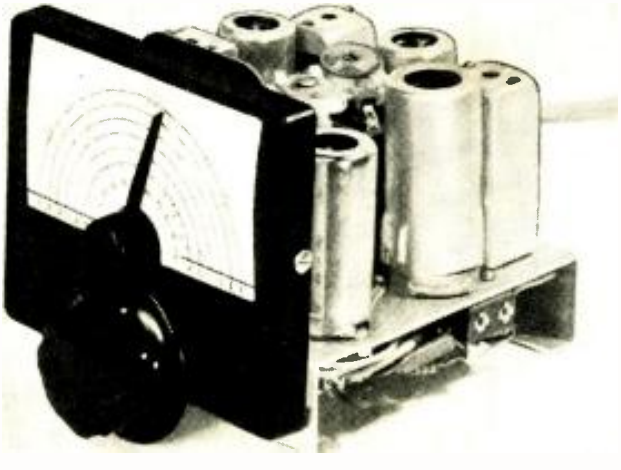
In spite of its low cost and small size, this little tuner will give many hours of enjoyment. The author's tuner has been in service for over a year, and stations over 50 miles away have been received with the use of a simple indoor folded dipole antenna. Local reception is fully as good as that normally provided by many commercial tuners.

Those builders who live more than 50 miles from an FM station may have better reception if an outdoor antenna is used. Usually, if a television signal is receivable in your area, successful FM reception is also possible. For real DX, one of the commercial yagi type FM antennas should be used. These antennas are installed and oriented in the same manner as TV antennas. If a special FM yagi is not readily available, a channel 6 TV antenna may be modified by cutting down all of the elements to 85 per-cent of their original length. Remove an equal amount of tubing from both ends of each element, of course, and flatten the ends with a hammer. This cut-down TV antenna will resonate at the middle of the FM band, but will be broad enough in its response to be useful over the entire band. —30—

Under chassis view. Disc ceramics are used to conserve space.



Over-all view of the tuner which uses standard parts throughout.



THE BROADCAST RECORDER

Over-all view of the new Berlant BR-1 broadcast recorder with the company's MCM-2 mixer shown at right.

By
E. E. BERLANT
Berlant Associates

Technical details on a recently-introduced professional unit that eliminates clutches, pulleys, idlers, belts, etc.

A NEW professional tape recorder, designed to meet the specialized requirements of broadcast and recording studio engineers as well as the advanced audiophile, has recently made its appearance.

Since the keynote of the design was dependability and freedom from maintenance problems, all clutches, belts, pulleys, idlers, and similar components have been eliminated in the construction of this recorder.

To achieve the requisite simplicity, the two reels had to be mounted directly on the capacitor start-and-run induction torque motors which were designed to perform the spooling operations with maximum efficiency. In addition, the tape drive capstan had to be constructed as an integral part of the synchronous drive, with no decoupling to introduce errors of timing or motion.

The main panel, upon which all mechanical components are assembled, was designed for pressure die casting in aeronautical aluminum alloy to combine rigidity, stability, dimensional accuracy, smooth finish, and high impact strength.

The recorder's "Unisync" drive is an innovation in the field of tape metering accuracy. This combination of drive capstan, two-speed (600 and 1200 rpm) hysteresis synchronous motor, flywheel, and cooling blower is engineered as a single integrated unit. The capstan is the exposed end of a precision-ground shaft supported in line-bored, self-lubricated bearings mounted in a flanged aluminum mounting sleeve.

On the outside of this bearing mount is fixed the field structure (stator) of the motor. The nickel cobalt hysteresis rotor ring is shrunk-fit into a die-cast housing designed for maximum flywheel effect and ribbed to act as a blower. Because the diameter of the rotor is outside the field, efficiency is high and an extremely cool running mechanism results. The entire rotor construction is dynamically balanced as a unit and mounted solidly to the main panel by four bolts.

Each reel-moving assembly is mounted directly on the motor and contains a 3-inch diameter steel brake drum. A brake arm, pressure die-cast of *Zamak III* alloy, brings a thick white long-staple felt pad against the drum. Both brakes are actuated by a common tension spring, with differential to keep the tape taut in braking established by the self-energizing action of the brakes. Wear of the pads increases clearance and does not require readjustment.

The tape is stripped from the reels over ball-bearing metal rollers with the tension arms concentrically pivoted to bear against the back of the tape. A *Microswitch*, mounted behind the panel, serves as a power cut off switch in the event of tape run-out or failure. The tension arms swing to a lock position for straight-line loading of the tape through the head assembly, then unlock to provide filter action.

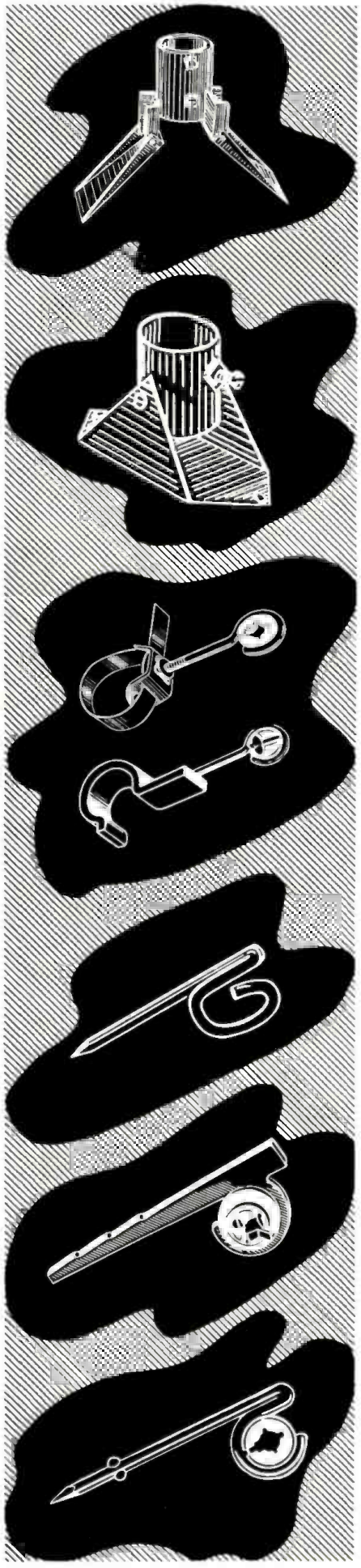
The transducers, or heads, are mounted on a precision pressure die-cast ribbed mount which has provision for positioning and adjusting five heads with accurate guides for locating the tape's course through the assembly. The mount is fastened to the main panel by three clamp screws. Electrical connection to the heads is by means of individual slip connectors. The added flexibility offered by the provision for two additional heads can be indicated by a few examples. An extra playback before the usual combination of erase, record, and playback heads permits the simultaneous playing of a delayed broadcast while erasing the tape and recording an incoming signal—thus permitting one recorder to do the work of two. Or, a combination of single- and dual-track erase and record heads gives a choice of dual-track recording for library requirements or single-track master recording with instant switch selection. Other possible combinations provide a choice of single track or stereo-binaural recording and use of multiple playback heads for echo and reverberation effects.

Tape contact with the heads is accomplished by a pressure die-cast *Zamak* shield mount that wraps the tape into an arc contact with the pole faces of the heads. A hum shield is mounted in close contact on the head shield of the playback heads. The shields are held in place by tapered spiral coil springs and snap lock retainer clips. No pressure pads are used in normal audio work. In fast-forward and rewind position the tape clears the heads, close enough for audible location of selections, but without contact to cause excessive wear. Movement of this mount is automatically controlled by the operation of the control levers.

All controls for the drive mechanism are included in one coaxial lever system located in the center of the panel. The tape drive lever moves to the right for "Run." This closes the head pressure mechanism, wrapping the tape into contact with the heads. Moving the lever to the left from "Stop" to "Cue" also wraps the tape around the heads but does not close the pressure roller against the capstan. Since the brakes are released and the spooling motors powered, the reels may be freely rotated to locate any desired point for cueing or editing. Swinging

(*Continued on page* 132)

HOW GOOD ARE YOUR



A PROFESSIONAL, well-planned antenna installation is important not only for the sake of satisfying your customers and providing the best possible reception—it is also the criterion by which prospective customers and fellow service technicians (possibly future employers) judge your competence.

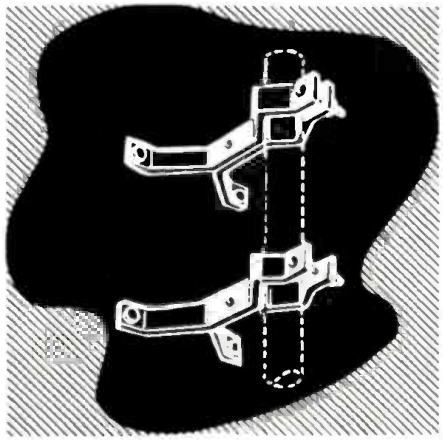
You should be familiar with the points of good installation practice described in this article if you are furnishing good installations. If not, this review should prove helpful.

1. *Anchor the mast properly.* Don't use haphazard mounting straps or clamps which rust or stretch. Use pipe clamps or bracket mounts if the antenna mast is to be installed on a wood, stone, or brick wall, or mounted on one side of the house. Use special chimney straps if the chimney is to be used for support.

2. *Use guy wires.* These are important from the standpoint of safety and rigidity. Storms is New York and other TV areas have shown the importance of proper guying. Use guy-wires in all cases where the mast extends more than 5 to 8 feet above the chimney or other support. Three guy wires are recommended for masts 10 to 15 high; six for masts 15 to 25 feet high, and nine or more guys for greater heights.

Where high winds are encountered, it is best to use a self-supporting or guyed tower instead of the usual hollow mast. The cost is greater but the initial investment will guarantee your customer far greater protection against collapse and possible damage during storms or high winds.

For the guy wires, use No. 6 or No. 8 stranded steel wires (or solid galvanized clothesline). Break the wires at odd lengths and insert strain insulators to prevent reflections or interaction with the antenna. (If serious ghosts result from some odd combination of guy lengths, try the small plastic-covered clothesline for guying. This particular type is waterproof, will give in high winds without undue stretching, and is sufficiently strong for most 10- to 15-foot masts.)



3. *Use solid anchor points for the guy wires.* Ordinary screw-type anchors with a hook or eye in one end are satisfactory if the wood beams, rafters, etc. are solid. For anchoring to brick or concrete walls, use wing-type bolts or special expansion plugs. Space the anchors evenly around the mast if possible (about 120 degrees apart) so the mast will have equal support from all directions. Make sure the anchors are bolted or screwed securely to the supporting surfaces.

The Down Lead

4. *Use ring lugs.* These lugs clamp on to the lead-in for connecting to the antenna terminals. They insure good electrical contact and take some of the strain off the leads. Wrapping the bared wires around the antenna terminal screws may cause a weak signal later when the terminals become loose or the wires corrode and cause poor contact.

5. *Secure the lead-in.* Whether the transmission line is twin-lead or coaxial, use a stand-off insulator every 4 feet or so to keep the lead-in taut and to prevent its swaying in the wind. Crimp the outer ring of the insulator just enough to provide firm, positive contact. Excessive pressure does not improve the grip and may result in damage to the wire or insulation. Allow enough slack between the antenna and the first stand-off insulator to allow for wind movement or for the full rotation of the electric rotator if one is used.

Rotator control wires should be run at least 2 or 3 feet away from unshielded twin-lead, all the way to the receiver. Ghosts or a smeared picture will result if these wires are too close together. The same applies if more than one lead-in line is used.

Note: It is not necessary to mount the rotator control wires on insulators. Insulated staples are satisfactory as long as the wires are not damaged nor the insulation punctured.

6. *Keep twin-lead away from metal.* Drain pipes, down-spouts, roof flashing, gutters, sheeting, vent pipes, metal conduit, electrical or telephone wiring, etc. will greatly attenuate the signal and may introduce serious reflections. Protect the line at roof edges with stand-off insulators, leaving just enough slack to keep the line from rubbing against the roof or other objects. Do not tape unshielded lead-in to the mast or other metal object, and avoid running it near or inside conduit. A wet lead-in touching or taped to a grounded water pipe will amount

TV INSTALLATIONS?

By **JOHN B. LEDBETTER**

Are your TV antenna installations getting sloppy? Check the methods you are now using against this brief review of good TV installation procedures.

almost to a short-circuit of the signal, especially at the higher frequencies.

7. *Protect twin-lead from the weather.* Don't run twin-lead for long lengths horizontally if you can help it. This can spoil reception in rainy or winter weather by allowing rain, snow, or ice to collect on a large part of the lead-in. Run the wire under the eaves or straight down as much as possible so that a minimum area will be exposed to the elements.

Note: Where the antenna mast is mounted on an unused chimney, run the lead-in down through the inside. This will provide the shortest possible run and give best weather protection. Use stand-off insulators on the chimney to relieve strain on the line. Run the lead-in into the basement and bring it up through the floor to the receiver, or bring the lead-in out through the fireplace if this is more convenient.

If the chimney is *active*, run the lead-in down the outside as usual and install a metal baffle plate on the chimney to keep soot from collecting on the antenna terminals and insulator. A heavy collection of soot will short-circuit the antenna insulator in damp or rainy weather. See a tinsmith, furnace dealer, or hardware store for the baffle.

8. *Use a good ground.* For adequate protection against lightning and electrical storms, run a ground wire from the antenna mast to a cold-water pipe or a 3-foot rod driven into the ground. No. 14 copper wire is adequate in most cases, but No. 6 is recommended for tall masts or where exceptionally long lengths of ground lead are used. Be sure the connections at all points are clean and tight. The ground wire can be stapled to one corner of the house and painted.

9. *Use a lightning arrestor with twin-lead.* Electrical codes in most cities require an approved-type lightning arrestor with twin-lead (none is required with coaxial lead-in if the shield is properly grounded). Connect the arrestor at the point where the lead-in enters the house, and be sure its ground strap or terminal is connected firmly to the regular ground wire. If the lead-in is run inside the chimney, install the arrestor at the closest convenient point to the receiver and run a No. 14 wire to the nearest cold-water pipe, gas pipe, electrical conduit (if properly grounded), or to an outside ground. If more than one lead-in is used, install a separate arrestor for each line. Always *clamp* or *bolt* the ground rod connections, never solder. Avoid using fire escapes, vent pipes, or similar metal objects for grounds. These usually are painted or rusty and make very poor grounds.

10. *Check reception before securing lead-in permanently.* With the lead-in temporarily connected to the receiver and antenna, check for ghosts, interference, and picture quality. Ghosts may be caused by reflections from a metal roof, large metal pipes, hidden electrical wiring, etc. Passing automobiles, trolley buses, or electrical equipment in the neighborhood may introduce serious interference. If the picture is good, install the lead-in permanently.

11. *Check the antenna's safety features.* Be sure it is rigidly mounted and that all precautions have been taken to prevent its damaging the roof or falling across electric power lines. If electric lines pass overhead, it is better to reroute the lead-in to avoid possible contact in case one of the power lines should break and fall.

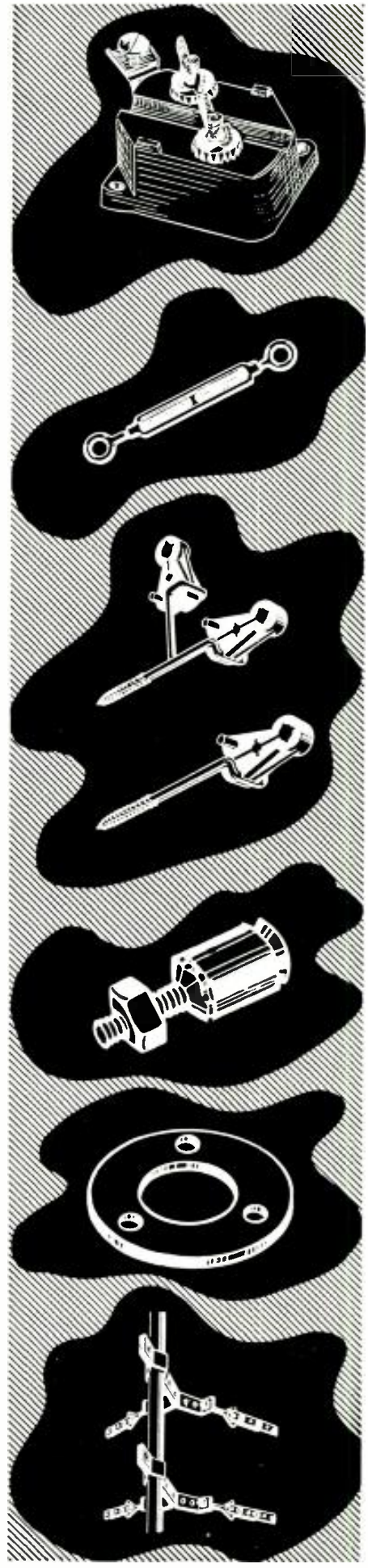
Note: When installing or adjusting the antenna, *do not use a metal ladder* if power lines of any sort are near. Accidental contact with a metal ladder usually is fatal! Use a dry, wooden ladder to be safe.

Special Considerations

12. *Installing on flat roofs, sun porches, etc.* If you do not use a regular commercial base mount be sure the mounting base is strong enough to keep the bottom end of the mast from twisting during high winds or rainstorms. Use a block of wood under the mast to prevent damage to the roof. If mounting holes have to be made in the roof, cover these with pitch or caulking compound to keep out rain and snow. Do the same to all mounting-screw heads and around the mounting base edges.

13. *Mounting on slate roofs.* A chimney mount is the most practical in this case. If you must walk on the slate to reach the chimney, use a wooden ladder as a catwalk to prevent damaging the roof.

Although all the preceding points are essential to every antenna installation, it is surprising how many are neglected—or forgotten. Can *your* installations pass the test? —30—



CHOOSING YOUR HI-FI SPEAKER ENCLOSURE

By **ABRAHAM B. COHEN**
University Loudspeakers, Inc.

The cabinet to house the speaker or speakers of your choice must be selected carefully if maximum pleasure is to be derived from your high-fidelity equipment.

LAST month the author discussed the criteria involved in the selection of speakers for high-fidelity audio systems ("Choosing Your Hi-Fi Loudspeaker"). We will now consider the important factors governing the choice of suitable speaker enclosures.

It is probable that there is just as much uncertainty in the minds of laymen regarding the selection of an enclosure as there is in choosing a loudspeaker. The choice of a speaker often dictates the type of enclosure, and, conversely, the type of enclosure needed will often limit the type of speaker which can be accommodated.

Having examined the various types of speakers in last month's article, we can now consider what types of cabinets can be used with specific speakers. There are two general types of cabinets. Like speakers, they are the direct-radiator type and the horn type. These types are depicted functionally in Fig. 1. The direct-radiator category includes bass-reflex cabinets and all the variations of this basic design. It is, essentially, a resonant device and usually has to be tuned to the particular speaker with which it is to be used. The horn type of cabinet is anti-resonant and, while it does not need to be tuned, it does have to provide the proper loading on the speaker diaphragm by proportioning the expansion of the horn and its throat area and rear chamber to the particular speaker to be used.

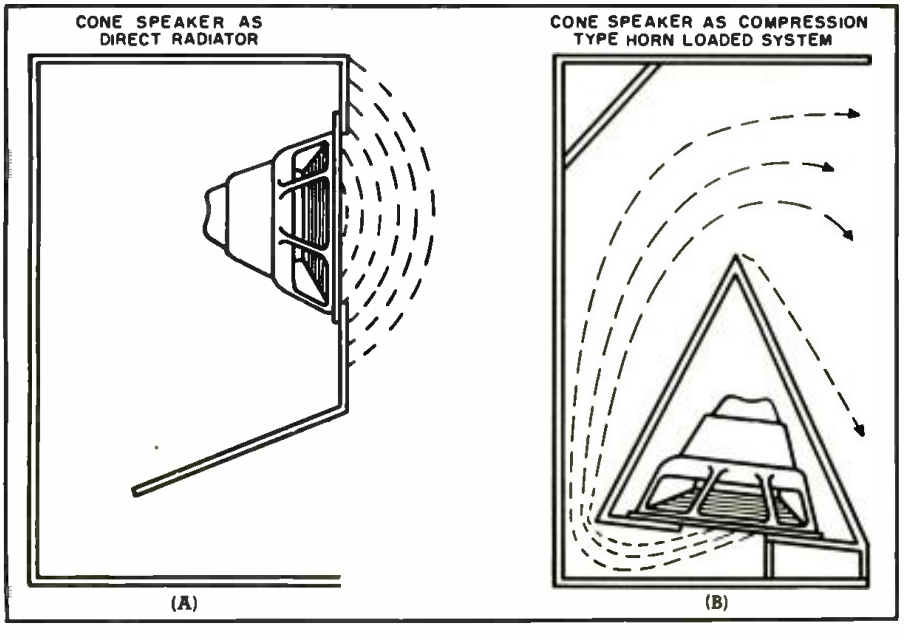
A good horn-type cabinet is more difficult to design and build than a direct-radiator type. This is just one reason for the ready acceptance of the bass-reflex type—its simplicity and economy. The principal reason for its popularity, however, is the compatibility of this type of cabinet with any type of speaker or combination of speakers. As the name "direct radiator" implies, the speaker, when mounted in the cabinet, looks directly out at its audience. This is important if one is planning an integrated two- or three-way speaker unit. When such a speaker is mounted in the cabinet, there is no obstruction between the tweeter and the ear, as pointed out last month. Life is almost as simple when using a bass-reflex cabinet for a two- or three-way system composed of separate units. The woofer can be mounted in the cut-out provided for it and the tweeter may be mounted wherever convenient by providing the proper opening for it on top of the cabinet.

A true horn-type cabinet, suitable for the living room, does not lend itself to a coaxial type speaker. In the construction of the horn it is usually necessary to fold it up at least once in order to squeeze it into a reasonable physical volume. The throat of the horn usually gets tucked away within the cabinetry and out of direct line with the ear, as can be seen from Fig. 1B. If the coaxial type of speaker is mounted at the throat of the horn, the tweeter would be forced to radiate into the base of the horn and all of its crispness and clarity is sacrificed. For this reason the tweeter must radiate in an unobstructed path to the ear.

If one wishes to use the horn-type of enclosure, it would be necessary to select separate, independent, and matched loudspeaker units, as shown in Fig. 2. If you want a single integrated unit, then you must stick with the direct-radiator type of cabinet.

Forgetting the matter of being able to select the specific components of a three-way system as against accepting the integrated package deal, is there any other advantage of one system

Fig. 1. Two methods of mounting a speaker within a "box" to give the effect of a direct radiator or a compression-type horn-loaded system. See text for advantages of each.



over the other? The answer is "yes." There is a psycho-acoustical advantage to a three-way system made up of separate units—it is possible to achieve greater spatial effects which tend to give added realism to the music. If a triaxial speaker is used in a direct-radiator cabinet, as in Fig. 1A, the sound source of all three speakers would then radiate from a single point. In the case of the three-way horn system, the sources of sound are separated by the differences in the lengths of the horns involved so that there is a feeling of physical separation. Moreover, the speakers are separated by the width of the cabinet, adding further to the illusion of acoustic depth.

There are horn variations on the direct-radiator baffle theme and, likewise, there are direct-radiator variations on the horn theme—and there is a large area of overlap between the two. One excellent version of a bass-reflex cabinet (Fig. 1A) has its port horn loaded which means that radiation from the port is given an additional boost by coupling to the horn. This enables it to radiate more efficiently.

In addition, there are totally "rear-of-speaker" horn-loaded cabinets in which the back of the speaker looks into a folded horn but the front of the speaker looks directly into the listening area. Such a cabinet is compatible with any combination of loudspeaker components.

With the horn family of cabinets there are several subdivisions which must be understood in order to facilitate the intelligent selection of components. The prevalent horn design is one that uses the corner of the room as a part of the horn, as an extension of the horn, if you will. Some of these models use the actual walls of the room to complete the horn while other corner models have their own integral side walls and do not depend upon the room walls. In some instances the corner in which you wish to place the cabinet may have heavy, absorbent drapes or other acoustical treatment which will deteriorate the action of the horn. In this case, the corner enclosure is made independent of the room-corner acoustics by building into it its own "corner wall." Such a complete horn, independent of the room walls, is shown in Fig. 2, along with the matched components designed to be used with it.

Another version of the corner-type cabinet has been dubbed the "cornerless corner horn" because it is shaped in such a way that it will fit into a corner or can be placed against a flat wall. These cabinets are made in both the horn-loaded and direct-radiator types.

The size of the enclosure selected will, of course, be governed by the speaker or speakers to be used in it. It will be found that the speaker cabinets now on the market are adaptable to a wide range of component sizes. There are midget enclosures for 8" speakers, medium sized cabinets to house 12" speakers, and extended sizes for larger installations—all of which are available in either direct-radiator or horn varieties. Selection of the cabinet will be rather straightforward if we keep in mind that, generally speaking, the larger the components, the better the low-frequency response and the more speaker components, the cleaner the system. Choose your acceptable cabinet size and choose your system for it—unitized into parts or integrated into one—and your choice will automatically be narrowed to one or two cabinets.

Now that the speakers are in the cabinet of your choice, there is one last detail in the auditory chain that should be covered—the listening room itself. The best spot for a loudspeaker enclosure is the corner of the room. The corner tends to reinforce the action of the cabinet just as an orchestral shell reinforces the sound from an orchestra. Even a rectangular cabinet may have its performance improved when placed in a corner. Not only will the low frequencies be greatly enhanced but the high frequencies will cover more floor area of the room when projected from a corner than when emanating from a cabinet placed against a flat wall. Fig. 3.

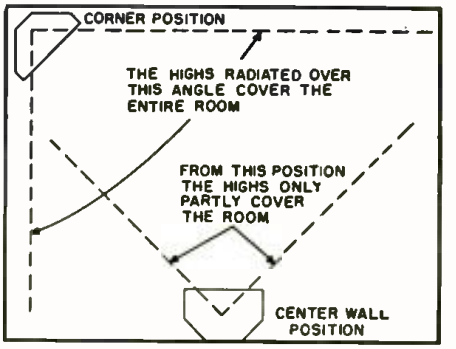


Fig. 3. Corner placement of an enclosure gives better low-frequency reproduction because the corner acts as a horn coupled to the speaker. A corner also provides better high-frequency coverage since the tweeter in this position "sees" all parts of room.

The room insulation will greatly affect the quality of the reproduced sound. A room without any absorptive surfaces will make the reproduction too reverberant and destroy the crispness and separation of the various notes. The lower notes will continue to roll around the room long after they have issued from the speaker and will tend to mask the following notes. In a completely untreated room, standing waves may be set up at certain frequencies, giving "hot spots" of energy

(*Continued on page* 120)

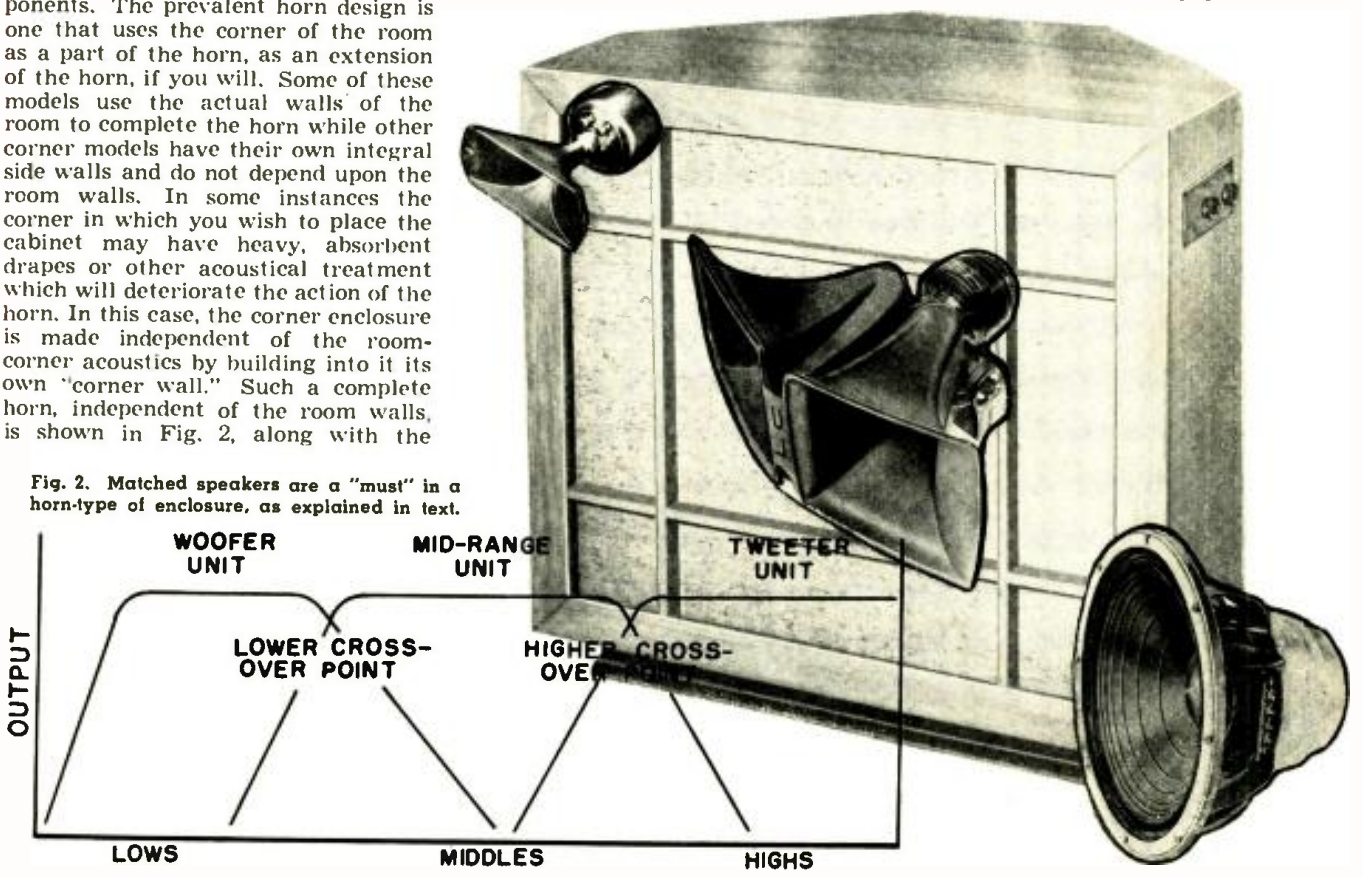


Fig. 2. Matched speakers are a "must" in a horn-type of enclosure, as explained in text.

ALL-PURPOSE ENCLOSURE FOR 12" SYSTEMS

Part 2. Performance of some popular high-fidelity loudspeakers in the "Fold-a-flex" enclosure and a description of a new, unique comparator technique.

By **OLIVER READ**
Editor and Asst. Publisher
RADIO & TELEVISION NEWS

THE enclosure for loudspeakers has a definite effect upon the reproduction that can be obtained from various systems. The damping effect on a moving cone of a loudspeaker has a direct control over the impedance characteristics of the voice coil. The amount of damping required will depend upon the behavior of a given loudspeaker mounted in its enclosure. The loading effect produced by a particular enclosure design can and does act as an acoustical brake to the piston-like excursion of a cone in the low frequency range. Horn type enclosures provide this loading advantage.

These are but two of the factors influencing the behavior of a loudspeaker. The leading manufacturers of hi-fi speakers have recognized the importance of the enclosure and have designed cabinets to meet the requirements of their own loudspeakers. Such compatibility has resulted in some very fine systems and has greatly simplified the problem of choice for the consumer.

The audio enthusiast, technician, and the serious student, to a great extent, like to build their own enclosures and to study the behavior of several loudspeakers before deciding which is best for their listening pleasure. The all-purpose enclosure, described last month, was a direct result of this search for a "guinea pig" cabinet that could meet the demands for checking the performance of any loudspeaker contained in but one assembly—but having the essential characteristics of the most popular enclosures: folded horn, infinite baffle, and bass reflex. The "Fold-a-flex" loudspeaker enclosure[1] was the result. A single cabinet instead of three provided the necessary housing for the experiments.

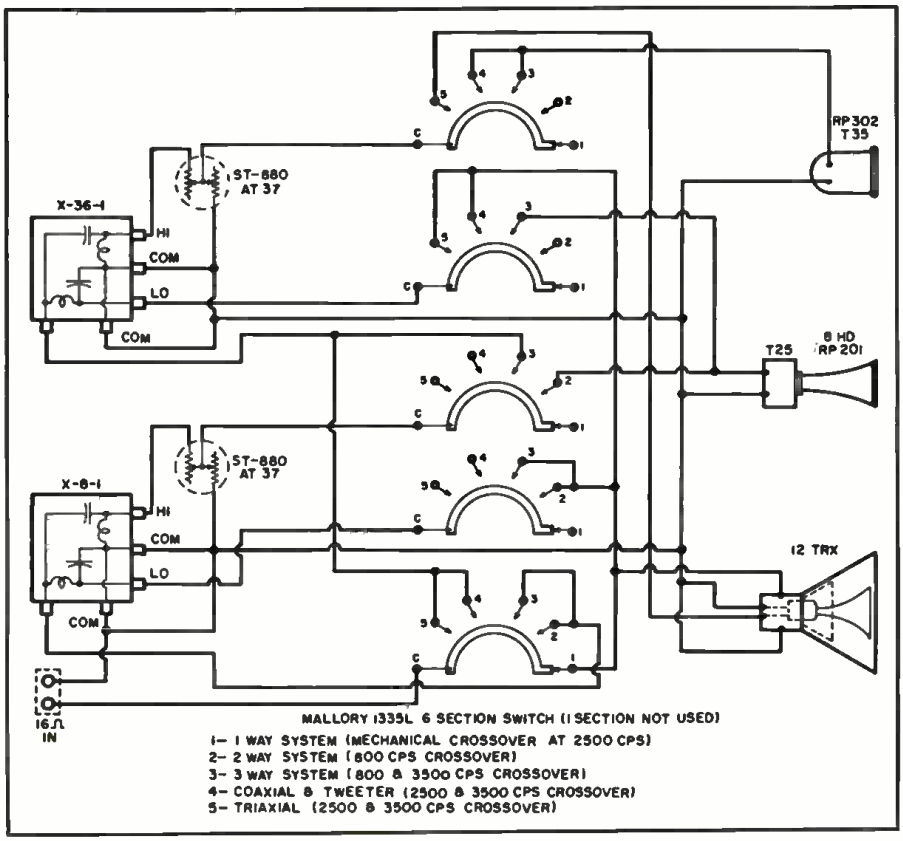
Frequency response measurements were made under "free field" conditions in an outdoor area free from reflective surfaces. The setup included two calibrated microphones; a dynamic (*E-V* 655) and a crystal (*Shure* 98-99). The low impedance 655 was coupled through a high-quality broadcast transformer to match the 1 megohm input of the a.c. vacuum-tube voltmeter. Because the 98-99 crystal is designed to feed a load of at least 20 megohms it is necessary to use either a correction factor or to modify the circuitry. We chose the latter so that direct readings would result in plotting the curves. The 98-99 microphone has an internal capacitance of 1000 $\mu\mu$fd. and the cable adds another 200 $\mu\mu$fd. The total then becomes 1200 $\mu\mu$fd. The microphone acts as a Thevenin generator with a constant voltage proportional to the sound pressure and a capacitance of 1200 $\mu\mu$fd. connected in series.

Our trusty *Shure* "Reactance Slide Rule" shows that a 1 megohm load is equal to the capacitive reactance of 1200 $\mu\mu$fd. at 130 cycles. The response of the v.t.v.m. will then be down 3 db at 130 cycles and will continue dropping at the rate of 6 db per octave below 130 cycles. Measurements were wanted down to 30 cycles. It was necessary then to connect a capacitor of 3000 $\mu\mu$fd. across the microphone. This causes a 10 db drop in the output of the microphone but it has the advantage of eliminating a correction factor. The result is an essentially flat output down to 30 cycles.

Spacing between the microphone and the front of the enclosure was maintained at 36 inches. A *Heath* audio generator (calibrated against a *Hewlett Packard* 200 C) was used as the signal source feeding a *Fisher* 70A amplifier to drive the test speakers.

The response curves, Figs. 2 to 4,

Fig. 1. Five distinct speaker combinations are switch-selected for demonstration purposes or for the study of loudspeaker behavior under various conditions.



[1] Pats. Pending.

show the effect of enclosure characteristics. The advantages of a tunable bass reflex port are clearly shown in the curves. The hump (at 150 cycles) results from cabinet resonance produced by an infinite baffle. Tuning the port results in a reduction of the hump and produces two equal humps of lower amplitude which is exactly the effect wanted. The difference can be easily distinguished when heard in the living room. Measurements made in a typical living room all show considerable improvement in bass response. When the enclosure is used as a folded horn, either on a flat wall or in a corner, even greater extension of the bass range is enjoyed.

Another innovation was made to permit demonstration of the "Fold-a-flex" at the New York Audio Fair in October. Many of our readers will remember the remote control system devised to show the wide difference in the performance of single and multiple loudspeakers under different conditions of baffling.

The circuit, Fig. 1, is designed for manual switch selection and is self-contained. Relays were substituted in our demo unit so that each function could be selected from across the room. The following components make up the system: A 12" triaxial loudspeaker with electrically independent tweeter, a mid-range horn, a small tweeter, a crossover network (800 cycles) and another at 3500 cycles. The two networks should have a common built-in connection between input and output. The switch is a 6-section (1 not used), 5-position rotary type.

Our demo unit contained an *Electro-Voice* 12TRX triaxial, a T25 driver, and 8HD horn and the *Jensen* RP302. The crossover networks are *E-V* X-8-1 and X-36-1. Level controls permit setting the mid-range horn and the tweeter to best balanced listening. The following are the functions available as selected by the switch:

Position (1): 1-way wide-range system. Here, the audio feeds directly to the voice coil of the 12" duo-cone. Its built-in mechanical crossover at 2500 cycles affords extended single cone coverage.

Position (2): A 2-way system. This shows the effect of adding a high-frequency horn to existing 1-way systems. Audio feeds to the 800-cycle network and utilizes the 12" cone as the woofer (800 cycles and below) and the horn for 800 cycles to the h.f. limits of the horn.

Position (3): A 3-way system comprising low frequency woofer, mid-range horn (800-3500 cycles) and u.h.f. tweeter (3500-15,000 cycles).

Position (4): Coaxial (2500-cycle mechanical crossover) and tweeter (3500 cycles). This demonstrates the effect of adding a tweeter to existing coaxial speaker systems.

Position (5): Triaxial. Showing the advantages of single point-source

(*Continued on page* 157)

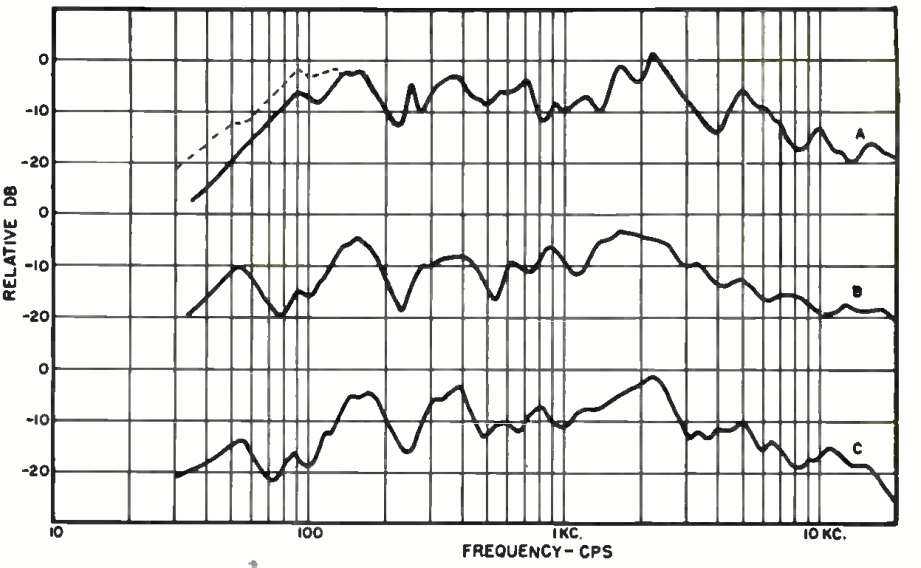


Fig. 2. Response curves of the Stephens 103LX, 216, and 814H two-way system in the original "Fold-a-flex" for 15" speakers described in 1953. (A) Folded horn. Dotted trace is for corner mounted enclosure. (B) Infinite baffle. (C) Bass reflex. Humps at 150 and 300-400 cycles have equal response as a result of tuning reflex port.

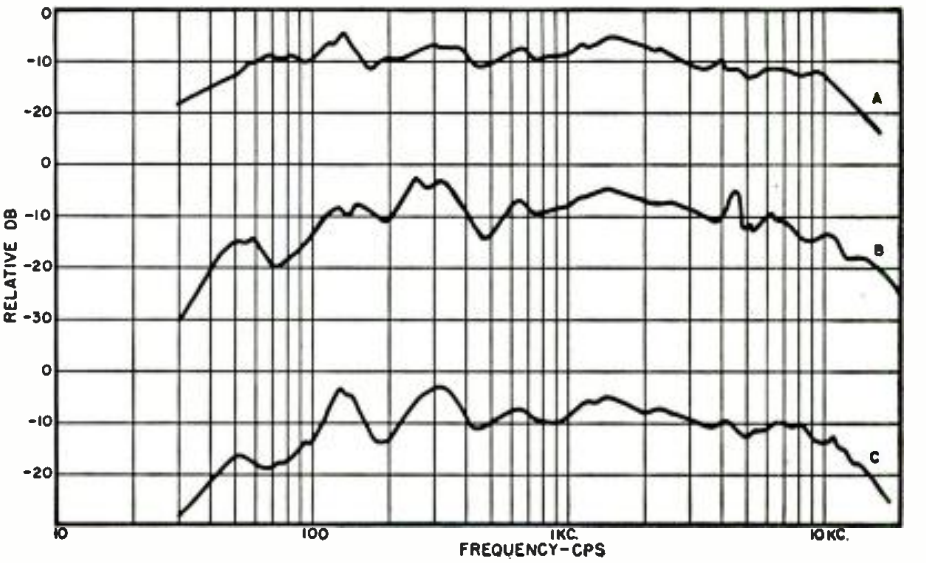
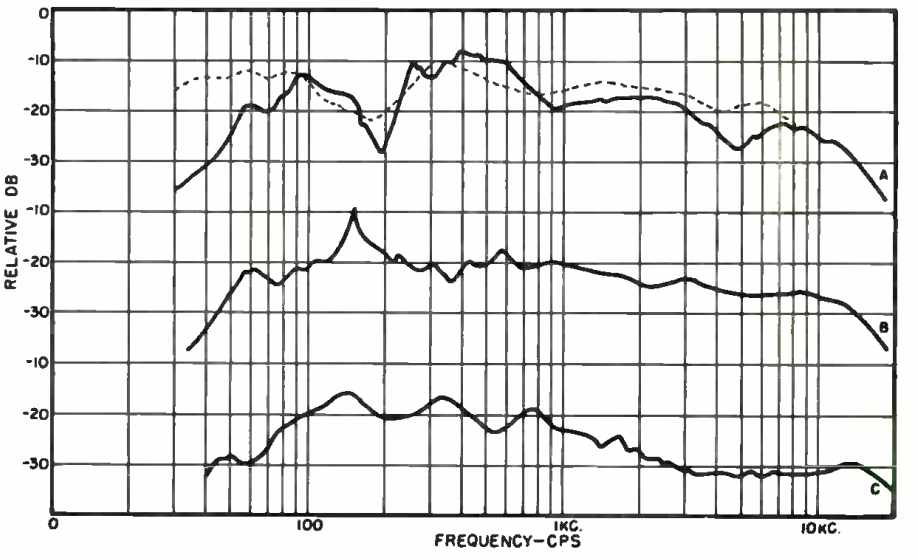


Fig. 3. Improved damping and horn shape of the Model 12 enclosure is reflected in these curves of the Electro-Voice 111 two-way system for 12" low-frequency driver and high-frequency horn. (A) Folded horn. (B) Infinite baffle. (C) Bass reflex.

Fig. 4. Response of the Jensen "Tri-Plex" system in the original enclosure. Dotted trace shows effect of corner mounting in a well-draped living room. (A) Folded horn. (B) Infinite baffle. (C) Bass reflex. See author's discussion in article.



A SEMI-AUTOMATIC TUBE CHECKER

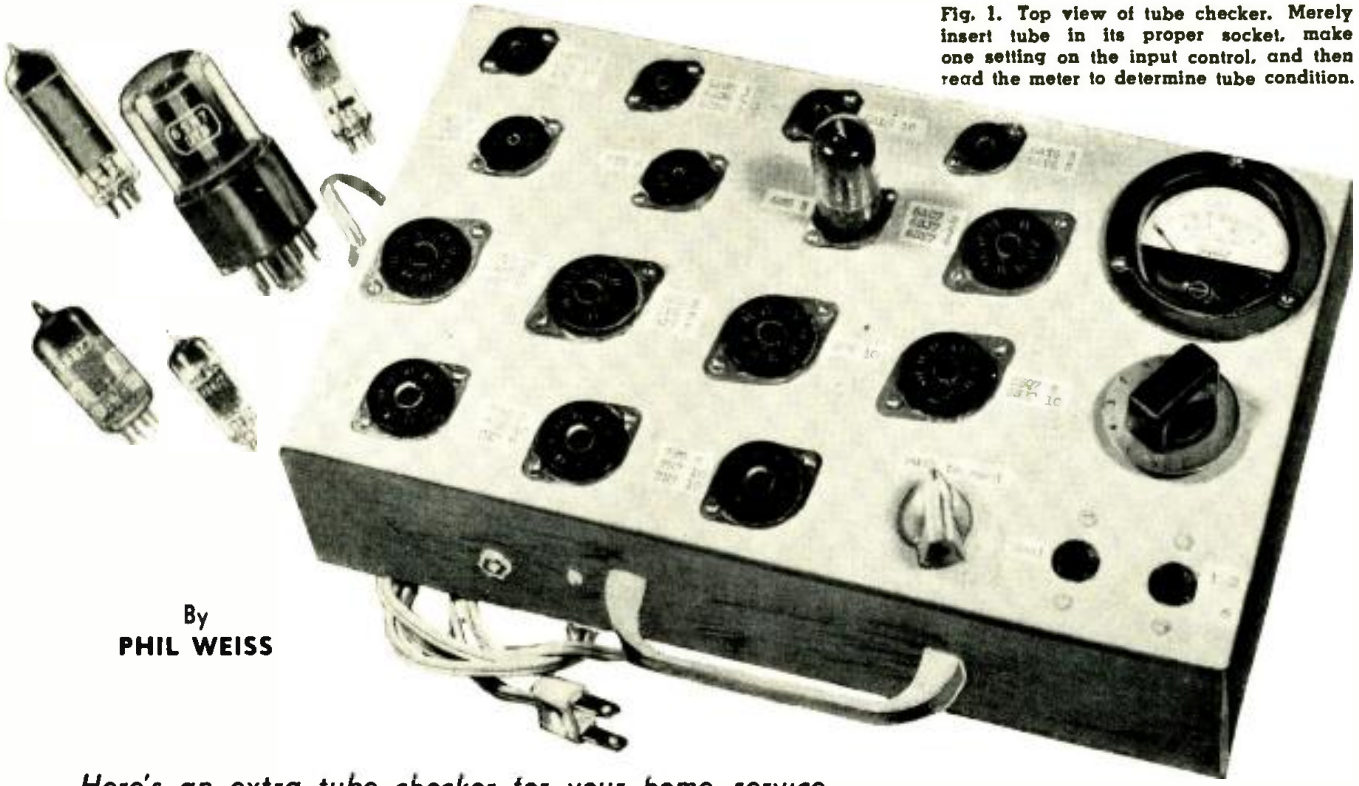


Fig. 1. Top view of tube checker. Merely insert tube in its proper socket, make one setting on the input control, and then read the meter to determine tube condition.

By
PHIL WEISS

Here's an extra tube checker for your home service calls that is easy to build and easier to operate.

IT IS a good idea for a TV service technician to check all the amplifier tubes in every set with a tube checker. From the customer's viewpoint, the set will give better performance if all the weak tubes are replaced, and it is usually cheaper to replace a weak tube than to wait until it goes out and have to pay an additional service charge. From the service technician's viewpoint there are many advantages:

1. It is faster and surer to spot some kinds of tube defects with a tube checker, than by substitution—especially when more than one tube is bad.
2. The number of callbacks is greatly reduced when all weak tubes are replaced.
3. Many more tubes are sold, especially in older sets.
4. The tube checker has great prestige value in the eyes of the customer.

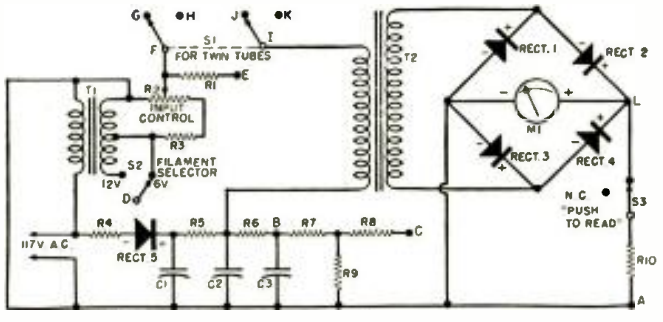


Fig. 2. Schematic diagram of the tube checker. Labeled points refer to Table 1.

R_1—3 megohm, ½ w. res.
R_2—8 ohm pot
R_3, R_9—50 ohm, 1 w. res.
R_4—22 ohm, 1 w. res.
R_5—200 ohm, 2 w. res.
R_6—2000 ohm, 5 w. res.
R_7—4000 ohm, 10 w. wirewound res.
R_8—150 ohm, 2 w. res.
R_{10}—5 ohm, 1 w. res.
C_1, C_2, C_3—20/20/20 μfd., 150 v. elec. capacitor
T_1—Fil. trans., 12.6 v. c.t. @ 1.5 amps. (Triad F-25X or equiv.)
T_2—Interstage trans., 1:3 ratio (Triad A-31X or equiv.)
Rect. 1, Rect. 2, Rect. 3, Rect. 4—Full-wave bridge instrument rectifier (Conant Type M or equiv.)
Rect. 5—100 ma. selenium rect. (Federal 1004)
S_1—D.p.d.t. slide switch
S_2—D.p.s.t. slide switch
S_3—S.p.d.t. spring-return, normally closed, rotary switch (Centralab 1463)
M_1—0-1 ma. d.c. milliammeter

Some important disadvantages to using a tube checker in the home are that many tube defects cannot be found with a tube checker, such as high voltage breakdown; it takes a long time to look up each tube in a chart, and to manipulate all the switches; it is expensive to provide each service technician with a tube checker; and commercial tube checkers are easily damaged when constantly carried about. Also the switches give trouble when used constantly.

The tube checker described in this article and shown in Fig. 1, was built to minimize these disadvantages. It does not attempt to check all tube types, but only about 100 of the most common tubes found in TV sets. This list can be enlarged or reduced, according to the individual preference of the constructor. The list does not include any of the power tubes, such as 6BG6 or 6W4, since the condition of these tubes is usually apparent from observing the performance of the TV set.

Each tube type goes into a socket according to its pin connections. For example: all 7-pin pentodes like the 6AG5 go into one socket, all 9-pin triodes like the 12AU7 into one socket, and so on. There are 15 sockets in all. They are wired in parallel by wires, so that when any tube is plugged into its proper socket it operates under the correct conditions for that type. An a.c. signal, adjustable from 0 to 10 units, is fed into the grid of the tube under test, and the a.c. output of the plate is read on a meter. The instru-

(*Continued on page* 114)

Top chassis view of the home-built SSB audio test oscillator. It is very compact.

SINGLE-SIDEBAND AUDIO TEST OSCILLATOR

By
EDMUND H. MARRINER

Compact test unit to be used with SSB exciters having 90 degree phase-shift networks.

SINGLE-SIDEBAND transmission needs a series of new gadgets to test SSB exciters. The following is an oscillator to use in place of the microphone. This makes a convenient way to tune up—just throw the switch and you have a tone with which you can monitor the transmitter on the oscilloscope. This oscillator is especially useful when used with the 10A or 20A SSB exciter and does not tie up any of your regular test equipment. It can also be used with any SSB exciter having a commercial 90 degree phase shift network.

Fig. 2 is the response of the average commercial 90 degree phase shift network used in an SSB exciter for a band of frequencies 200 cycles to 3000 cycles. It is possible to have one point in that range exactly 90 degrees. This point falls about 1225 cycles and can be used for alignment purposes. Some networks may be up or down a bit.

Fig. 1 is a Franklin oscillator with three fixed frequencies of 1200, 1225, and 1250 cycles which would cover any network which might be off slightly. It is necessary that the oscillator have low output, not over .075 volt r.m.s, to properly balance the SSB exciter and avoid distortion. Another reason for this small auxiliary oscillator is that the regular oscillators with a dial are hard to set exactly on 1225 cps because they are not calibrated this close. It is also hard to find the same dial setting each time you want to tune up.

The values given in the schematic were measured on a *GR* bridge and if followed will give the previously-mentioned frequencies exactly as measured on a *Berkeley* counter. Paralleling small silver mica capacitors to obtain this value will be close enough to

(*Continued on page* 116)

R_1—*1 megohm, ½ w. res.*
R_2—*15,000 ohm, ½ w. res.*
R_3—*120,000 ohm, ½ w. res.*
R_4—*150,000 ohm, 1 w. res.*
R_5—*1000 ohm pot*
R_6—*250 ohm, 1 w. res.*
R_7, R_8*—1000 ohm, 1 w. res.*
C_1—*.0021 μμfd. mica capacitor (see text)*
C_2—*.0016 μμfd. mica capacitor (see text)*
C_3—*.0011 μμfd. mica capacitor (see text)*
C_4—*.01 μfd., mica capacitor*
C_5—*.05 μfd., 200 v. capacitor*
C_6—*.03 μfd., 200 v. capacitor*
C_7, C_8*—8 μfd., 200 v. elec. capacitor*
Rect. 1—*40 ma. selenium rectifier*
L_1—*1.47 hy. toroidal coil (W. E. or Hycor, see text)*
T_1—*117 v., 40 ma. trans. (TV booster type) with 6.3 v., 1 amp. winding*
J_1, J_2, J_3—*Microphone jack*
S_1—*S.p. 3-pos. rotary switch*
S_2—*S.p.d.t. switch*
V_1—*6J6 tube*
**Optional*

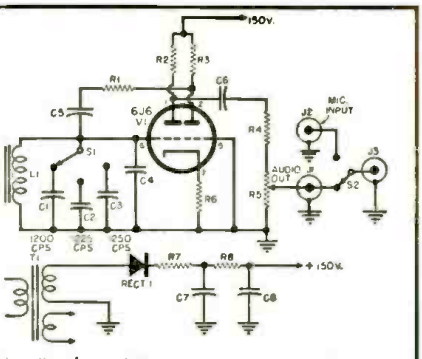
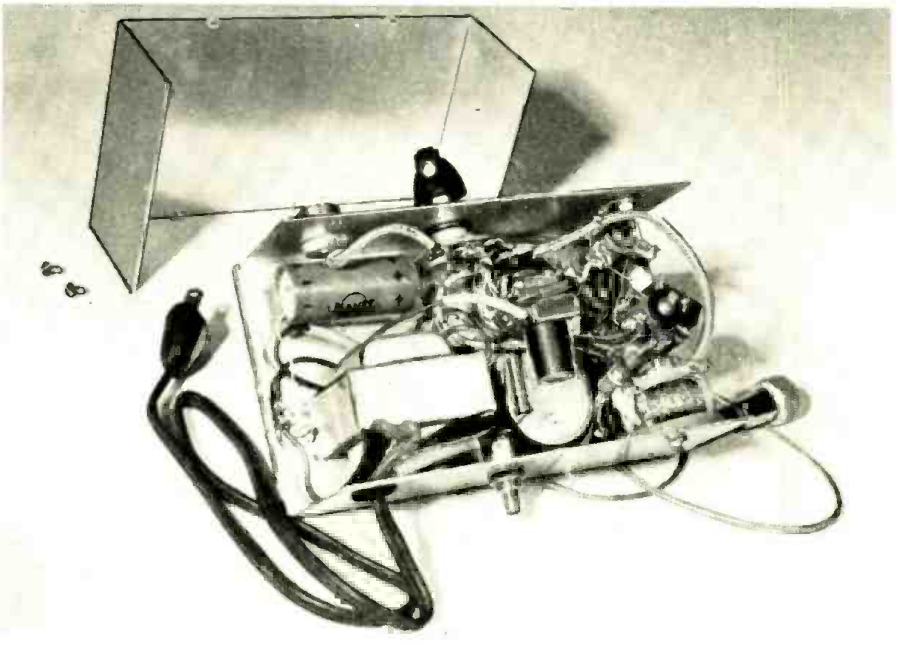


Fig. 1. Complete schematic and parts list covering the SSB audio test oscillator.

Under chassis view. The toroid is visible at far right, mounted on chassis lip.



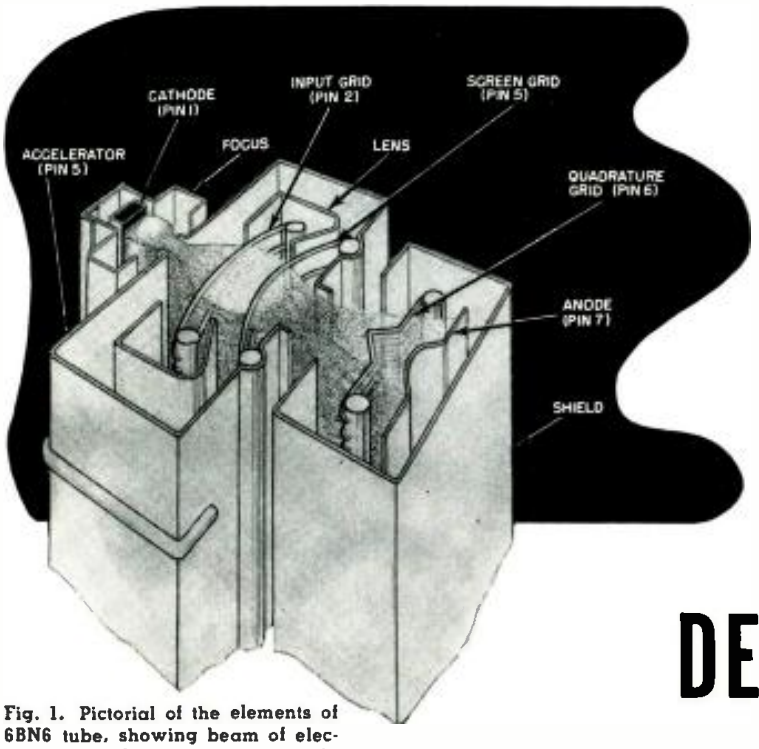
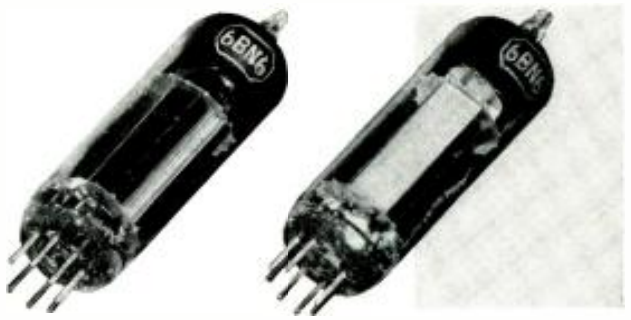


Fig. 1. Pictorial of the elements of 6BN6 tube, showing beam of electrons going from cathode to anode through the various grids of tube.



Servicing GATED-BEAM DETECTOR CIRCUITS

By **MATTHEW MANDL**

Details on the operation of the 6BN6 limiter-detector which is now being used in many present-day TV receivers.

THE 6BN6 gated-beam FM detector is being used with increasing regularity in modern television receivers as well as FM sets. This unique tube is a combined limiter and frequency modulation detector and at the same time requires much less signal input than the conventional discriminator or ratio detector type of FM demodulator. Thus, only one i.f. stage is required preceding the detector instead of the usual two or three, and the stage of audio voltage amplification can be dispensed with since the output from the gated-beam detector is sufficient in amplitude to drive the audio output amplifier tube.

The 6BN6 gated-beam tube has an internal construction which concentrates the electron beam into a narrow stream. As shown in Figs. 1 and 2, the major elements which are brought to the tube base consist of the anode, pin number 7; the quadrature electrode, pin number 6; the accelerator grid, pin number 5; the input grid, pin number 2; plus the cathode, pin number 1, as well as the usual heater terminals.

The tube is so constructed that if either the input or quadrature grid has a fixed potential, plate current will not increase beyond a certain value, no matter how positive the other grid is made. If either grid is negative enough, plate current will be cut off, regardless of the potential on the other grid. Plate current cannot flow unless both grids are above cut-off, and a variation in plate current with grid potential is limited in both directions, particularly in the case of the input grid.

The quadrature grid (pin 6) incorporates a resonant circuit tuned to the i.f. frequency. This quadrature grid is coupled to the input grid *via* the space charge within the tube. When electrons approach the quadrature grid, they repel electrons in the grid wires. Thus, by electrostatic induction, energy is coupled to the resonant quadrature circuit. Such induced energy, however, must reach a maximum value before the interchange of energy can occur between the condenser and inductor of the resonant circuit (flywheel effect). Hence, a 90-degree phase difference exists between the signal voltage at the input grid with respect to the quadrature grid voltage. The potentials which exist at the input grid and the quadrature grid are shown in Fig. 3A.

The 90-degree phase difference between the two signals permits the tube to conduct only during the time when both signals are above the zero reference line as shown. Thus, the average tube conduction is a fixed value when the signal which is applied to the gated-beam tube is an unmodulated carrier (the i.f. frequency of 4.5 megacycles in intercarrier receivers). With normal operating bias, an input signal of approximately one volt or more causes plate current to reach saturation immediately and the tube conduction interval shown in Fig. 3A occurs. Thus, a square wave of beam current is generated and the input grid of the tube acts as a limiter, since an increase in signal amplitude, as represented by static, does not cause an increase in plate current flow.

When the incoming signal is frequency modulated, the change of input frequency causes a phase displacement between the voltage at the quadrature grid with respect to that at the limiter grid. This comes about because the quadrature resonant circuit is still tuned to the center frequency and for a shift of the applied frequency the inductive reactance of the coil no longer equals the capacitive reactance of the condenser. The voltage at the quadrature grid will, therefore, assume a different phase relationship with respect to the signal at the input grid. This is shown in Figs. 3B and 3C. Thus, if the i.f. carrier shifts to a lower frequency, the inductive reactance of the resonant circuit becomes less than the capacitive reactance. When the inductive reactance is lower than the capacitive reactance, the circuit is predominately inductive since this component has a greater shunting effect on the signal. Voltage leads in an inductive circuit and, thus, the quadrature grid voltage becomes less than 90 degrees out-of-phase with respect to the input grid voltage. This is shown in Fig. 3B, and the result is that tube conduction is increased in duration.

When the carrier frequency shifts higher, the resonant circuit becomes predominately capacitive (lower capacitive reactance than the inductive reactance). Since voltage lags in a capacitive circuit, the quadrature grid potential is caused to lag more than the 90 degrees, as shown in Fig. 3C. Thus the duration of plate current flow decreases.

Since the i.f. carrier signal deviates in frequency each side of the 4.5 megacycle center frequency during frequency modulation, the audio signal appears in the anode circuit as a variation of average plate current. The plate load resistor (the volume control) of Fig. 2, plus the shunting .001 μfd. con-

denser, form an integrating network which averages out the amplitudes of the square waves of current and thus produces the audio signal voltage variations. The condenser, in effect, holds its charge between successive valleys of the square waves.

The 470-ohm resistor in the anode circuit is for feedback purposes. The voltage drop developed across this is coupled *via* interelectrode capacities to the quadrature circuit to improve the linearity of the detection system.

The variable cathode resistor regulates the amount of bias applied to the limiter grid (about 3 volts). Since this potentiometer is also adjusted to minimize intercarrier buzz as well as set the extent of limiting, it is usually designated as the "buzz control" in television receiver schematics. The "buzz control" is regulated so that the bias permits operation on the best portion of the characteristic curve of the tube. The signal to the limiter grid may reach amplitudes up to 5 or 10 volts which normally would mean a considerable grid current flow. This is held to a minimum, however, by tube design so that the input circuit would not be damped objectionably.

Typical Circuits

Fig. 2 is the type circuit used in some *Crosley* TV receivers. The coupling transformer between the anode of the 6U8 i.f. amplifier and the limiter grid is tuned to the i.f. frequency (4.5 megacycles in intercarrier TV receivers, and 10.7 megacycles for FM receivers). The quadrature coil is tuned to the same frequency as the sound i.f. stage.

Sometimes a separate resonant input circuit is employed, as shown in Fig. 4, which illustrates the system used in many late *Westinghouse* receivers. The gated-beam circuit is similar to the one previously discussed except for slight changes in component parts. Here, the output of the first sound i.f. amplifier has a separate resonant circuit which is slug-tuned, and the signal is applied to the limiter grid which has an additional inductance to ground. The service notes for this receiver designate a cathode voltage range from zero to 4 volts, in contrast to the 2.6 volts designated for the *Crosley* receiver in Fig. 2. There is also a difference with respect to the accelerator grid voltage as well as the anode potential. The *Westinghouse* service notes indicate 100 volts as normal on pin 5 of the tube in this circuit while *Crosley* suggests 110 volts. The latter receiver indicates 77 volts at the anode pin 7, while *Westinghouse* shows a range from 35 volts to 200 volts.

Except for such slight variations as cited, most other manufacturers employing the gated-beam tube utilize circuits which, basically, are identical. This is indicated in Fig. 5 which illustrates the 6BN6 stage in some *Zenith* television receivers. Here a single 6AU6 tube precedes the sound detector and this 6AU6 acts as a sound limiter and thus performs some clipping function as well as amplifying the signal derived from the sound take-off coil. The clipping action assures a greater attenuation of amplitude modulation variations.

Alignment Procedures

Since the gated-beam circuit is rather simple as compared to the discriminator types of detectors which may employ two i.f. stages besides a limiter, alignment procedures are much less complex.

Alignment of the gated-beam circuit can be accomplished by using a transmitted television signal. The signal at the antenna terminals of the receiver should be reduced sufficiently so that limiting action in the gated-beam tube is prevented. At such a level, a pronounced hissing accompanies the sound output. A low ohm resistor can be placed across the antenna terminals to reduce the signal input. Several should be tried until one is found which brings the signal level down sufficiently.

When the limiting action of the gated-beam tube no longer prevails and the hiss is heard, adjustments are made to the sound take-off coil, the transformer between the sound i.f. amplifier and the gated-beam detector, as well as the quadrature coil. The buzz control is also adjusted in conjunction with the slug adjustments of the aforementioned coils, until the cleanest sound is produced with a minimum of buzz. Adjustments should be made until the sound output has good quality with minimum buzz, even though the output level may not be at its maximum for minimum buzz. If the hiss disappears during adjustments of the controls, it may be necessary to reduce the input signal by an additional amount so that the hiss may be heard during adjustments.

In the absence of a station with accompanying sound modulation, a sweep generator may be employed. This generator should be capable of producing the necessary 4.5 megacycle signal in frequency modulated form. This can be applied to the input of the video amplifier in lieu of the station signal.

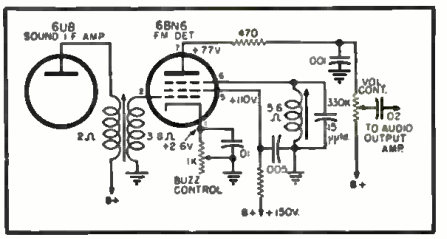


Fig. 2. Schematic diagram of the FM detector circuit used in the Crosley chassis 426. The 6BN6 also serves as limiter.

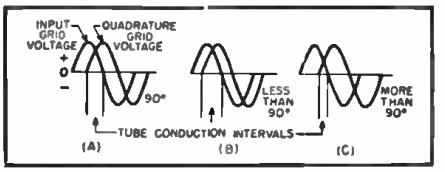


Fig. 3. Current flows through the 6BN6 only when there is a positive bias on both the input and quadrature grids. The length of time that current flows depends on the phase difference between the voltages on the quadrature and input grids.

Servicing Factors

If the alignment procedures fail to reduce the intercarrier buzz to a satisfactory level, the 6BN6 tube should be tested or a new one tried. If a new tube does not help, the a.g.c. system of the receiver may require adjustment. If the a.g.c. circuit is functioning properly, the fault may be due to improper tuner tracking or video i.f. alignment. If this has been checked without reducing buzz, the component parts associated with the gated-beam circuit should be checked and compared with the values given in the service notes. Voltages should also be tested and compared with those given.

When parts are replaced, care should be exercised with respect to lead-dress. The leads of new resistors and condensers should be trimmed to the same length as the original components and the units should be placed in approximately the same position as the old parts.

A defective bypass condenser in the cathode circuit of the gated-beam tube will upset the bias on the grid and may increase the intercarrier buzz level. An improper setting will also increase the distortion factor. Distortions will also prevail if the other bypass condensers become defective. -30-

Fig. 4. Sound detector circuit used in Westinghouse TV sets.

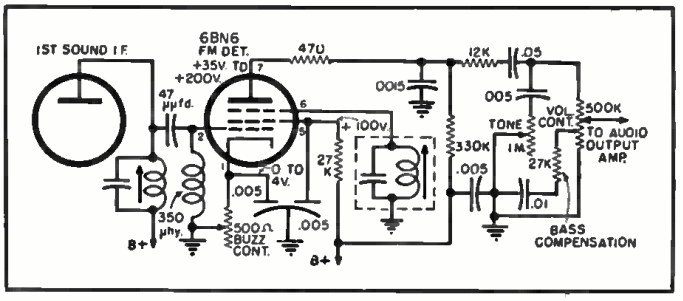
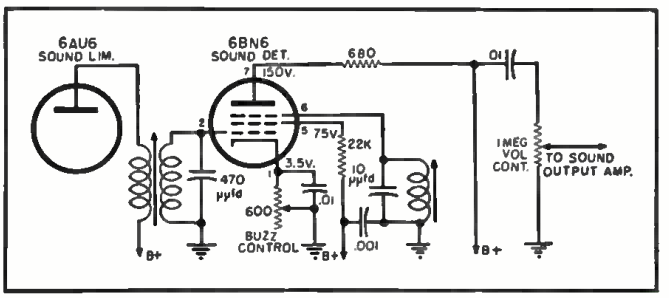


Fig. 5. Sound detector circuit used in Zenith TV receivers.



Front panel view of "Globe Scout 65," a bandswitching ham transmitter which is designed for novice ticket holders.

THE "GLOBE SCOUT"

Details on a new transmitter which covers all bands from 10 to 160 meters. Power is 65 watts c.w., 50 watts phone.

By
LEO I. MEYERSON, WØGFQ
World Radio Laboratories

THE "Globe Scout 65" transmitter is a general-purpose, 65-watt c.w., 50-watt phone, bandswitching transmitter covering 160 meters through 10 meters and designed for the beginning or experienced amateur or as the "second" transmitter for the higher powered group of hams.

While designed primarily as a fixed transmitter, it has also been used as a mobile unit by amateurs and CAP groups, since it is merely necessary to pull the jumper plug on the back of the chassis and plug in a d.c. power supply. We suggest the use of a 400 volt, 200 ma. d.c. supply.

This transmitter has a 6146 final tube with a 6F6 oscillator using the hot cathode circuit. Complete coverage of 160 through 10 meters is obtained by use of 160-, 80-, and 40-meter crystals. The oscillator stage is easily driven by a small v.f.o. (such as the *Lysco* model 382). The speech amplifier consists of a 6SJ7 and a 6C5, with a 6L6 as modulator in a combination of Heising and screen-grid modulation which provides ample audio power to fully modulate the final.

A high-impedance microphone input is provided. Metering is done in the final grid and final plate. A pi-network antenna tuner with "L" section is utilized in the output to match most types of antennas. The power supply is self-contained.

All parts are standard with the exception of the coils and bandswitch which may be purchased from the manufacturer.

The oscillator and final coils may also be wound by the builder as follows: Oscillator coil, L_2—72 turns of #28 enameled wire closewound on 1" form with taps at 45 turns and 61 turns. The final coil, L_3, has 82 turns of #22 enameled wire on 1" form with the first 60 turns closewound, tapped at 30th and 60th turn. Then wind 14 turns on ¾" space with tap at 14th turn, then 4 turns on ⅜" space with tap at 4th turn, then another 4 turns on ⅜" space.

Circuit Functions

Oscillator: The oscillator circuit was primarily designed for crystal operation, although any v.f.o. with an output of 2 to 5 watts will work equally as well. The stage employs controlled regeneration allowing the use of standard 160 to 40 meter crystals and provides more than enough harmonic output to drive the final to full output. Bandswitching is incorporated in this stage and the cathode keying is crisp and clear on all bands. On straight-through operation, the excitation to the final stage may be in excess of requirements; in this instance, the oscillator tuning control must be detuned slightly to reduce the amount of drive to the proper level. The oscillator stage is capacity coupled to the final amplifier.

Rear view of transmitter. This particular unit is commercially available in kit form.

R.F. Power Amplifier. This stage employs a 6146 tube operated as a class C amplifier. Two types of bias are applied to this stage; one is cathode, or self bias, and the other is excitation bias. The cathode of this stage is keyed as is that of the oscillator. The final operates straight-through on all bands except 10 meters where doubling in this stage does not affect the output to any appreciable extent. Design of the plate circuit in the final stage utilizes bandswitching plus a pi-network. The pi-network allows matching into various antenna impedances.

Speech and Modulator. The speech amplifier circuit is of conventional design, utilizing a 6SJ7 tube. The amplified speech signal is fed into a conventional 6C5 driver stage through the volume control. Latest components such as printed circuit "Couplates" are utilized; these refinements increase efficiency and ease of wiring. Capacity coupling is utilized between the driver stage and a modified Heising-type modulator circuit. Modification of the original Heising circuit consists of heavily modulating the screen of the 6146, as well as the plate. Metering of either the final grid or final plate circuits is provided with a dual scale meter for constant monitoring of circuit operation.

Power Supply. The power supply utilizes a 5U4G tube as the rectifier. The voltage and current supplied are 500 v.d.c. @ 200 ma., which is adequate to power the complete transmitter. An auxiliary socket mounted on the rear of the transmitter provides for external power such as would be required in a mobile installation. Power requirements for mobile operation are 6 v.d.c. @ 4 amps. and 300 to 500 v.d.c. @ 200 ma.

General Information

A two screw terminal strip (labeled "Antenna Relay") on the rear of the chassis, provides a 115 v.a.c. source when the transmit switch is in the "on" position. This provides the necessary voltage for an antenna changeover and receiver disabling relay.

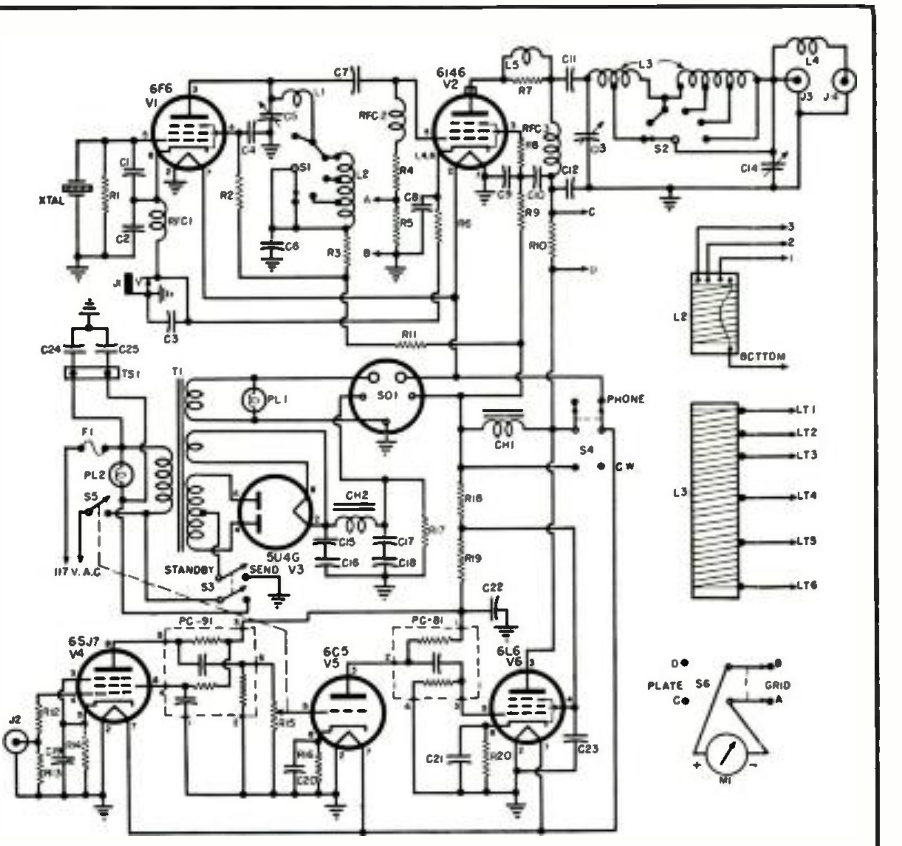
Operation and Loading

A good electrical ground connection to the chassis of the transmitter is essential to efficient operation and proper loading of the final stage. An antenna length of between 60 and 80 feet, at least 15 feet clear of the ground, has been found to be almost ideal for all band operation. A folded dipole type antenna for any band, will match into the pi-section very well, needing no extra matching section.

The extra coax connector labeled "Doublet" is used with doublets on the 80- and 160-meter bands, or with antennas on the higher bands (40-10 meters).

Tune up procedure for the pi-section is simple, but care must be exercised so that you do not inadvertently tune to a harmonic of the fundamental signal. The proper tuning point on the final tank is indicated by a sharp, clean and low dip in plate current with the plate tuning capacitor approximately half meshed. When attempting to load with the antenna load control, do not operate with the loading capacitor at minimum capacity as this produces excessive reactance and will lead to excessive harmonic radiation. The loading capacitor should load gradually but firmly from maximum capacity, and should show full load at half of its full capacity. Antenna trimming or lengthening is the obvious remedy for any faulty loading conditions.

(*Continued on page* 113)



R_1, R_2—47,000 ohm, ½ w. res.
R_3—120 ohm, ½ w. res.
R_4—27,000 ohm, ½ w. res.
R_5—22 ohm, ½ w. res.
R_6—450 ohm, 10 w. wirewound res.
R_7—Parasitic suppressor (Ohmite P-300) (See L_5) 56 ohm, 1 w. res.
R_8—56 ohm, ½ w. res.
R_9—12,500 ohm, 10 w. wirewound res.
R_{10}—.4 ohm meter shunt
R_{11}—5000 ohm, 10 w. res.
R_{12}—47,000 ohm, ½ w. res.
R_{13}—2.2 megohm, ½ w. res.
R_{14}—2200 ohm, ½ w. res.
R_{15}—500,000 ohm volume control with switch (S_5)
R_{16}—1500 ohm, ½ w. res.
R_{17}—50,000 ohm, 10 w. wirewound res.
R_{18}—22,000 ohm, 2 w. res.
R_{19}—20,000 ohm, ½ w. res.
R_{20}—220 ohm, 2 w. res.
C_1—25 μμfd., 600 v. capacitor
C_2—120 μμfd., 600 v. capacitor
C_3, C_4, C_6, C_8, C_9, C_{10}, C_{12}—.005 μfd., 600 v. disc capacitor
C_5—75 μμfd. var. capacitor
C_7—33 μμfd. capacitor
C_{11}—.001 μfd., 600 v. mica capacitor
C_{13}, C_{14}—365 μμfd. var. capacitor
C_{15}, C_{16}, C_{17}, C_{18}—16 μfd., 350 v. elec. capacitor
C_{19}—25 μfd., 25 v. elec. capacitor
C_{20}, C_{21}, C_{22}, C_{23}—10 μfd., 450 v. elec. capacitor
C_{24}, C_{25}—.008 μfd.,
CH_1, CH_2—8 hy., 150 ma. choke
F_1—3AG, 3 amp. fuse
J_1—Closed circuit key jack
J_2—Closed circuit mike jack
J_3, J_4—Chassis type coax connector
L_1—Osc. plate coil (See text)
L_2—Tapped osc. coil (See text)
L_3—Pi-network final coil (See text)
L_4—20 t. B&W #3016
L_5—Wound on R_7 (9 turns #20 wire)
PC_1—Pentode Couplate (Centralab PC-91)
PC_2—Triode Couplate (Centralab PC-81)
PL_1—6 v. pilot light
PL_2—117 v. pilot light
RFC_1, RFC_2—5 mhy., 50 ma. r.f. choke
RFC_3—2.5 mhy., 200 ma. r.f. choke
S_1-S_2—Two-section, six-position bandswitch
S_3—D.p.s.t. switch
S_4, S_6—D.p.d.t. switch
S_5—S.p.s.t. switch (on R_{15})
T_1—Power trans. 1000-1100 v. c.t. @ 200 ma., 5 v. @ 3 amps.; 6.3 v. @ 4 amps. (Chicago PCR-200)
V_1—6F6 tube
V_2—6146 tube
V_3—5U4G tube
V_4—6SJ7 tube
V_5—6C5 tube
V_6—6L6 tube

BAND	OSC. TUNING	FINAL PLATE TUNING
10	¾	¼
15	¼	¼
20	¾	½
40	¾	½
80	½	½
160	½	¾

Complete schematic diagram and parts list covering the "Globe Scout 65". This transmitter is available in kit form or may be built from available components.

1954 TV RECEIVER SPECIFICATIONS

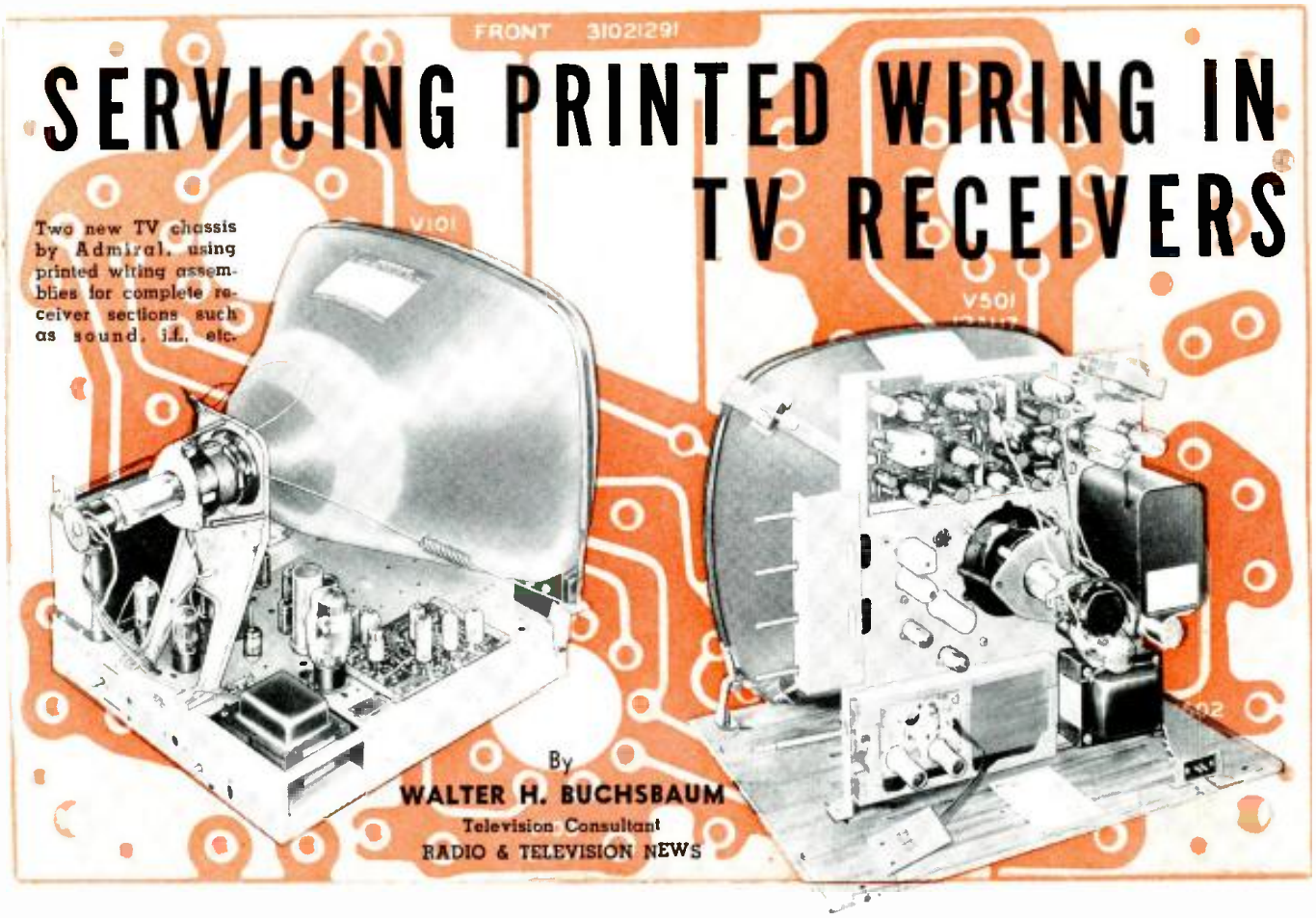
Conclusion of the list of mechanical and electrical specifications on 1954 Television receivers for service technicians.

MFR.	CHASSIS	TUBES							VIDEO I.F. FREQ. (MC.)	H.V.[4] (KV.)	U.H.F. PRO-VISION	POWER (WATTS)	SPECIAL FEA-TURES
		TUNER	I.F.[1]	VIDEO[2]	AUDIO	SWEEP[3]	P.S.	CRT					
TRAV-LER (Cont'd)	48A3	6AF4 6BZ7 6U8	6CB6 6CB6 6CB6	1N64 6AH6	6AL5 6AU6 6AV6 6V6	6BQ6, 6C4 6C4, 6S4 6SN7, 6SN7 6W4	1B3 5U4	17HP4 21YP4	45.75	14	11	185	10
	48C3	6AF4 6BZ7 6U8	6CB6 6CB6 6CB6	1N64 6AH6	6AL5 6AU6 6AV6 6V6	6BL7, 6C4 6C4, 6CD6 6SN7, 6SN7 6W4	1B3 5U4	24CP4A 24TP4	45.75	16	11	185	10
WESTINGHOUSE	V2243	6BZ7	6CB6	1N60	6AU6	6AL5, 6AU6	1B3GT	21YP4	45.75	16.5	Strips	225	10, 12,
	V2247	6X8	6CB6	or	6BK5	6AX4GT,6BQ6GT	5U4G	21FP4A	45.75	16.5	or	225	Audio
	V2263		6CB6	1N64	6BN6	6SN7GT, 12AT7	5U4G	21YP4	45.75	16.5	11	225	Noise
	V2273			6AU6 12BY7		12AU7, 12BH7		21YP4	45.75	16.5	11	225	Control
	V2250	6BQ7A or 6BZ7 6X8	6CB6 6CB6 6CB6	1N60 or 1N64 6AU6 12BY7	6AU6 6BK5 6BN6	6AL5, 6AS4GT 6AU6, 6AX4GT 6BL7GT, 6C4 6CD6G, 12AT7 12AU7, 12AU7	1B3 5U4G 5U4G	24CP4A 24TP4A	45.75	18.5	Strips or 11	300	10, 12, Audio Noise Control
	V2260	6BQ7A or 6BZ7 6X8	6CB6 6CB6 6CB6	1N64 6BK5	6BK5 6BN6	6AL5, 6AU6 6AX4GT, 6BQ6G 12AU7, 12AU7 12BH7	1B3GT 5U4G	17LP4 17VP4	45.75	15	Strips or 11	290	
	V2270								45.75	15	11	290	
ZENITH	19M20 19M21 19M22	6BK7A 6U8	6CB6 6CB6 6CB6	1N64 12AX7* 12BY7	6AQ5 6AU6 6BN6	6AH4GT,6AQ7GT 6AX4GT,6BQ6GT 6CS6, 6SN7GT 12AX7*	1B3GT 5U4 5U4	17LP4 21YP4 21YP4	45.75	14	Strips or 11	185	5, 10, 12
	20M20	6BK7A 6U8	6CB6 6CB6 6CB6	1N64 12AX7* 12BY7	6AU6 6BK5 6BN6	6AH4GT,6AQ7GT 6AX4GT, 6CD6 6CS6, 6SN7GT 12AX7*	1B3GT 5U4G 5U4G	21EP4A 21EP4B	45.75	18	Strips or 11	250	5, 10, 12, Video Amplifier Response Control
	20M21	6BK7A 6U8	6CB6 6CB6 6CB6	1N64 12AX7* 12BY7	6AU6 6BK5 6BN6	6AQ7GT,6AU5GT or 6AV5GT 6CD6, 6CS6 6SN7GT, 6V3A 12AX7*	1B3GT 5U4G 5U4G	24CP4 24CP4A 27EP4	45.75	18	Strips or 11	275	5,10, 12, Video Amplifier Response Control

1. Video i.f. tubes only. 2. Includes detector and a.g.c. 3. Includes sync section and a.f.c. 4. CRT 2nd anode voltage. 5. Removable safety glass. 6. Local-fringe a.g.c. adjustment. 7. High-fidelity sound. 8. Aluminized picture tube. 9. TV-radio-phono combination. 10. Built-in antenna. 11. 82-channel tuner. 12. Adjustable dial light. *Part of tube is used in another section.

If you would like us to publish a similar table listing the specifications on 1955 TV receivers, write to RADIO & TELEVISION NEWS, 366 Madison Avenue, New York 17, N. Y. Tells us also which specifications you would like us to add to this table.

SERVICING PRINTED WIRING IN TV RECEIVERS



Two new TV chassis by Admiral, using printed wiring assemblies for complete receiver sections such as sound, i.f., etc.

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS

You will be seeing more and more printed wiring in TV sets; learn how to troubleshoot and repair them.

ADMIRAL, MOTOROLA, and several other major TV manufacturers have recently begun to use printed wiring in certain subassemblies. Now a complete television receiver made up of printed wiring assemblies has been demonstrated by *Walsco*. As production techniques are further improved and circuitry becomes more standardized, the use of the printed wiring system in TV receivers will become even more widespread. This will require a different approach from the point of view of the man who has to troubleshoot and repair TV sets. Repairs in printed wiring assemblies are somewhat different than for conventional chassis; this article shows how parts replacement and other chores can be handled without damaging the assembly.

Before going into technical details, the terminology of this new method should be understood. *Printed circuits*, as used in hearing aids, vertical integrating networks, etc., involve the printing of capacitors, resistors, and coils on a ceramic base. Printed circuit assemblies usually cannot be repaired, but must be replaced entirely. *Printed wiring*, the type of assembly described in this article, uses standard components, but in place of interconnecting wires there is a thin pattern of copper foil, bonded to an insulating material. Either eyelets or holes in the insulating material filled with solder hold the components individually by their pigtails. Larger parts are mounted with straps, sockets, etc.

A typical basic printed wiring plate is shown in Fig. 1. Here the paths of the conducting copper foil are clearly shown.

Manufacture

The most widely used method of making printed wiring sections starts out with a copper-clad laminate consisting of a sheet of Bakelite or similar material bonded onto a thin copper foil. The desired pattern is transferred from a drawing onto a printing matrix by means of photo-engraving methods. This master matrix then prints the pattern, with a special ink, on the copper surface. The ink used is an acid resisting material which covers the copper at those points where a conductor is desired.

Next, the entire assembly is dipped into an acid bath which removes all the copper not covered with the special ink. After a neutralizing and cleaning bath the section is ready for assembly. In some instances the copper foil is plated before assembly which requires reverse printing and an acid which is more active on copper than on the plating material.

Some printed wiring sections have conductors on both sides with holes as connections between the two sides. In many such instances the inside of the hole is plated through or else an eyelet is inserted. The practice of using eyelets at all holes results in a stronger joint and ultimately simplifies parts replacement.

The original copper foil after printing, etching, and cleaning is often only about 0.001 inch thick and naturally very fragile. To connect resistors or capacitors to this very thin foil requires that at the junction point some mechanical anchorage be provided since the copper foil itself is insufficient support. The usual practice is therefore to trim and bend the leads from the components to standard lengths and then insert them into the proper holes, bending them over the copper foil on the other side. The body of the component is then supported by the insulating board and does not rest on the two pigtails.

After all components are in place, the entire assembly is dip soldered. This process requires a special flux and a closely controlled temperature and timing cycle. In many places the dip soldering operation is done completely by machine and this usually makes for a cheaper, more uniform product. During the soldering all holes should fill up with solder and all connections are made at one time. A cleaning bath to remove or neutralize the flux finishes the process. In some instances the residue of the flux is a

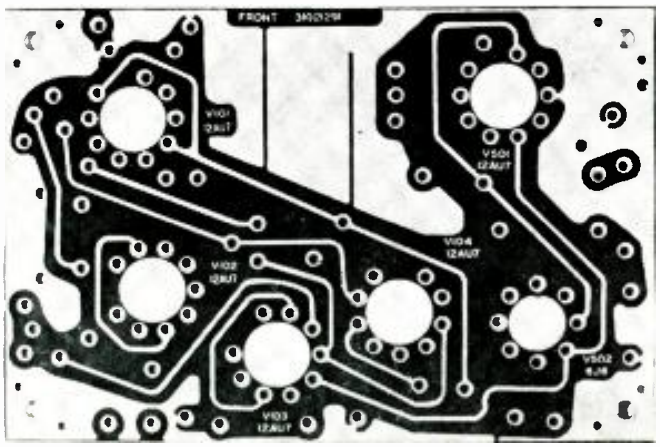


Fig. 1. Phenolic plate showing the copper clad portions which serve as wiring in white. The large holes take tube sockets.

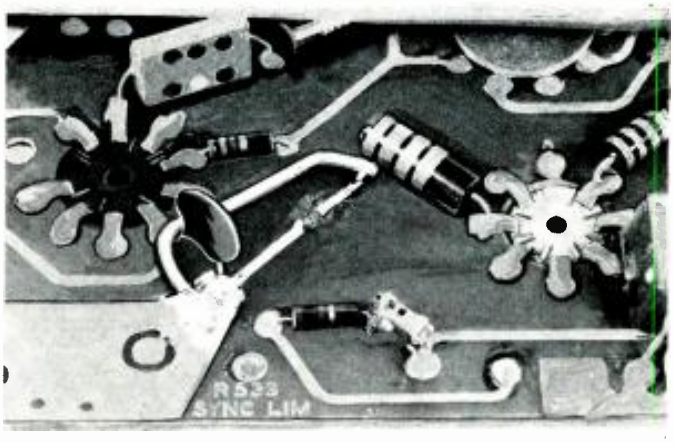


Fig. 2. The method of repairing a break in printed wiring is shown here. A piece of hook-up wire is shunted across the break.

wax coating which is left on to protect the printed wiring against moisture. Other manufacturers finish the assemblies by spraying them with a varnish or similar moisture resisting material.

In order to fully utilize the printed wiring method, many special components were developed. Potentiometers, tube sockets, switches, and electrolytic capacitors are now available with terminals that mount on printed wiring and can be dip soldered. When such components become defective the exact replacement part must be used in most instances. This means that, as printed-wiring type receivers become more popular, the TV service shop must carry additional stocks of special parts.

Troubleshooting

At the time of writing only the *Walsco* TV chassis employs printed wiring throughout. Most other manufacturers use the printed wiring portion only for certain subassemblies such as the audio section, or the i.f. section. The *Walsco* model PC-9 chassis has a total of 25 tubes and is made up of 10 separate subassemblies, nine of which are of the printed wiring type. A rear view of the chassis is shown in Fig. 5, illustrating how conventional i.f. shield cans, capacitors, and other components are mounted on the printed wiring subassemblies.

The service technician can use conventional TV troubleshooting methods to trace the defect in a receiver to a particular section and then proceed to find the defective component. If, for example, the entire i.f. section is mounted on one printed wiring assembly, the service technician can remove the individual subassembly from the main chassis for further test. In locating the trouble spot or making various measurements, connections can usually be made to the different resistors and capacitors from the same side on which the components are mounted, simply by clipping directly to their leads.

Although in some printed wiring systems the conductors and components are located on both surfaces, most TV receiver applications use only one side for the actual wiring. Where conductors are found on both sides it is important to remember that the eyelets or solder-filled holes in the insulating material serve as connections from one side to the other and usually hook circuit elements together.

Another important aspect of printed wiring troubleshooting is the relative fragility of the assemblies. Never rest a chassis on a component or any portion of the printed wiring assembly. Even if no break occurs, the flexing of the insulating material may be enough to injure a connection or a lead. Generally, it is good practice to service printed assemblies in the chassis or else lay them on a soft, non-abrasive surface. The use of pin type probes on the printed wiring should be avoided since even a slight slip of the test probe can break a conductor, loosen an eyelet, or otherwise damage the unit. Alligator or crocodile type clips should likewise not be hooked onto joints which could possibly peel off. Another thing to watch for in troubleshooting is to keep the printed wiring assembly away from soldering irons, infrared lamps, or other sources of heat. The solder used in the dip-soldering operation usually has a low melting point and excessive heat can do considerable damage.

In troubleshooting for an intermittent defect in an ordinary TV receiver it is common practice to tap tubes and various parts, pull leads, and probe and scratch connections to find the intermittent. This method must be modified for the printed wiring assembly. Visual inspection is most helpful in this instance. Where a broken wire could not be seen through the insulation or sleeving, the printed wiring assembly clearly shows all conductors, and breaks in them are easily spotted. Intermittent components are not as easily located, but there are certain typical troubles inherent in the assembly method of printed wiring.

As mentioned previously, the pigtails of the resistors and capacitors are trimmed and bent to their proper lengths either by machine or else in some kind of jig. Occasionally, some components have a weak spot in the leads or else are dislocated in the crimping jig, with the result that the lead tends to break intermittently at the bending or crimping point. Look at the junction of the individual leads and the body of the component when this type of intermittent is encountered.

Another possible source of intermittents is at the holes through the base board. As can be seen from Fig. 1, the conducting ring around each hole may not be concentric due to slippage, shrinkage, or misregistration of the pattern and this may result in a faulty connecting joint. If the copper does not circle the hole, subsequent plating or dip soldering may also be weaker and with some added strain an intermittent joint may result.

Intermittent tube pins are no more frequent in printed wiring than in an ordinary tube socket, but if one is found it is usually harder to repair.

Repairs

If troubleshooting requires no new technique, the repair of defects found in printed wiring assemblies is certainly different and often more time consuming than for standard wired models. For one thing, the unsoldering of the defective component is considerably more difficult since extreme care must be taken not to damage the assembly. The simplest way to remove a defective small component such as a resistor or pigtail-type capacitor is to cut its leads off near the body. Then, by carefully heating the joint with a small soldering iron, the loose pigtail wire is gently pushed through the hole and extracted at the other side. Never try to apply heat at the joint and pull the crimped end of the pigtail through.

Large components are usually mounted by a strap in addition to the soldered terminals. A good example of this are electrolytic capacitors which have a mounting strap eyeleted directly to the printed assembly. After having clipped the leads of such a capacitor and temporarily substituted a replacement, the mounting eyelet must be drilled out carefully before a new capacitor can be installed. In drilling out eyelets and rivets, the major difficulty is the tendency of the eyelet to spin with the drill. One simple way

to avoid this is to rest the head of the eyelet or rivet on a piece of sandpaper and drill against that. The friction of the head against the sandpaper usually prevents spinning and the drill then makes short work of the eyelet. Another quick method for removing rivets is to use a small grinding wheel attached to an electric hand drill. Grinding off the head and pushing the body of the rivet through with a center punch is often simpler than drilling a rivet out, but care must be taken that the grinding wheel does not slip and damage other parts.

In addition to the use of rivets and eyelets, some large components are staked to the Bakelite board. This is usually done with metal tabs which fit into rectangular slots in the board and are staked or bent after assembly. The best method of removing this type of fastening is to carefully grind off all projecting metal until each tab can be withdrawn smoothly. Bending or attempting to break these tabs off can result in breakage of the insulating board or, at least, damage to the mounting slots which will prevent replacement with the identical part. In replacing a staked lug or tab, the staking operation can be performed with a small chisel or sharpened screwdriver and a light tap hammer. Be sure to work against good support since otherwise the insulating board can be damaged.

In replacing small components such as resistors and paper or ceramic capacitors, be sure to trim and bend the leads properly before actually mounting the part. Fig. 4A shows the correct method of mounting a component by its leads. Note that the body rests flush against the Bakelite board while the leads are bent over at the other side, resting against the copper foil. By leaving one or both of the pigtails loose, as in Fig. 4B, the weight of the component is made to rest effectively on the solder connection. In time, it is possible to peel off the copper foil and, with the aid of vibration, a broken copper conductor may result. In printed wiring assemblies which use an eyelet or a through-plated hole for each connection, the likelihood that the foil will peel off is decreased and the solder joints can support more weight.

Another possible mistake in installing a replacement part is to tighten the bent-over pigtail too much. This creates a stress causing either the Bakelite to bend, the copper foil to tear, or else the pigtail to pull out of the component in time. A word should be said here about bending pigtail leads on resistors and capacitors. Never bend a lead closer than ⅛th inch from the body of a ½-watt carbon resistor. Make the minimum bending radius larger as the wire thickness increases. For a 2-watt carbon resistor, the pigtail should be bent at least ¼ inch from the body.

If the copper foil forming a conductor is broken, the best way to repair this is by shunting a piece of hook-up wire between the solder joints which the broken lead has connected. Fig. 2 shows how such a break is repaired. In this instance the large metal area at the lower left is a ground strip and the broken conductor was connected from the 2-watt resistor to ground. A short length of hook-up wire has been connected in place of the broken piece.

In many instances the eyelet or terminal hole is not readily accessible for repairs and then it is best to connect directly to the proper leads. Soldering on printed wiring is not the same as for ordinary wiring. Remember, the solder used in printed assemblies is not of the common rosin-core type; its melting temperature usually is much lower than the solder used for general service work. On some printed wiring assemblies, a protective coat of lacquer is sprayed on after dip soldering. Before heat is applied to such an assembly, scrape off the layer of lacquer carefully at the joint with a dull knife or file. Some assemblies have a wax coating which is part of the flux used in the dip soldering operation. This coating can remain, but will smoke and smell slightly when heat is applied.

Fig. 3 shows a preferred method of soldering a new component into place. A small iron tip, rounded and without sharp points, is used. The soldering-iron tip is applied to the pigtail wire and never directly to the copper foil. Melt the solder, let it flow, and immediately withdraw the iron. Too much heat from a powerful iron can melt the low temperature solder in nearby holes and loosen some connections. In general, the small soldering irons of the 25- to 50-watt sizes are best for printed wiring repairs. Always use some type of flux to help dissipate the heat from the soldering iron. The rosin flux from the new solder should be cleaned off, either with alcohol or else by wiping with a cloth while the joint is still warm.

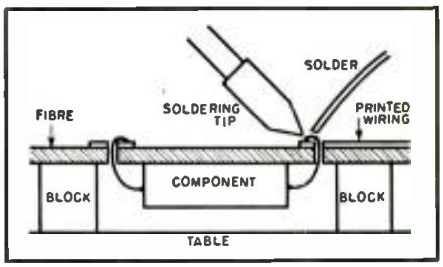


Fig. 3. When making repairs to a printed wiring board, support it as shown.

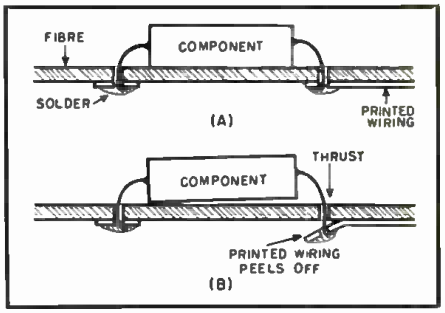


Fig. 4. The correct and incorrect way of mounting components on printed wiring boards. The result of using excessively long component pigtails for a repair is shown in (B).

In the illustration of Fig. 3, the assembly rests on two blocks rather than on the component. Holding the printed assembly properly while working on it is of great importance since otherwise it is very easy to damage parts and connections. One satisfactory and simple way is to put extra long tube shields on some of the tubes and rest the assembly on these shields. Another method utilizes a stiff cardboard box, with the rim of the open box supporting the Bakelite board. More elaborate supports can be made by using long screws and nuts through the regular mounting holes and resting the board on these screws.

The great advantages of using printed wiring in manufacturing make it

(*Continued on page* 155)

Fig. 5. A vertical-chassis receiver constructed entirely of printed wiring sub-assemblies. This set has a separate turret tuner, remotely controlled, shown at the lower left side.

By **BERT WHYTE**

THE Christmas season is here again, a fact which occasions much rejoicing among high-fidelity enthusiasts. They can look forward to someone (or perhaps themselves) gifting them with a new amplifier or speaker, or perhaps a nice big batch of new recordings. They might even be the happy recipient of a shiny new tape recorder. Which brings up a point. Ever since I began to review pre-recorded tapes, I have had a succession of very sad, and sometimes very irate letters from tape machine owners. Someone had done them dirty, they moaned. Their plight? That old debbil equalization! Seems they had dug deep into their jeans for a copy of one of the new pre-recorded tapes, and instead of sweet music, they heard a discordant dub! Yes, they found out the hard way that there is a great deal of variance in the playback equalization of tape machines. In fact, the problem of differing equalization among the many makes of tape machines, is far more serious than was the recently resolved case of phonograph records. You see, the engineering staffs of the various companies who make tape recorders, have their own particular ideas on how a record and playback head should be constructed and what kind of electrical circuitry is involved. There is no standardization of equalization in the tape machine business. All that exists is a very tenuous and unenforceable clause in the NARTB "suggested standards" guide, which *proposes* certain standards of equalization. A few of the large professional manufacturers adhere fairly close to these standards, although they arrive at the results by different methods. The manufacturers who make the small non-professional tape machines ignore these proposals and the result is chaos. However, it must be said that the engineers of these companies are not just being "pig-headed." They have plenty of valid reasons for their non-conformity to a single standard. *Cost* is a very big factor. Another thing is the desire for increased frequency response at the slower tape speeds. This is done to increase the sales appeal of a unit, and it carries with it the penalty of non-standard equalization. You may be very proud of your unit which gives you "12,000 cycles at 7½ in. per sec.", but remember this . . . treble equalization with anywhere from *11 to 23* decibels of boost is necessary in some machines to achieve such high frequencies. When you play back a pre-recorded tape which was recorded on a professional machine utilizing *far less* boost, naturally all that you get is a screechy caricature of the music. There are other variations on this theme with the results always the same . . . tapes recorded on one machine do not necessarily sound good when played back on a different machine. What can you do to correct this situation? Not much, I'm afraid. The prospects for agreement among engineers for a standard equalization are pretty remote at this writing. If you own a professional-type unit which normally doesn't include an integral amplifier, you should have no trouble. They can thus be connected to the preamp of a hi-fi amplifier and judicious use of the bass and treble tone controls will give you a balanced sound. Most of the less expensive "home type" machines have an output jack for connection to an external speaker. While it is less easy of accomplishment, there is no good reason why an output jack could not be provided on these machines which would bypass the integral amplifier and allow connection to a tone control preamp. As with the professional units, this would allow you to balance the music to your particular requirements. It is possible that this modification has been incorporated in some of the newer models which will be shown at the Audio Fairs. I will investigate and report to you what I find. If no help is forthcoming, maybe you can rise up in your collective might and petition the manufacturers to get on the ball!

Christmas is, of course, the season for giving as well as receiving. In addition to the usual reviews, I will list some recordings old and new, which you can use as a "gift guide" in buying for your friends, or for . . . yourself. To all my friends everywhere . . . a most joyous and Merry Christmas!!

Equipment used this month: *Electrosonic* cartridge, *Fairchild* arm; *Components Corporation* turntable; *Fisher* 50-C preamp; *McIntosh* 30-watt amplifier, *Jim Lansing* D34001 two-way horn speaker; *Ampex* 600 tape equipment.

A CHRISTMAS RECORD BUYING GUIDE

Gaite Parisienne
Les Patineurs

The Boston "Pops" conducted by Arthur Fiedler, RCA Victor LM1817

Super-fi versions of these old favorites. Fiedler is a master with this sort of thing. Some terrific wood block, snare, and bass drum sounds in the "Gaite"!

Liszt Piano Recital

Orazio Frugoni, pianist. Vox PL8800

If you are looking for some wild and wooly piano in the grand old manner, this is for you. In the "Dante Sonata," and others, Frugoni whips up quite a pianistic storm. Good piano sound.

Violin Concert

Joseph Szigeti in works of Bach, Tartini, and Handel with Columbia Symphony Orchestra conducted by George Szell and Carlo Bussotti, pianist. Columbia ML4891

Szigeti shows off his fabulous skill and versatility in a pair of violin concertos with Szell and in a pair of sonatas with Bussotti. Music making of very high order and recording of more than uncommon merit.

Paganini Recital

Ruggiero Ricci, violinist with Louis Persinger, pianist. London LL-1005

Sarasate Recital

Ruggiero Ricci, violinist with Louis Persinger, pianist. London LL-962

For those of you who like virtuoso violin playing, this is a rare treat. Ricci is one of the brightest young talents today and his technique and tone are amazing, especially when reproduced with the fabulous clarity of this recording.

Christmas Organ Music

Fritz Heitmann, organist. Telefunken LGX66009

One of the most astute masters of the organ plays Christmas hymns of Bach, Buxtehude, and others. Telefunken has always had a great reputation for the quality of their organ recordings and this is no exception. Very clean-lined, luminous sound with properly sonorous pedals in the right places.

STRAUSS, RICHARD
SALOME
Christel Goltz, Salome; Julius Patzak, Herod; Margareta Kenny, Herodias; Hans Braun, Jokanaan; Anton Dermota, Narraboth. The Vienna Philharmonic Orchestra conducted by Clemens Krauss. London LL1038/39. RIAA curve. Price $11.90.

The things that happen in this age of LP! The echoes of *Columbia's* good but not outstanding "Salome" of a few months ago, have hardly died away, and here we are with a new edition from *London*. This recording is a bird of a different feather, however. It will take a formidable combination of soloists and orchestra and conductor to supplant this version. In fact, I doubt that few record companies will be foolhardy enough to undertake such a venture. This is not to say that this recording is faultless. Looking at the over-all picture, there is room here and there for improvement. But, by and large, this is the most exciting "Salome" on records. This is a dramatic work and one that is terribly demanding of the participants. The singers must be superb vocalists; they must also be first rate in their acting. The orchestra must be completely at ease with the complex Strauss orchestration, yet their technical mastery should not make feeling and expression subsidiary. The conductor must maintain a rigid discipline over all his forces, in a score which can destroy itself by its own unchecked momentum. Yet he must not be so inflexible, so unsympathetic that the work loses its poetry and drama. That these impossible conditions are fulfilled, almost to perfection, is as great a tribute to the recording as I can summon. Fate had Christel Goltz as the "Salome" of the first complete

(*Continued on page* 102)

THE "BASS ULTRAFLEX" ENCLOSURE

Fig. 1. "Ultraflex" enclosure with back removed to show the three-way system. It can also be used with a single-cone unit or two-way loud speaker systems. See text.

By
DANIEL J. PLACH
and
PHILIP B. WILLIAMS
Jensen Manufacturing Co.

Both 15- and 12-inch versions of this design are included in this article covering Jensen's new speaker housing.

THE major part of design work and experimentation with speaker enclosures has been, and still is being devoted to efforts to get more bass output in a given space—or to retain a certain degree of output in a smaller space. Economic considerations and space limitations dictate that most speaker enclosures must be smaller than the ideal size. Reproduction of low frequencies down to, say, 40 cycles, at approximately constant efficiency over the entire range still requires a very large enclosure, and a rather expensive one if furniture finish is specified.

The battle to achieve more bass in moderately-sized speaker systems still goes on. At *Jensen*, a major program of examination, analysis, and evaluation of all the known principles of enclosure operation has been completed, and several new products have evolved.

The end results of this activity have been most gratifying in the achievement of the greatest total bass output possible at this stage of the art for cabinets of medium size. A new approach retains the desirable features of back-loading corner operation in a simple enclosure structure.

During this development program it was realized that small, compact horns are not capable of reproducing extreme low frequencies at high efficiency with smoothness. Inadequate mouth area produces reflections which create dips in the output, when the horn and driver are properly matched. As it must be assumed that this proper matching is part of the design, it follows that a horn with a too small mouth area does not create peaks which might help offset the dips in total bass output heard, so the net effect is less bass. A small size horn enclosure gives attendant difficulties in development of the path length, as well. So compromises are necessary which to some degree nullify the theoretical gains of horn-loading. Because of these factors, investigation was restricted to three types—total enclosures, bass reflex, and a new *Jensen* development called "Bass Ultraflex."

It was determined that medium size total enclosures had these disadvantages:

1. Resonant frequency of the speaker is raised because of the added stiffness behind it. In the case of very large (infinite baffle) total enclosures, this would not happen, but even so, hangover in the speaker is still a problem. The response shape is determined largely by the damping factor of the entire system, including the speaker. Low-frequency performance is definitely limited when amplifiers of high damping factor drive speakers of high efficiency and high magnetic energy. Furthermore, the light low frequency loading may give excessive distortion at moderate or high power inputs.

2. In general, the speaker resonant point is shifted upward even more when the speaker has a cone suspension of high compliance, as with low resonant frequency speakers. This means that these speakers suffer the most, as they will be affected more by the enclosure-added stiffness than will a speaker with higher resonant frequency. Thus we are limited in how low the resonant point can be placed.

3. Roll-off of the woofer below its resonant frequency is inherently and uncontrollably set at 12 db-per-octave, which severely limits output of the speaker below its resonant frequency. The infinite baffle is far from "pure" and basic as a standard of comparison. In many cases it is out-performed by moderate sized enclosures of other design.

Fig. 2. Comparison of the performance of three different types of speaker enclosures.

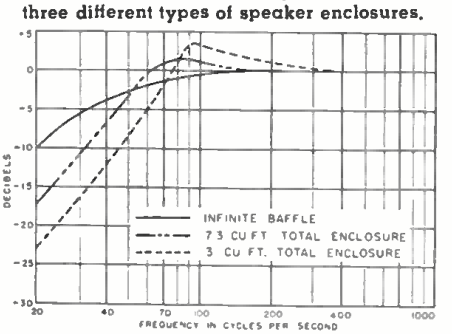
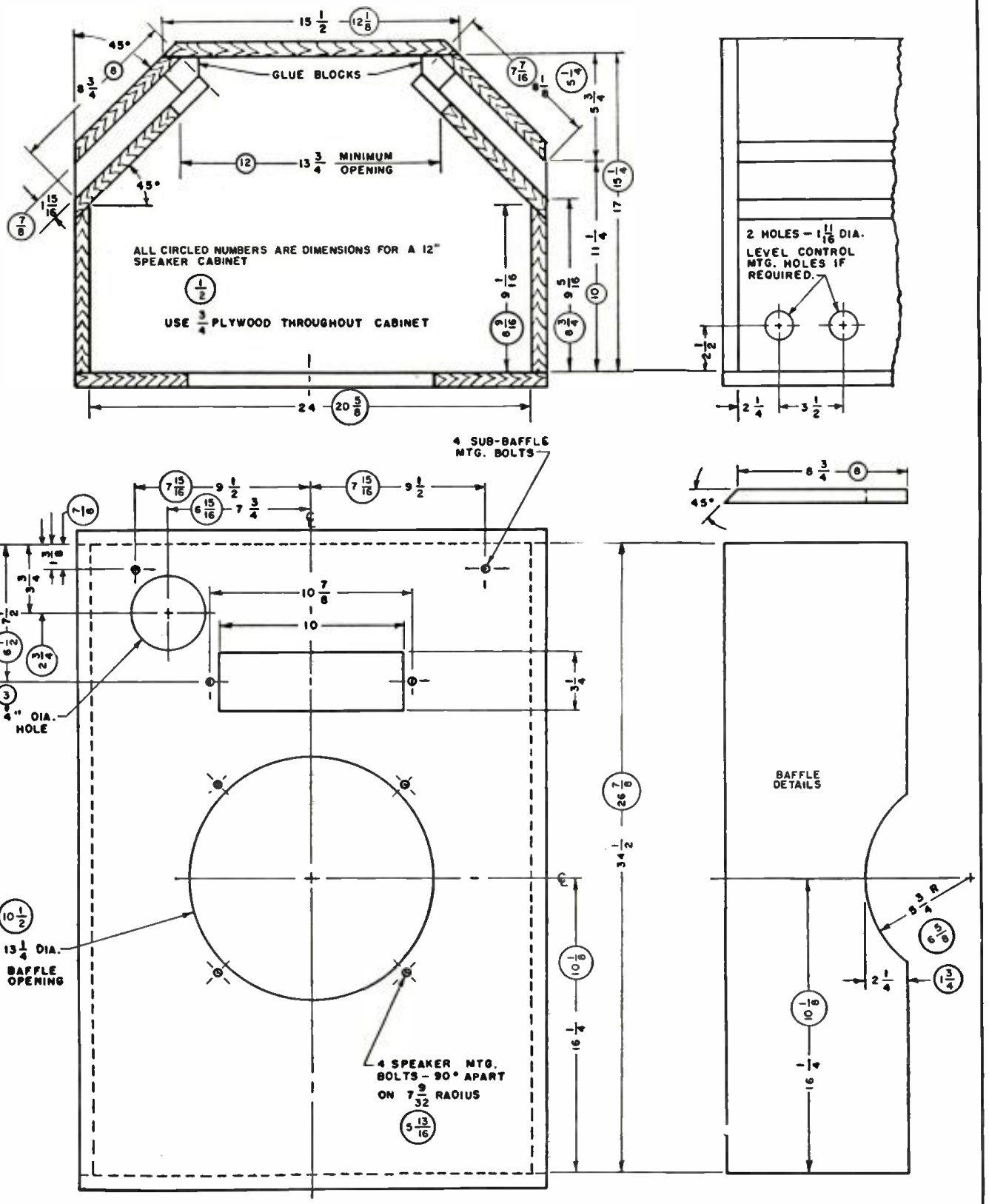


Fig. 2 shows the effect of various sizes of total enclosure. The infinite baffle gives the lowest cut-off. Smaller enclosures produce a rise above cut-off which will increase the "thump" at that frequency. This "thump" effect is sometimes used commercially to give the impression of more bass.

Bass Reflex

The bass reflex principle employs a total enclosure with a vent in the box. The vent uses the back wave by inversion to combine with the front radiation at the enclosure resonant frequency and somewhat above. With proper phasing and damping correlation of the speaker and its bass reflex enclosure, a gain may also be achieved below the speaker resonance frequency, as compared to an infinite baffle. The vent may be considered to add a mass and a parallel resistance shunting the compliance of the enclosure, the compliance being the cushioning effect of the surrounded air. At the anti-resonant frequency of this combination, the impedance is high and can add appreciably to the loudspeaker damping if its system relationships are properly chosen. All these factors are to the good. Furthermore, when large damping in the electrical and speaker systems is used, bass reflex offers definite advantages in over-

Fig. 3. Mechanical details of the 15-inch "Ultraflex" loudspeaker enclosure. For a 12-inch version, use all those dimensions shown circled. The cut-out shown in baffle detail section (bottom right) is incorporated solely to permit the loudspeaker to be inserted or removed easily. Note particularly that the design, as presented, includes all mechanical details for a three-way speaker system. For this condition, the crossover controls are mounted on the side of the cabinet (cut-out detail for these controls is shown in the upper right-hand section). Should other variations be desired, that is, the use of only a single-cone speaker or possibly a two-way system, the front panel cut-outs that would not be required, could be omitted. If the ultra-high-frequency horn is not used, the crossover controls could be moved to the front panel instead of to the side. It is extremely important that all joints be well glued and screwed to obtain an air-tight enclosure.



coming the choking effect exerted by the amplifier upon the speaker cone movement at low frequencies. The increased loading makes possible reduced distortion with increased sound pressure output as compared to the total enclosure or infinite baffle.

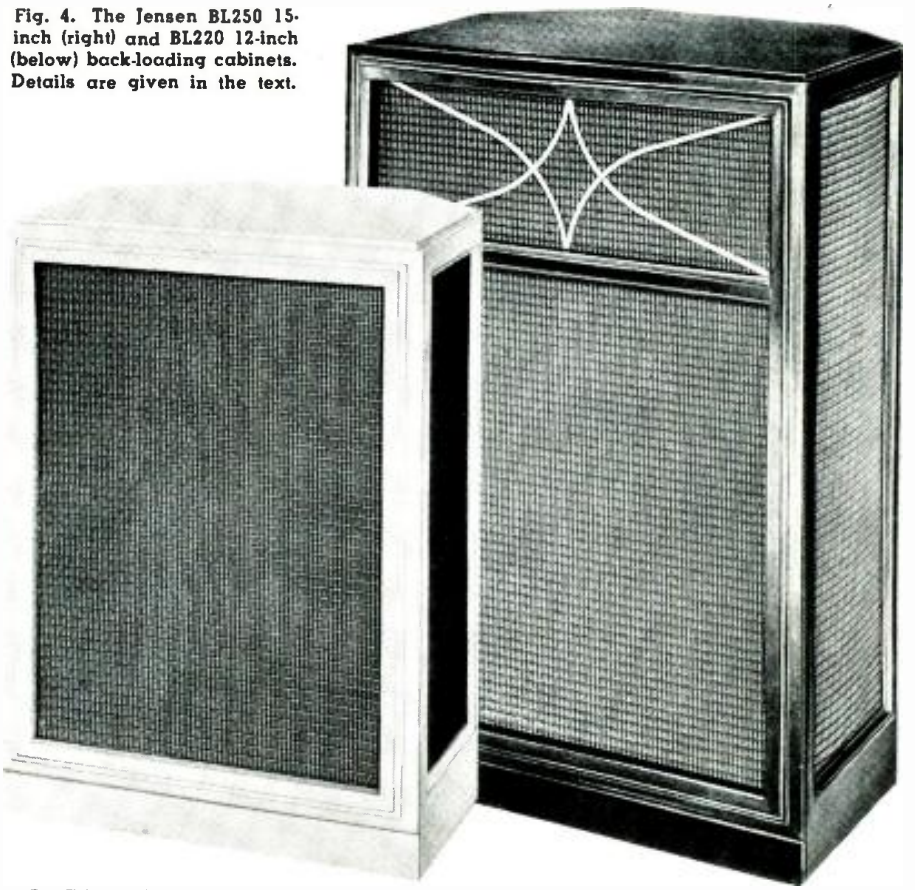
Some comments have been made from time to time to the effect that bass reflex cabinets are "boom boxes." This may be true where the enclosure and the speaker are not properly matched. Matching does not necessarily mean that resonant frequencies are to be identical, and matching is not as simple a matter as once generally thought. It is possible to get boomy response from bass reflex, especially when the system is not properly tuned and there is insufficient electrical and mechanical damping combined in the over-all system. In this case, an upper resonant mode (above speaker resonant frequency) is likely to appear, and to give a thumpy sound when excited by a fundamental signal at its frequency, or when shock-excited by a different frequency. This condition seems to be the cause of the troubles encountered by experimenters who have not taken into consideration all the factors of operations of this type system.

"Bass Ultraflex" is this company's improved version of the bass reflex. The principle is incorporated in the BL220 and BL250 enclosures shown in Fig. 4. Essentially, it consists of a compliant chamber behind the speaker, this chamber feeding into two rectangular tubes. These tubes add additional mass across the compliance of the chamber in such a manner as to make possible a lower Helmholtz resonance for the system for a given radiating area. This gives the designer an additional tool for controlling performance of the system. This all amounts to furnishing more bass at less distortion than bass reflex can give. The mouths of these tubes are placed, when the cabinet is in a corner, practically flush with the two walls. This placement gives the greatest possible coupling and takes maximum advantage of the "image effect" which increases the usefully applied radiation resistance, and thereby increases the efficiency. The advantages of the back loading feature of folded horns have been obtained with less critical matching and placement factors. When the cabinet is placed against a wall, somewhat less output is produced than with corner operation.

The end result is that matching becomes less critical in regard to variations to be found in different types of speakers, especially when the speakers are fairly efficient. Thus with speakers of moderate (27 ounce) magnet weights or larger, these advantages occur, compared even to bass reflex:

1. With speakers of higher than recommended resonant frequency, drop-off of the output is smaller below resonant frequency of the speaker.
2. Transient response is improved at low frequencies.

Fig. 4. The Jensen BL250 15-inch (right) and BL220 12-inch (below) back-loading cabinets. Details are given in the text.



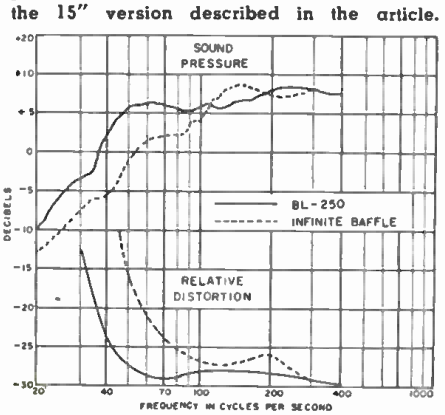
3. Distortion is reduced to negligible levels at moderate powers.
4. Smooth peak and dip-free response occurs down to 40 cycles with recommended 15" speakers. With 12" speakers response is similar, but with somewhat lower efficiency because of the smaller cone area and magnets in the usual 12" speakers.

Fig. 5 shows the comparative sound pressure and distortion characteristics of a 15" woofer driven by a constant voltage source, as measured in an infinite baffle and in the BL250 enclosure.

Fig. 3 shows the dimensioning and construction of the BL250. This cabinet can easily be constructed in the home workshop. Proper performance is assured by following several construction rules:

1. Joints must be well secured and tight.

Fig. 5. Sound pressure and relative distortion of the BL250 loudspeaker enclosure as compared to an infinite baffle. The BL250 is the 15" version described in the article.



2. The sides of the tubes must be interbraced in at least two spots.
3. Inside dimensions should be held as closely as possible to those specified.
4. There must be no air leaks through any cut-outs or control holes.
5. The back must be tightly sealed, preferably with rubber gaskets.

In the drawing of Fig. 3, a flexible arrangement of holes and blocking covers allows use of various combinations of woofer, mid-channel, and/or tweeter units with only the three front panel holes shown. Unused holes, which can include either or both of the top two front panel cut-outs, can be covered by a sub-panel.

For a coaxial or "Triaxial" speaker, these would be omitted.

The commercial version of this cabinet is supplied with a sub-baffle, or panel, to permit the mounting of various types of mid-range and high-frequency horns. Details of this sub-baffle have been omitted since this flexibility would not be required by the home builder. The commercial unit was designed to be used with the company's RP102 2000-cycle unit, or RP302 super-tweeter, and a mid-channel unit such as the 600-cycle RP201.

Fig. 1 illustrates the inside of the BL250 with a 3-channel system.

When efficient speakers in these enclosures are driven by amplifiers of even moderately high damping factor, interior padding does not seem to be worthwhile. Under other conditions, padding on sides and top may be called for. When in doubt, apply sufficient 1" glass fiber insulation to cover the bottom and one cabinet side. —30—

A TRANSISTOR VIBRATION AMPLIFIER

By **LOUIS E. GARNER, JR.**

Transistorized and simplified version of a circuit first described in Jan. 1953 issue.

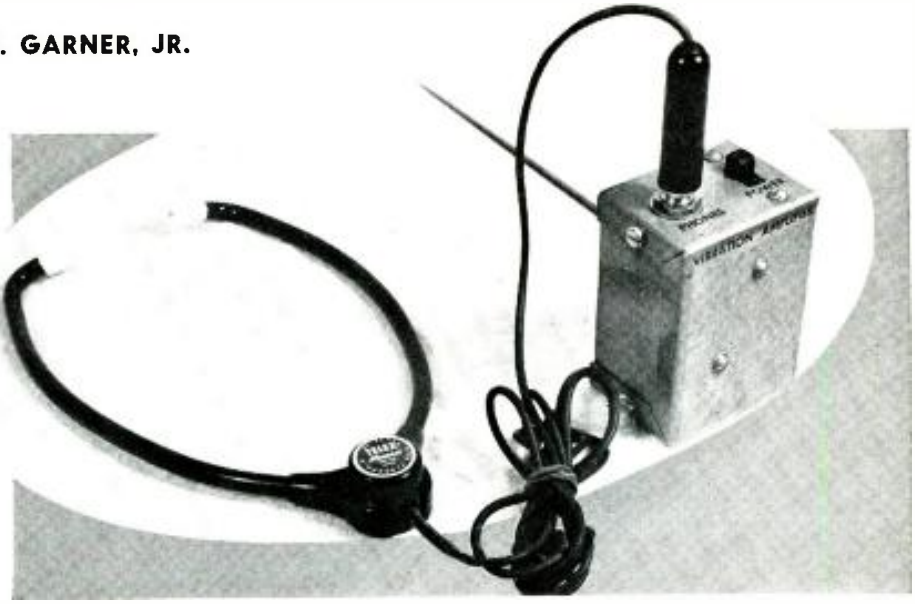


Fig. 1. Over-all view of transistorized vibration pickup and its amplifier.

THE extremely small power requirements of transistors make it quite advantageous to "transistorize" portable equipment wherever practicable. This is true not only of hearing aids and portable radios, but also of most types of portable test and measuring equipment.

In an earlier article, the author described a small vibration-pickup amplifier built around a used hearing aid ("A Vibration-Pickup Amplifier," January, 1953, RADIO & TELEVISION NEWS). A "transistorized" version of a vibration pickup and amplifier is shown in Fig. 1, together with the headphones used as an accessory.

No attempt was made, in designing this transistorized version, to exactly duplicate the performance of the earlier unit. Rather, the instrument shown in Fig. 1 was designed for a somewhat different application. Where the earlier unit was used primarily to check for mechanical movements and vibrations in locks, this instrument is designed for checking sounds in heavier mechanical equipment, specifically, to aid an automobile mechanic in diagnosing troubles. Because of this, only one transistor is used (two tubes were used in the earlier version), and less gain is provided.

Circuit Description

The circuit used in the transistor vibration amplifier is quite simple and straightforward, as can be easily seen by reference to the schematic diagram given in Fig. 2. A conventional single-stage *grounded-emitter* amplifier circuit is employed.

In operation, mechanical vibrations picked up by the probe are converted into electrical signals by a piezoelectric crystal (an ordinary phono crystal cartridge). These signals are, in turn, applied to the primary winding of T_1.

A piezoelectric crystal has a high output impedance. The transistor amplifier stage has a low input impedance. Hence, in order to match these two impedances to insure maximum signal transfer, a transformer (T_1) having a stepdown turns ratio is employed.

The signal appearing across the secondary winding of T_1 is applied to the base-emitter circuit of the transistor through coupling condenser C_1. A fairly large capacity condenser is used here to prevent loss of signal level at medium and lower frequencies, which might otherwise occur due to introducing a comparatively high impedance in series with the low input impedance of the transistor.

R_1 serves as the "base return" resistor, and, by providing a d.c. path between the power source and the base, establishes the base "bias" current. The value of this resistor determines the "bias" current flow and hence the operating characteristics of the stage.

The collector current also varies with the size of R_1, as collector current is directly proportional to base current.

The audio signal is amplified by the transistor stage and the amplified signal appearing in the collector circuit is applied to the headphones. Since magnetic headphones are used, they also serve to complete the d.c. path for collector current flow.

A hearing-aid type battery, B_1, serves as the power supply, and a s.p.s.t. slide switch, S_1, as the power switch.

No provision has been made for a gain control, as it is not needed with a single stage of amplification.

Construction Hints

Both the pickup probe and the amplifier itself are assembled in a small *Bud* "Minibox." These small aluminum boxes may be obtained with either a gray hammerloid or an etched aluminum finish.

The general parts arrangement used by the author is apparent from the interior photograph given in Fig. 4. Layout is not critical, however, and a somewhat different arrangement may be used by the builder, if desired.

In the author's model, the small transformer and the battery are held in place by two "Z" brackets, fastened in place by a single machine screw and nut. Connections to the battery are made by soldering leads directly to the terminals. *Scotch* electrical tape is used over the battery terminals to prevent accidental shorts.

Another builder might prefer to devise a small socket arrangement so that the battery may be installed and removed without soldering.

The transistor has been wired directly into the circuit in the model shown. Where this is done, special care must be taken to avoid overheating the transistor leads. Like most semiconductor devices, the transistor is particularly sensitive to heat, and may be easily damaged by excessively high temperatures.

As an alternative, a socket might well be used for the transistor. An ordinary 5-pin subminiature tube socket is employed (only three of the pin positions are required).

Once the unit is completed, labels may be made up by using standard decals, obtainable through most wholesale parts distributors. In the author's model, black decals were used. After the decals were attached, three coats of clear plastic were applied to protect both the decals and the finish of the case.

Some builders may prefer to omit the labels, however, since they add nothing to the performance of the unit.

Assembling the Probe: A detailed cross-sectional view of the probe assembly is given in Fig. 3 and this sketch is, to some extent, self-explanatory. A few comments are appropriate, however.

The probe itself is made up from an ice pick. The metal point is removed from the handle and the blunt end heated in a gas flame until it changes

color. This process removes the temper and permits a standard die to be used for threading the end.

Choose a die size that is appropriate for the diameter of the ice pick point used. This will vary somewhat with different ice picks. A 10-32 die was used by the author.

The sharp end of the ice pick should be rounded slightly by using a grinding wheel. This is done to prevent the point from digging into or scratching the surfaces against which it is held. *Do not remove the temper from the point by heating, however.*

Only that portion of the probe which is to be treated should be re-tempered. For best results, the rest of the probe should be kept in its original state.

When assembling the phono cartridge and probe point as shown in Fig. 3, note that *the probe point and its mounting nut bear against the case of the crystal cartridge, not against the needle chuck!*

In operation, the case tends to vibrate around and against the crystal, with the inertia of the crystal resisting this movement. This provides the necessary bending and twisting motion to operate the crystal so that an electrical signal is produced.

Parts Substitutions: Since so few parts are required for this unit, and these are all standard, the prospective builder should not find it necessary to make substitutions. A number of substitutions are permissible, however.

First, a case different from the one employed by the author might well be used. In choosing another case, keep in mind that it should be fairly rigid—for this reason, a plastic case is not generally recommended.

Another transformer might well be substituted for T_1. Use any transformer capable of matching a high impedance to the low input impedance of the transistor. A certain amount of mismatch will not cause difficulty. In choosing another transformer, make sure that its physical size is such that it will fit easily into the case chosen.

If preferred, a somewhat smaller condenser may be used in place of C_1. The author used a 10 μfd. condenser because of its ready availability. An 8, 4, or even a 2 μfd. condenser should give equally satisfactory results.

A toggle or rotary switch might be substituted for the slide switch used in the author's model.

Either an open or a closed circuit jack may be used as J_1, although an open circuit jack will prevent accidental current drain when the headphones are removed (should the switch be in the "on" position). As an alternative, the headphones could be wired permanently in place and no jack provided.

Circuit Modification

Only a moderate amount of gain is provided by the single amplifier stage used in the author's model. This is sufficient, however, where the unit is used on equipment having vibrations of large amplitude.

For some types of work, the builder may prefer an amplifier providing more gain.

One simple technique for increasing the gain of the unit is to substitute a *Raytheon* type CK721 transistor ("*p-n-p*" type) for the CK722 shown in the schematic diagram (Fig. 2). The connections are the same, and it should not be necessary to change any parts values.

Where even greater gain is desired, a two-, or even three-, stage amplifier may be used. In such cases, it will be necessary to provide a gain control to prevent overload on strong input signals.

For general information on multi-stage transistor amplifiers, as well as suggested gain control circuits, refer to Charles W. Martel's article "Transistorize Your Audio Amplifiers" (March, 1953, RADIO & TELEVISION NEWS).

The builder may find that a tone control will be desirable for some applications. Such a control may be added by connecting a .05 μfd. condenser in series with a 25,000 ohm rheostat, and connecting the entire assembly between the collector and emitter leads of the transistor. This forms a simple, but effective, "losser" type tone control circuit.

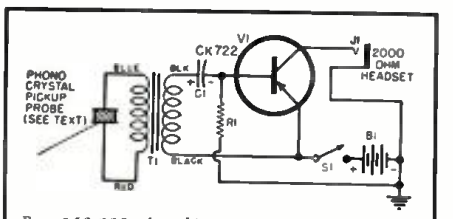
Using the Unit

To use the transistor vibration amplifier, plug a pair of magnetic headphones into the output jack (J_1) and turn the unit "on."

The case is held in the hand and the pointed probe held firmly, but lightly, against the machinery or equipment being checked. Experiment with both the angle at which the probe touches the machinery as well as the exact point at which contact is made.

This technique often enables the user to distinguish between different types of vibration sounds, and to pick out those signals of particular interest.

If the builder has assembled a unit using two or more amplifier stages, and has provided a gain control, this control should be set for minimum gain when the probe is first placed in position. The gain is then gradually



R_1—160,000 ohm, ½ w. res.
C_1—10 μfd., 25 v. elec. cond.
S_1—S.p.s.t. slide switch
B_1—15-volt hearing-aid type battery (Burgess U-10)
J_1—Open-circuit jack
T_1—Plate-to-line trans., 10,000-25,000 ohms to 200-500 ohms (UTC "Sub-Ounce" SO-3)
1—Crystal phono cartridge
1—Ice pick (see text)
1—2000 ohm headset (Telex #4625)
V_1—"p-n-p" junction transistor (Raytheon CK722)

Fig. 2. Diagram of vibration pickup unit.

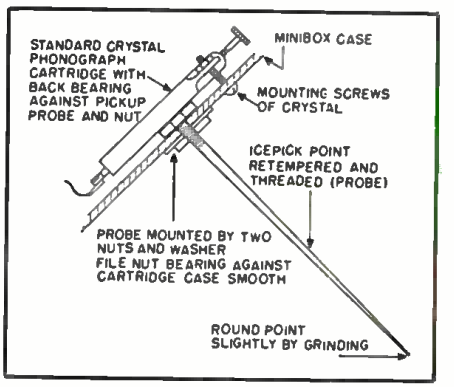


Fig. 3. Mechanical details for assembling the probe. See text for full instructions.

increased, without moving the probe, until the desired signal level is finally reached.

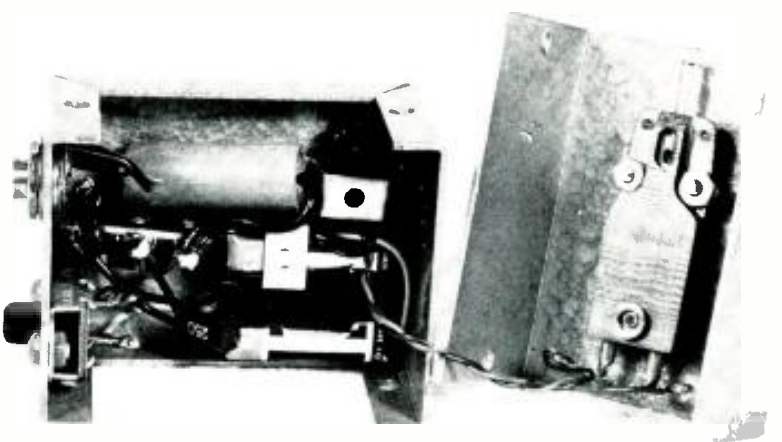
This last technique is used for two reasons. (1) to prevent "blasting" due to high signal levels, and (2) to prevent accidental signal overload, with resulting distortion and changes in signal quality. A distorted signal is difficult to properly interpret.

Applications

Although primarily designed for lis-

(*Continued on page* 160)

Fig. 4. Interior view of unit. Layout may be altered to suit needs of the builder.



A COMPACT 100-WATT BANDSWITCHING HAM TRANSMITTER

Front panel view of the home-built 100-watt bandswitching transmitter. Controls are identified and correspond to the schematic. The transmitter covers 80, 40, 20, 15, and 10 meters.

By

MAURICE P. JOHNSON, W3TRR

WAAM Engineering Department

Complete construction details on a TVI-proof transmitter which uses standard components and covers five ham bands.

A CONSIDERABLE number of amateurs are interested in a transmitter in the 100-watt class, provided that such a transmitter is compact as well as versatile and includes modern design features. This interest is particularly evident in the terrific sales popularity of the currently available manufactured units and transmitter kits in this power range. This article will discuss a somewhat similar transmitter which meets these specifications, yet is suitable for home construction without the need for complicated sheet metal work or for special components.

This transmitter was designed for maximum flexibility in keeping with its compactness. Four modern tubes are used in the r.f. section, four tubes are devoted to the high-level plate modulator, while three rectifiers and a voltage regulator complete the tube line-up. The transmitter covers five bands in the range from 3.5 to 30 mc., yet is completely bandswitching without plug-in coils. Only three tuning controls require attention when shifting frequency. A continuous tuning pi network is used for the final. All controls as well as the oscillator crystal are accessible from the front panel, eliminating the need for "digging" into the rig when operating. The oscillator also functions as a buffer amplifier for external v.f.o. operation. All power supplies are integral parts of the unit, with a bias pack to supply fixed bias to permit excitation keying. Naturally, AM as well as c.w. output is available, and all stages are completely metered. The entire transmitter mounts on a 13" x 17" x 3" chassis with an 8¾" rack panel.

Modern transmitter design is being influenced by a number of factors, which, in the light of present day circumstances, are making construction practices of a few years ago somewhat obsolete and undesirable. Perhaps the most important factor to be considered can be attributed to the rapid expansion of commercial television broadcasting, which has compelled amateurs to consider the reduction of TVI caused by their transmitters. The generally accepted methods of combating TVI involve complete shielding and filtering of the rig. Sometimes these measures are a bit difficult to adapt to existing equipment, but, by considering the problems involved at the onset of design, can be incorporated in a new transmitter without undue trouble.

This attention to TVI reduction and its associated problems led to several of the design features of this rig. Because of its marked superiority in reducing undesired harmonic output, a pi-network was selected for the final output coupling. The *E. F. Johnson Company* has made available to amateur circles, a line of components for pi-network construction. Their 229-201 rotary inductor allows the network to be tuned from 3.5 through 30 mc. without coil changing, and thus is perfectly suited to a bandswitching transmitter.

It was reasoned that if the r.f. components mounted above the chassis in this transmitter could be assembled in their own small shield box, the problems of complete transmitter shielding would be greatly simplified. To avoid the necessity of fabricating such a shield box at home, some shopping around was done to locate a unit of commercial manufacture which could be used. Fortunately, the *Bud* "Minibox" series met the requirements and a 10" x 6" x 3½" unit, CU-3010, was selected as the correct size to house the pi-network components and the final amplifier tubes.

The proper choice of output tubes for the transmitter was given careful consideration. Beam power and screen grid type tubes are gaining in popularity over triodes for use in ham gear. Undeniably, the higher power sensitivity of such tubes permits the use of low driving power, and the fact that they can operate without neutralization helps to simplify circuitry. On the other hand, many hams recall without relish, the parasitic tendencies and unstable operation sometimes experienced with tubes such as the 807. However, recent tube developments have resulted in a new button-stem construction with short internal leads and multiple base connections for cathode and suppressor to permit better r.f. grounding, as well as internal base shielding. This construction is used in the efficient 2E26, and in the 6146 beam power amplifier tube. This compact 6146 has an ICAS rating of 90 watts input per tube up to 60 mc., so a pair connected in parallel, as used in this transmitter, is easily capable of 100 watts r.f. output.

Separation of the grid and plate circuits of the final amplifier was readily accomplished since the 6146 is provided with a top plate cap. Assembling the plate components in the previously-mentioned "Minibox" shield allows the grid circuitry to be completely isolated simply by mounting these parts under the chassis. This has resulted in an amplifier which is completely stable in operation.

Only two additional stages are used to complete the r.f. section of this

transmitter. This makes for compact construction, and has the advantage of minimizing the number of stages requiring attention when changing frequency. After some thought, it was decided to avoid the use of broadband circuits; instead, tuned plate loads were selected for their increased efficiency. Several trial constructions were made to investigate various tube combinations and circuits. Finally, the nine-pin miniature 5763 tube was chosen for both the oscillator and multiplier stages, and has proven to be suitable for both applications.

The first stage is connected as a Colpitts harmonic oscillator, which is modified so as to allow operation as a buffer-multiplier as well, with excitation then coming from an external v.f.o. A double-pole, double-throw wafer switch, S_1, in the grid-cathode circuit of this stage permits this changeover. The screen of this tube is supplied with a well regulated 150 volts, controlled by an 0A2 VR tube.

The second 5763, V_2, operates as a buffer-multiplier to drive the final to full output on all bands. Approximately 45 volts of negative bias from the bias pack keeps this stage below cutoff without excitation, with additional operating bias developed across the grid leak by the driving signal. A variable screen voltage control functions as an excitation control to adjust the drive supplied to the final grids. The 5763 cathode and suppressor are tied directly to the chassis at the socket, to produce effective r.f. grounding.

The two 5763 stages are made bandswitching, covering five ham bands without plug-in coils, namely 80, 40, 20, 15, and 10 meters. On 80 meters, a 3.5 mc. crystal is used, with the rig operating straight through in all stages. Either 3.5 or 7 mc. crystals may be used for 40 meter operation since the oscillator plate is then tuned to 7 mc., with the buffer and final again running straight through. On the 20 meter band, the oscillator tank is tuned to 7 mc.; however, the buffer stage now acts as a doubler to supply 14 mc. signal to the final grids. To reach 15 meters, the 7 mc. output of the oscillator is tripled to drive the final on 21 mc. Finally, to reach the 10 meter band, the 7 mc. crystal frequency is doubled in the oscillator tank, and again doubled in the multiplier to reach 28 mc. for the final grid. The final stage, it will be noted, functions as a straight amplifier on all bands.

A three-stage audio amplifier is included in the rig, for high level plate modulation of the final amplifier. A 6BA6 is used as the first speech amplifier, intended for use with a crystal microphone of average output. Contact bias is used to develop the slight bias voltage required by this stage, so that the cathode can be returned directly to ground in the interests of minimizing hum pickup at this input stage. An r.f. filter is provided in the grid and heavy decoupling is used in the plate feed. An audio gain control appears at the grid of the following 6AG5 amplifier, which is used as a driver for the modulator tubes. Inverse-feedback is added to the first two stages, and while the gain control is included in the loop, this feedback is desirable in improving the regulation of the driver. A transformer with a 1.5:1 turns ratio is used to couple the driver to the grids of the modulator tubes, which are conventional 807's in push-pull, operating with 30 volts fixed bias and 300 volts on the screens.

While economical in the number of stages, this audio section has been found more than adequate, and fully modulates the final with the gain control less than half open, when used with an *Astatic* T-3 mike. It is unusually hum free, and the components have been selected to give a restricted frequency response to produce clean crisp quality so necessary for ham work.

To facilitate an accurate check on the operation of the transmitter, a complete metering system is used. A rather tricky metering method, as used in the *Johnson* "Viking," has been adapted to this rig. For an effective r.f. ground, the 6146 cathodes are grounded directly, and yet with this metering technique, it is possible to measure the final cathode current. This is accomplished by inserting a milliammeter in the high voltage supply negative return lead, a 500 ma. movement being adequate in this case. Notice that the modulator cathodes are returned to the transformer center tap, rather than ground, to prevent their current from flowing through the meter.

An additional 0-50 ma. meter is used to measure the grid and plate currents of the exciter by switching the meter across small resistors provided for this purpose in the desired leads. In addition, this meter is switched into the 807 cathodes, with a suitable shunt to increase the range to 250 ma., for checking the modulator cathode current. Both meters and leads involved are carefully r.f. bypassed.

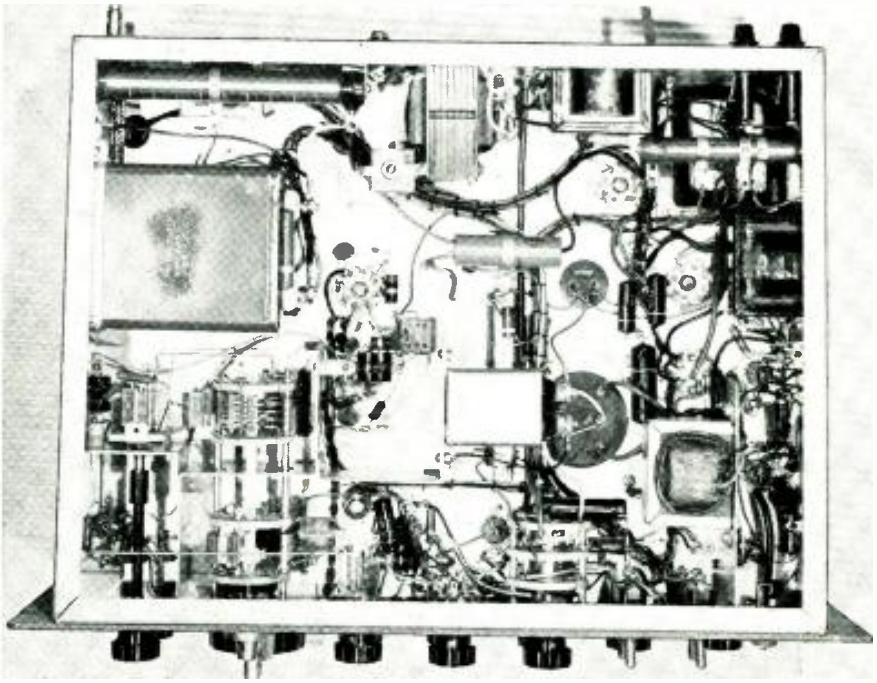
A three-deck ceramic wafer switch with 90 degree indexing is used to change the rig from c.w. to phone operation. One deck is used in the oscillator cathode, to switch the cathode return from the key jack to the high voltage panel switch for phone standby. The other decks control the final screen and modulation transformer changeover.

A high voltage power supply furnishes slightly over 600 volts under full load to the final and modulator stages, using a choke input filter to smooth out ripple. A high wattage bleeder is tapped at 300 volts to supply the modulator screens during phone operation, and through a dropping resistor, feeds well regulated voltage to the final amplifier when operating c.w. Under phone conditions, both screen and plate circuits of the class C stage are modulated to secure 100% modulation. An additional resistor with a shorting switch is added to the r.f. screen circuit to reduce power output for tuning.

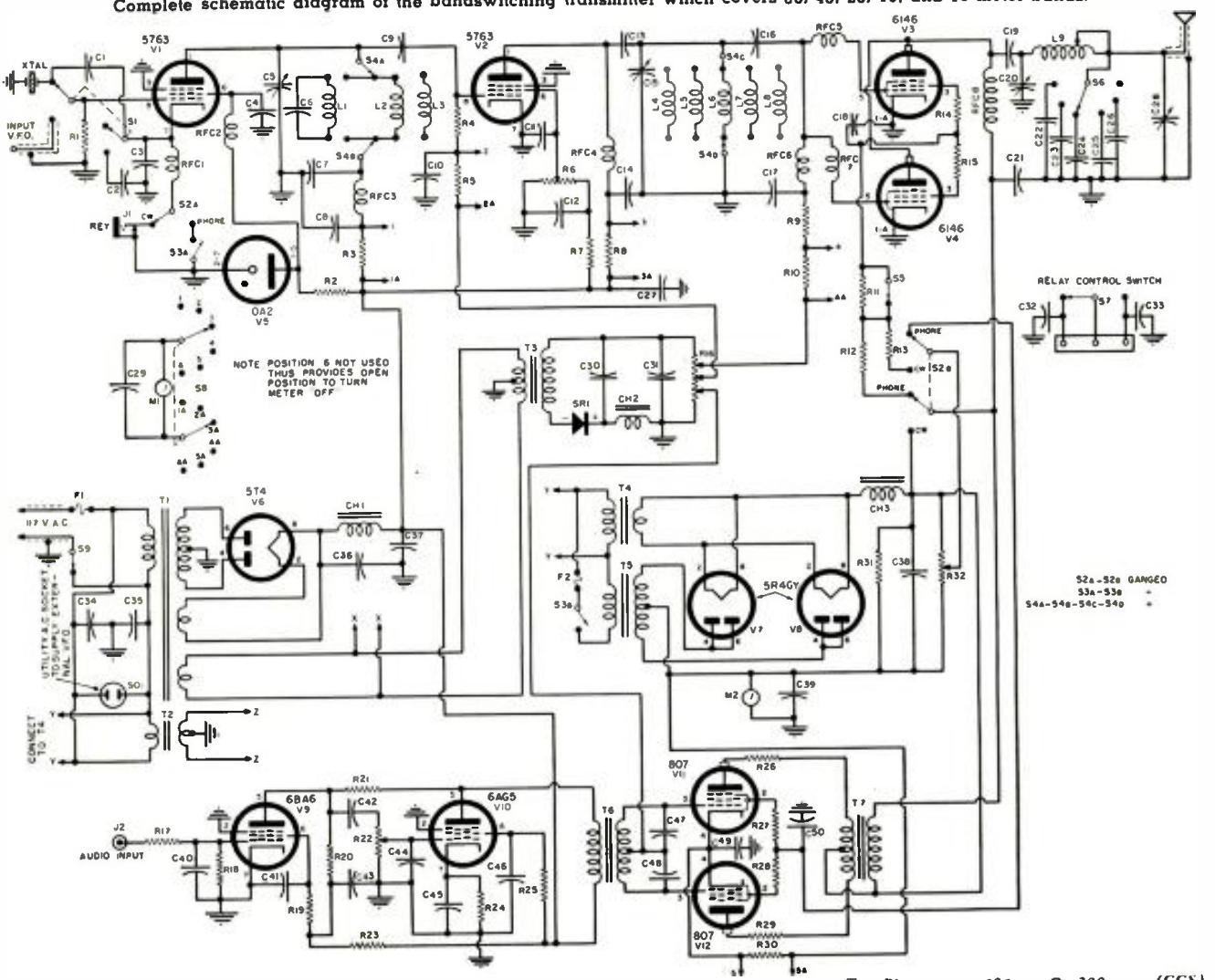
A low voltage power supply provides slightly in excess of 300 volts for the low level r.f. and audio stages, by using a metal 5T4 rectifier and pi-section filter. The input filter capacitor is intentionally kept small to prevent soaring voltages from this supply under conditions of no load. The excitation control also serves as a minimum bleeder across this supply.

The bias pack uses a back-connected filament transformer, into a selenium rectifier and pi filter to produce up to 100 volts bias. The final requires 75 volts, the buffer 45 volts, and modulator 30 volts, available from a low resistance bleeder with three sliders

Under chassis view of transmitter. Note the shielding which helps TVI-proof unit.



Complete schematic diagram of the bandswitching transmitter which covers 80, 40, 20, 15, and 10 meter bands.



R_1—*100,000 ohm, ½ w. res.*
R_2—*25,000 ohm, 10 w. wirewound res.*
R_3, R_5, R_8, R_{10}, R_{27}, R_{28}—*100 ohm, ½ w. res.*
R_4—*68,000 ohm, ½ w. res.*
R_6—*25,000 ohm, 5 w. wirewound pot*
R_7—*2700 ohm, 2 w. res.*
R_9—*2200 ohm, ½ w. res.*
R_{11}—*20,000 ohm. 10 w. wirewound res.*
R_{12}—*20,000 ohm, 25 w. wirewound res.*
R_{13}—*2500 ohm, 10 w. wirewound res.*
R_{14}, R_{15}—*47 ohm, 2 w. res.*
R_{16}—*3000 ohm, 50 w. wirewound res. with 3 sliders*
R_{17}—*47,000 ohm, ½ w. res.*
R_{18}—*2.2 megohm, ½ w. res.*
R_{19}—*1 megohm, ½ w. res.*
R_{20}—*250,000 ohm, ½ w. res.*
R_{21}—*1.8 megohm, 1 w. res.*
R_{22}—*500,000 ohm pot.*
R_{23}—*27,000 ohm, 2 w. res.*
R_{24}—*270 ohm, 1 w. res.*
R_{25}—*2700 ohm, 1 w. res.*
R_{26}, R_{29}—*120 ohm, ½ w. res.*
R_{30}—*.8 ohm meter multiplier shunt (to increase 50 ma. meter to 250 ma.)*
R_{31}—*2.2 megohm, 2 w. res.*
R_{32}—*15,000 ohm, 100 w. wirewound res. with 1 slider*
C_1—*15 μμfd. ceramic capacitor*
C_2, C_4, C_8, C_{10}, C_{11}, C_{12}, C_{14}, C_{17}, C_{27}, C_{29}, C_{32}, C_{33}, C_{39}, C_{40}, C_{47}, C_{48}, C_{49}—*1000 μμfd. ceramic capacitor*
C_3, C_9, C_{13}, C_{16}—*100 μμfd. ceramic capacitor*
C_5, C_{15}—*100 μμfd. midget var. capacitor*
C_6—*40 μμfd. silver mica capacitor*
C_7—*.02 μfd. mica capacitor*
C_{18}—*.003 μfd., 1500 v. mica capacitor*
C_{19}—*.002 μfd., 2500 v. mica capacitor*
C_{20}, C_{28}—*350 μμfd. var. capacitor (Johnson 350E20)*
C_{21}—*.005 μfd., 2500 v. mica capacitor*
C_{22}—*1250 μμfd., 1000 v. midget mica capacitor*
C_{23}—*1000 μμfd., 1000 v. midget mica capacitor*
C_{24}—*750 μμfd., 1500 v. midget mica capacitor*
C_{25}—*500 μμfd., 1500 v. midget mica capacitor*
C_{26}—*250 μμfd., 3000 v. midget mica capacitor (two 500 μμfd., 1500 v. in series)*
C_{30}, C_{31}—*30/30 μfd., 150 v. elec. capacitor*
C_{34}, C_{35}, C_{41}, C_{46}—*.05 μfd. bypass capacitor*
C_{36}—*1 μfd., 1000 v. oil-filled capacitor*
C_{37}, C_{43}—*40/40 μfd., 450 v. elec. capacitor*
C_{38}—*10 μfd., 1000 v. oil-filled capacitor*
C_{42}—*.005 μfd. coupling capacitor*
C_{44}—*250 μμfd. ceramic capacitor*
C_{45}—*10 μfd., 50 v. elec. capacitor*
C_{50}—*.1 μfd. bypass capacitor*
RFC_1, RFC_2, RFC_3, RFC_4, RFC_6—*2.5 mhy., 150 ma. r.f. choke*
RFC_5, RFC_7—*.8 μhy., 1000 ma. r.f. choke (Ohmite Z-235)*
RFC_8—*2.5 mhy., 500 ma. r.f. choke (Millen)*
CH_1—*6 hy., 150 ma. filter choke*
CH_2—*30 hy., 60 ma. filter choke*
CH_3—*10 hy., 300 ma. filter choke (Thordarson T-20C56)*
L_1, L_4—*80 m.—48 t. B & W "Miniductor" #3012*
L_2, L_7—*40 m.—20 t. B & W "Miniductor" #3012*
L_3, L_6—*20 m.—13 t. B & W "Miniductor" #3011*
L_7—*15 m.—6 t. B & W "Miniductor" #3006*
L_8—*10 m.—4 t. #14 bus, ⅜" dia., ⅞" long*
L_9—*Rotary pi-network inductor (Johnson #229-201)*
T_1—*Power trans. 350-0-350 v. @ 150 ma.; 5 v. @ 3 amps.; 6.3 v. @ 6.5 amps. (Merit P-3173 or equiv. Author used a now-obsolete trans.)*
T_2, T_3—*Fil. trans. 6. 3 v. @ 3 amps.*
T_4—*Fil. trans. 5 v.c.t. @ 6 amps. (Stancor P-3062)*
T_5—*Plate trans. 600 v. @ 300 ma. (CCS) (Stancor P-8042)*
T_6—*Driver trans. 1.5 to 1 single plate to push-pull grids (Stancor A-4752)*
T_7—*Mod. trans. 1.6 to 1, 807's class AB to paralleled 807's r.f. suitable, 75 w. or more audio capacity*
M_1—*0-50 ma. milliammeter (Simpson type 127)*
M_2—*0-500 ma. milliammeter (Simpson type 127)*
S_1—*D.p.d.t. ceramic wafer switch*
S_{2A}, S_{2B}—*3-pole, 2-pos. switch made from Centralab 90 degree index assembly and 3 ceramic wafers ("C.W.-Phone Switch")*
S_{3A}, S_{3B}—*D.p.s.t. bat-handle toggle switch*
S_{4A}, S_{4B}, S_{4C}, S_{4D}—*4-pole, 11-pos. exciter band-switch made from Centralab 30 degree index assembly and 4 ceramic "Y" sections. (Only 5 pos. required, see text on modifications)*
S_5—*S.p.s.t. bat-handle toggle switch ("Tune-Up Voltage Control")*
S_6—*S.p. 6-pos. switch (5-pos. required)*
S_7—*S.p.d.t. bat-handle toggle switch ("Relay Control")*
S_8—*D.p. 6-pos. non-shorting meter switch*
S_9—*S.p.s.t. bat-handle toggle switch ("A.C. Line Switch")*
J_1—*Closed circuit key jack*
J_2—*Shielded shorting-type audio input connector*
SR_1—*75 ma. selenium rectifier*
Xtal.—See text
F_1, F_2—*5 amp. fuse*
SO_1—*117 volt utility socket*
V_1, V_2—*5763 tube*
V_3, V_4—*6146 tube*
V_5—*0A2 tube*
V_6—*5T4 tube*
V_7, V_8—*5R4GY tube*
V_9—*6BA6 tube*
V_{10}—*6AG5 tube*
V_{11}, V_{12}—*807 tube*

which is connected across this pack.

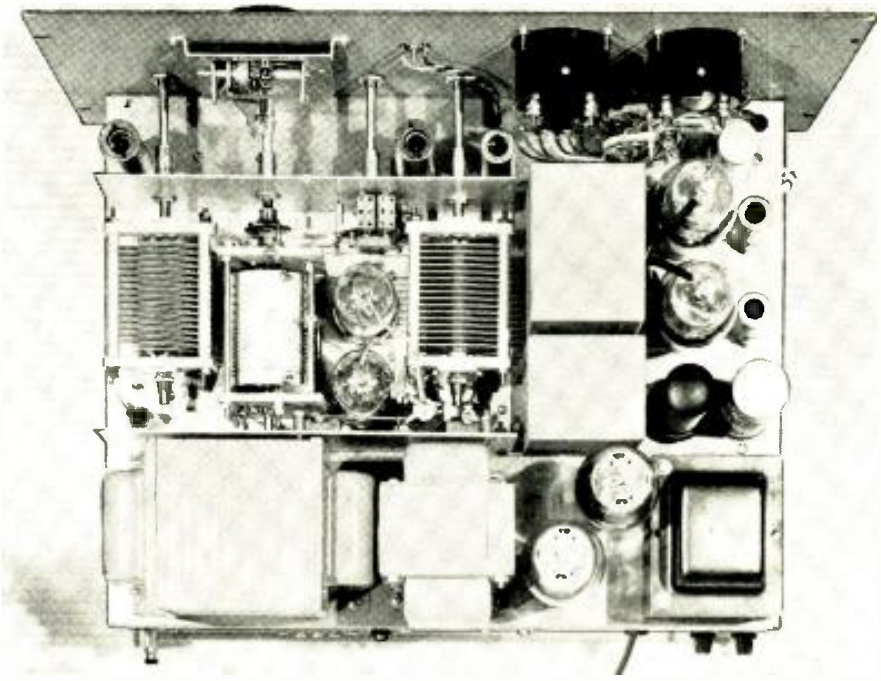
Because of the compactness of this transmitter, the layout is determined, to a great extent, by the sizes and shapes of major components. For this reason, it is suggested that those persons who may be interested in duplicating the rig obtain *all* parts before commencing work on the chassis. Needless to say, electrical equivalents will be satisfactory providing they are of comparable size.

Construction was inaugurated by fitting the plate components into the "Minibox," and reference to the photographs will aid in this layout. All mounting holes should be drilled in the "Minibox," and then transferred to the main chassis which should be drilled before any assembly is started. Tube sockets for the 6146's are mounted in the main chassis, with larger clearance holes cut in this "Minibox," but all other components are mounted through both chassis and "Minibox."

The "Minibox" should be placed on the main 13" x 17" x 3" aluminum chassis while the high and low voltage power supply and audio amplifier components are arranged as shown in the photographs. It should be noted that the high voltage transformer and filter choke mount near the rear left corner of the chassis with the "Minibox" closely against them, to provide space on the front top of the chassis for the exciter and VR tubes. The counter-dial, *Johnson* 116-208-4, requires some space behind the panel, which should be considered in spacing out the tubes. Shaft bearings in both "Minibox" and front panel permit brass shaft extensions to protrude to the front panel. The pi-network layout which was best able to utilize the available space, and still result in a neat front panel layout, is evident in the photos. The plate tuning capacitor is to the right of the tubes, with the fixed loading capacitors and switch directly in front of the tubes. The variable coil is immediately to the left, with the variable loading capacitors in the remaining space, with a coaxial cable output lead to the rear.

The two 5R4GY high-voltage rectifiers and the low-voltage power transformer occupy the rest of the back chassis top surface, with the 5T4, filter components, and the audio tubes with modulation transformer taking the space immediately to the right of the "Minibox." The space directly behind the front panel is required for the meters and meter switch, as well as audio and excitation pots.

Viewing the panel from the front, the seven controls from left to right stretched across the center section of the panel, are as follows: the audio gain control (R_{22}), six position meter switch (S_9), excitation control (R_8), plate tuning capacitor (C_{20}), fixed loading switch (S_6), variable inductor tuning dial (L_6), and variable loading capacitor (C_{28}). The meters are mounted to the front panel side by side, with the crystal socket located between them and the tuning dial. The



Top chassis view of transmitter with shield cover removed to show parts location.

remaining controls are under the chassis, accessible from the front panel. The key jack and mike input connector (shorting type) are to the extreme left. The four toggle switches are grouped together, and control a.c. input (S_8), high voltage (S_3), reduced voltage tune-up (S_5), and an additional switch for relay control purposes (S_7), intended for antenna changeover, v.f.o. standby, etc. Next comes the c.w.-phone switch (S_2), followed by the crystal-v.f.o. switch (S_1), the oscillator tuning capacitor (C_5), exciter bandswitch (S_4), and tuning capacitor (C_{19}).

Two fuses, shielded line cord, v.f.o. input jack, v.f.o. a.c. utility outlet, relay switch terminal strip, ground binding post, and the coaxial antenna connector are on the rear chassis edge.

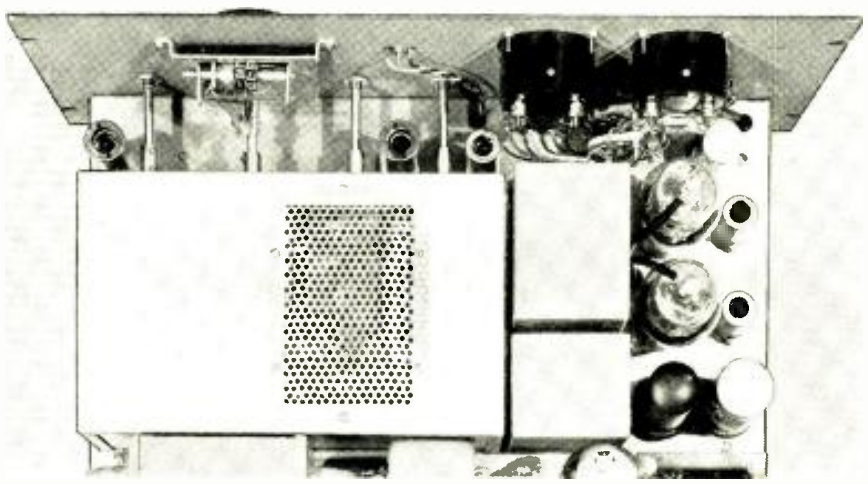
The photograph of the under side of the chassis shows the layout of remaining parts, including bleeders, filament transformers, bias supply, and filter capacitors. A few comments on various phases of construction may be of assistance to builders of the transmitter.

The bandswitch is assembled from four 11-position ceramic switch wafers, *Centralab* "Y" sections, and a 30 degree indexing unit. The switch is assembled on a "Z" shaped aluminum bracket, approximately 3 inches on a side with a $\frac{3}{8}$" mounting lip along the lower edge. The coils are attached to the switch before mounting to the chassis. Only five of the switch contacts are used per deck, in addition to the wiper, so the r.f. insulation was improved by carefully drilling out the rivet and removing every other contact, with increased spacing and resultant 60 degree coil indexing. The coils are assembled to the wafers so that the 10 meter coil is nearest the wiper, to obtain short r.f. leads on this band.

A small aluminum bracket fastens between the bandswitch shield and the chassis lip to support the multiplier

(*Continued on page* 155)

Partial view of the top of the chassis with "Minibox" subchassis cover in place.



International SHORT-WAVE

Compiled by KENNETH R. BOORD

IN a special DX session, your short-wave editor, Ken Boord, will play a 30-minute program of Christmas organ melodies over station TIFC, "The Lighthouse of the Caribbean," Box 2710, San Jose, Costa Rica, Central America, at 0000-0030 *EST* on Friday, December 24th, and repeated at 0000-0030 *EST* on Saturday, December 25th (0500-0530 GMT on Friday, Dec. 24, with repeat at 0500-0530 GMT on Saturday, Dec. 25). Listed frequencies to be used are 9.645 (actually 9.647), 6.037, and 995 kc. (latter channel on second night only). *Reception reports will be appreciated from anyone anywhere in the world.* Philip B. Smith, director of TIFC, says all correct reports will be verified with a QSL card and that an IRC will *not* be necessary.

* * *

This Month's Schedules

Albania—Radio Tirana, 7.852, noted 1700 with news; has French session now 1600-1630 (formerly was 1630-1700). (Cox, Dela.) *DX-Radio*, Sweden, reports *Radio Shkodra* on 8.215, heard in Sweden 1400.

Algeria—Radio Algerie, 6.160, noted 1710 with Arabic session, strong level. (Catch, England.) Noted closing 1744A with "La Marseillaise." (Pearce, England)

Anglo-Egyptian Sudan—Latest schedule from *Radio Omdurman* is Arabic daily (*except Fri.*) 2315-2345, 1130-1430; Fri. 0215-0430, 0900-1000; Sun. 0300-0400; *English* daily (*except Sun.*) 0215-0230, 1000-1015, and Sun. 0215-0245 on 6.410, 7.100. (Hardwick, N. Z.)

Angola—CR6RI, 9.340, *Radio Diamang*, can be heard sometimes in Japan around 1500; all-Portuguese. (JSWC) CR6RA, 4.869, Luanda, noted 1620 in Portguese; closed 1630 with "A Portuguesa," fair strength and readability in England. (Catch) Fairs, England, reports Luanda heard on 6.355 around 1400. (URDXC)

Argentina—Radio Splendid, 9.310A, noted 2040 in Spanish, good level in Mo. (Kirby) LRS, 11.880, Buenos Aires, heard 1720 with tango music in Spanish transmission. (Catch, England)

Australia—VLR9, 9.680, noted 0145-0330. (Adam, Brt. Columbia) The *Sunday* DX session from *Radio Australia* in the African beam at 0030 is now over 15.200; at 0247 over 9.580, 7.280, 15.320 (and possibly 11.710) to Europe, South and Southeast Asia and South Pacific Islands, and on 9.615 to Eastern North America 0830; is radiated to Western North America *Saturday* 2300 over 15.200. (Radio Australia) VLX9, 9.660, can be heard in parallel with VLW11, 11.830, at 0300-0330 fade-out. (Kapp, Calif.) VLM4, 4.920, Brisbane, noted 0715-0730 with music. (Peterson, Texas) VLA15, 15.200, is strong level 2155-2315, news 2245, in Western North American beam. (Himber, Calif.)

Austria—Blue Danube Network, 9.617, Salzburg, noted in Sweden 0500-0600 with QSB. (Astrom, Jonsson) Heard on 5.080 at 1245 with music. (Catch, England)

Azores—CSA93, 4.865, Ponta Delgada, noted at weak level 1540 in Portuguese. (Cox, Dela.) CSA92, 11.925, should now be on *winter* schedule of 1500-1600. (Ferguson, N. C.)

Bechuanaland—ZNB, 8.252, *measured*, is weak but in the clear around 1310, says Fairs, England. (URDXC)

Belgium—ORU, 15.335, Brussels, noted 1200-1245 closedown, good level. (Ferguson, N. C.)

Belgian Congo—OTC, 9.655, Leopoldville, is good level in *English* to North America 2000-2200. (Peterson, Texas, others) *Radio Congo Belge*, 9.380, Leopoldville, noted 1105 with music, fair level in Calif. (Morgan) Heard on 6.295 with news in French 0000, fair level in N. Z. (Hardwick)

Bolivia—CP5, *Radio Illimani*, 5.970, is heard well in Denmark from 2100 to 2300 closedown. (ISWC, London) Is weak level in Alberta then. (Duering) CP38, 9.442, La Paz, heard closing 2128 at good level in N. C. (Ferguson)

Brazil—Radio Cultura, 6.165A, still noted in *English* around 2300. (Niblack, Ind.) PRB23, 15.135, Sao Paulo, is heard in Sweden 1530-1630. (*GDX-aren*, Sweden) ZYB9, 15.155, Sao Paulo, noted 1814-1825, very strong; QSL received. (Machajewski, N. Y.) PSL, 7.936, and PSH, 10.2235, Rio de Janeiro, noted with news in Portuguese 1730. (Catch, England) ZYK3, 9.565, Recife, noted weekdays with "Brazil Calling" (*English*) 2005-2030. (Peterson, Texas) ZYC8, 9.610, Rio de Janeiro, noted 1830-2015 at strong level. (Duering, Alta.)

British Guiana—ZFY, *measured* 3.255, noted closing 2121. (Ferguson, N. C.) Heard on 5.981 at 0500. (Hardwick, N. Z.)

British Honduras—ZIK2, 3.300, Belize, *measured* 3.300, noted closing 2231. (Ferguson, N. C.)

Bulgaria—Radio Sofia, 7.256A, good

(*Continued on page* 122)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock, has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

This attractive listening post, owned and operated by Floyd Backus of Richmond, Va., features a National NC-98 receiver. Note Floyd's fine collection of QSL cards.

NEW FM-ONLY TUNER

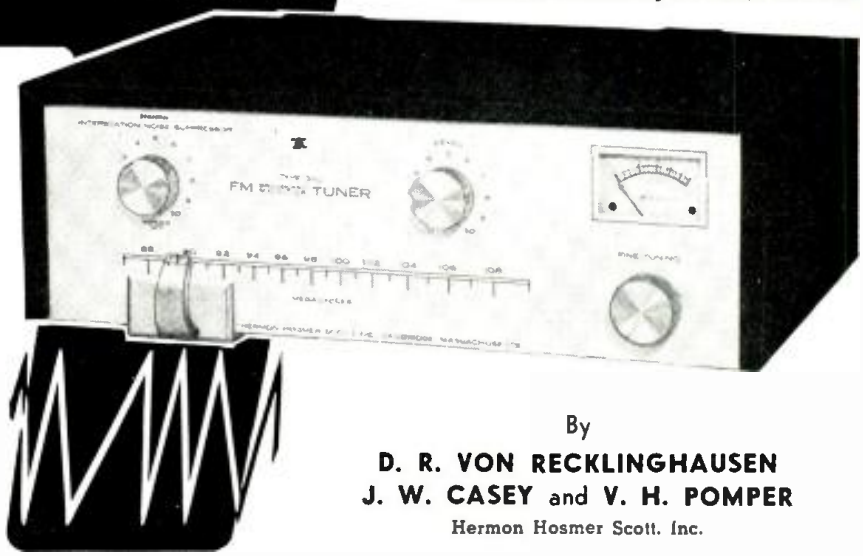


Fig. 1. Over-all view of the Model 310-A FM tuner. The tuning indicator is so designed that the entire band can be swept with the flick of a finger. This Lucite tuning indicator also serves as a pilot light and a means of illuminating the etched dial face.

By
D. R. VON RECKLINGHAUSEN
J. W. CASEY and V. H. POMPER
Hermon Hosmer Scott, Inc.

Engineering design details on a new audio component which features an interstation noise suppression circuit, a.g.c., capacitor tuning of the oscillator, and 3 limiting stages.

FREQUENCY MODULATION broadcasting offers major fundamental advantages over amplitude modulation in the reception of wide-range undistorted sound with minimum interference from atmospheric noise, electrical equipment, etc. To realize the tremendous advantages of FM reception, a good receiver is needed and sensitivity alone is not enough. Good FM reception is determined largely by what is *not* picked up. In urban areas, strong local stations can cause a multitude of spurious responses resulting from cross-modulation and image interference. Impulse noise from vehicle ignition systems, diathermy machines, and interference from TV and other devices is high. Reflections of the signal from buildings cause multi-path transmissions and consequent fading which often reduces the level of the desired signal. In rural areas, high sensitivity and high selectivity are required to provide noise-free reception and to overcome the fading caused by multi-path transmission.

The performance of a good FM receiver is determined largely by absence of interference and noise. Other desirable factors are reasonable cost, attractive styling, operating convenience, interstation noise suppressor and tuning and signal strength meter.

In the design of the *H. H. Scott* 310-A FM "Broadcast Monitor Tuner" shown in Fig. 1 every effort was made to avoid undesirable effects in reception while including all desirable performance features. In many cases, appreciable departures from tradition and conventional design were required, including an entirely new tuning drive and a completely enclosed case.

In order to make the most of the desirable features uniquely inherent in FM transmission, wide-band circuitry was used rather than the more common narrow-band circuits. The advantages of wide-band design are significant reduction in adjacent channel, co-channel, and impulse noise interference; improved capture ratio; and significant reduction in distortion caused by overmodulation, by signal detuning or by the inherently greater non-linearity of typical narrow-band circuits. Also, the wide-band design makes possible non-critical tuning and virtually eliminates the effects of minor drift as a result of temperature or power line voltage changes or component aging, thereby making complex and troublesome a.f.c. circuits unnecessary. The wide-band design tunes in a fashion similar to one with a strong a.f.c. circuit but avoids the drift caused by unavoidable aging of a.f.c. circuit characteristics or by slight misalignment of critical a.f.c. adjustments. It also avoids the tendency with a.f.c. for strong stations to "pull" the tuning so that adjacent weak stations cannot be received.

The further advantages of wide-band design in reduction of interference and noise were recognized and pointed out in Armstrong's early work. To pass without significant interference a desired signal when an interfering signal has an amplitude almost that of the desired signal, a bandwidth of at least 2 megacycles is required in both limiters and detector. In the design of the 310-A, a 2 megacycle bandwidth in limiters and detector was found practical, thereby providing a capture ratio of less than 2.5 db. Capture ratio is the ratio between desired signal and the maximum interfering signal which still permits good interference rejection. Contrast this with the 300 kc. average detector bandwidth of a good narrow-band receiver, which may have a capture ratio as high as 20 db.

In order that the limiters perform adequately, very high-speed perfect limiting is essential if phase and frequency distortion of the signal are to be avoided. In choosing limiter circuits, the simple diode limiter was rejected as ineffective.

For true FM performance full limiting action must take place on even the weakest input signals. Therefore, three effective stages of limiting are used. The first is an electronic limiter, using a 6BN6 gated-beam tube. The second, a plate limiter using a 6AU6 tube, has high output which is applied directly to the wide-band detector, an unbalanced ratio detector which also acts as a third stage of limiting.

The unbalanced ratio detector offers several significant advantages over typical discriminator circuits which are not capable of as good co-channel interference rejection. Distortion caused by non-linearity in the discriminator response is responsible for a significant amount of the annoying distortion audible in narrow-band receivers. This cause of distortion is virtually eliminated by use of a wide-band ratio detector.

Factors important in the design of the i.f. or intermediate frequency amplifier stages are flatness of the passband characteristics, passband width and selectivity, high overload margin, high gain and low noise. The i.f. passband characteristic must have as flat a frequency response as possible to prevent slight variations in i.f. response from reversing relative strengths of almost equal desired and undesired signals, thereby increasing co-channel interference and degrading capture ratio.

The i.f. passband width was designed to be flat over the full modulation band of 150 kc. With tuners having significantly narrower i.f. passbands, detuning or high modulation causes serious phase distortion in the i.f. signal which cannot be eliminated and may cause as much as 10% audio harmonic distortion. The 150 kc. wide flat passband designed into the i.f.'s virtually eliminates such distortion. High attenuation outside of the flat passband is desirable to minimize interference caused by adjacent-channel stations.

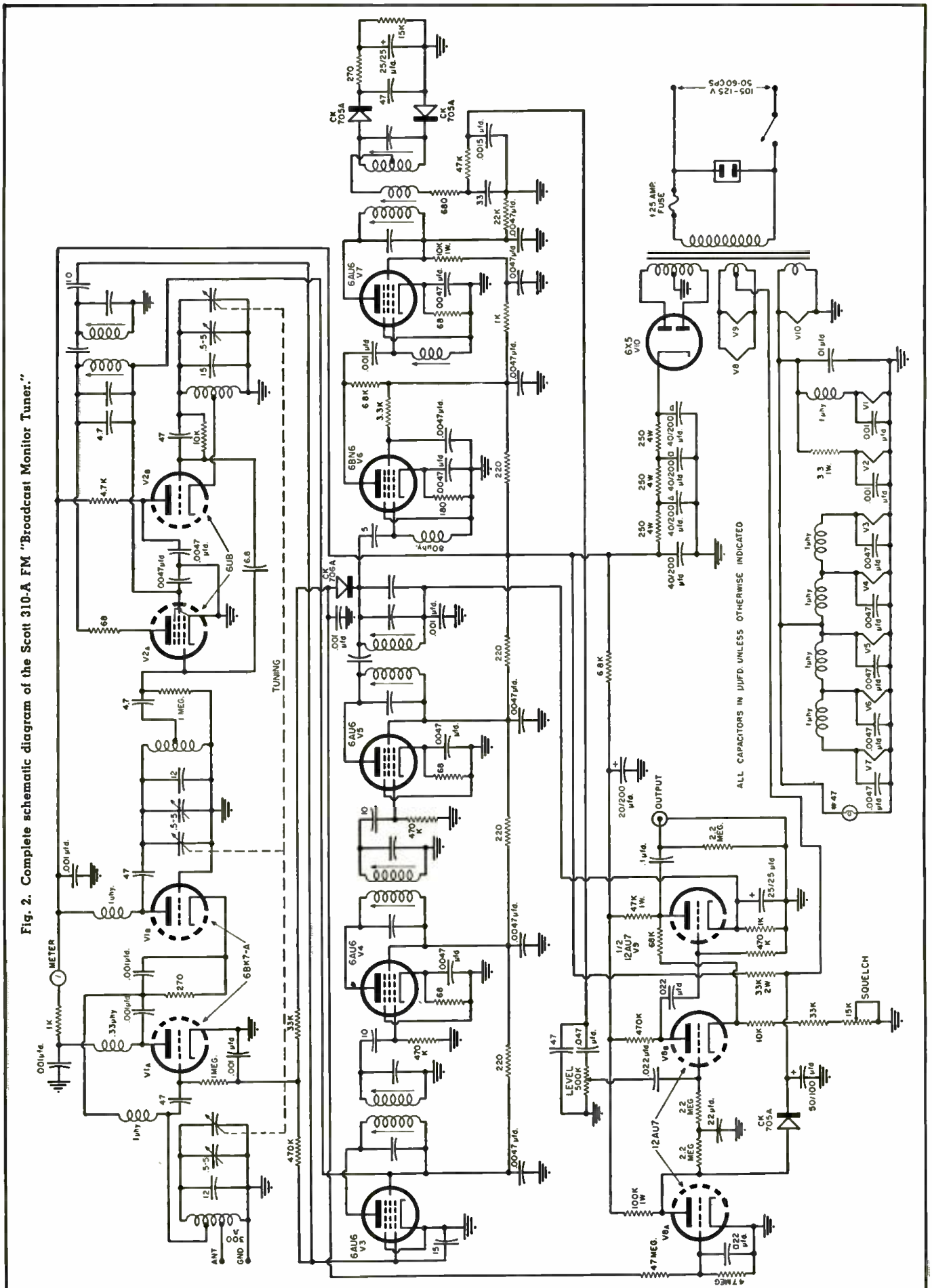


Fig. 2. Complete schematic diagram of the Scott 310-A FM "Broadcast Monitor Tuner."

Three i.f. stages with eight tuned circuits were used to obtain maximum attenuation outside of the i.f. passband. This permits listening to weak stations located at only slight frequency separation from strong local stations.

The i.f. stages were designed to have relatively large overload margins so that strong pulses riding in with the incoming signal will not cause stage overloading, with consequent degraded capture ratio. The i.f. stages were also designed with loose coupling to prevent undue detuning on strong signal strengths.

Capacitor tuning of the oscillator was used rather than slug tuning since its basic rotary motion is mechanically easier, smoother, and more reproducible, allowing greater control accuracy and exact tuning over the entire range.

Also, with capacitor tuning it is practical to have the oscillator frequency above the carrier, which is a real advantage in minimizing image interference. With slug tuning it is difficult to get adequate tracking with an oscillator frequency higher than the carrier unless specially shaped slugs are used.

It was considered important that the oscillator frequency be higher than the signal frequency because if the oscillator is tuned above the signal any possible image interference can only be from the aircraft control bands where transmitter powers are only several hundred watts. If the oscillator is tuned below the signal, image interference comes from the TV band where transmitter powers may be 100 kilowatts. A reduction in possible image interference of nearly 30 db is achieved by choice of oscillator frequency.

Another type of interference common in FM receivers is the result of cross-modulation between strong local signals, the oscillator signal, and other signals. This causes spurious responses which show up as reception of the same stations at many different points on the dial. By careful design of selectivity and linearity of the r.f. stage it was possible to obtain a spurious response rejection of 85 db, an outstanding design accomplishment, since sensitivity, which is usually sacrificed, was unaffected.

A neutralized cascode circuit was chosen for the r.f. stage, providing high sensitivity, selectivity, and stability together with lowest noise.

The high selectivity prevents overloading the r.f. stage when the incoming signal is off tune. The input impedance to the r.f. stage and its circuits was designed to be 300 ohms so that a standard 300-ohm folded-dipole antenna may be used with exact matching. The design was carefully chosen to be non-critical so that 75-ohm antennas may be accommodated with entirely negligible mismatch.

Few FM tuners include automatic gain control or a.g.c. The typical FM tuner depends on the limiting action to present uniformly equal voltages on all input signals to the detector. Unfortunately, if no gain adjustment is provided, high signal strengths may cause overloading of individual stages with consequent distortion of i.f. passband shape. This increases distortion, co-channel interference, cross-modulation, and impulse noise interference. Automatic gain control was chosen in order to eliminate need for a manual control to decrease sensitivity on high inputs. The a.g.c. voltage is developed by a diode on the output of the i.f. and is used to reduce the gain of the r.f. and first i.f. stages whenever high signal strengths are encountered. Delayed action a.g.c. is used so that tube noise alone does not institute control action. With undelayed a.g.c. even extremely weak signals will reduce the r.f. gain and increase the equivalent noise, thereby causing weak signals to be received with a substantially degraded signal-to-noise ratio.

The output of the unbalanced ratio detector is applied to a two-stage feedback amplifier which permits very low distortion, less than 0.1% even with 100% signal modulation. This circuit also makes possible a very low output impedance equivalent to that of a cathode follower, so that a long output cable may be used between tuner and power amplifier.

One of the most annoying features of most FM reception is the loud rushing noise heard between stations. A dynamic action interstation noise suppression circuit was provided to eliminate this annoyance. A continuously variable control was provided on the front panel for convenient adjustment from maximum noise suppression to maximum sensitivity.

While tuning is non-critical, a combined signal strength and tuning meter is provided for maximum convenience in tuning very weak signals and in orienting the antenna. The tuning technique is therefore similar to the simple and familiar AM tuning.

Also, with high interstage noise suppression action, weak stations might be passed over completely. However, the combined tuning and signal strength meter provides a visual indication of the existence of a signal with noise suppression on, so suppression may be reduced for receiving weak signals.

To avoid laborious "cranking" of a tuning knob, a basic departure from conventional tuning drives was developed as indicated in the photographs of Figs. 1, 3 and 4. The tuning indicator serves as a sturdy finger grip for sweeping through the entire FM band

(*Continued on page* 145)

Fig. 3. Top view with cover off, showing unique tuning drive.

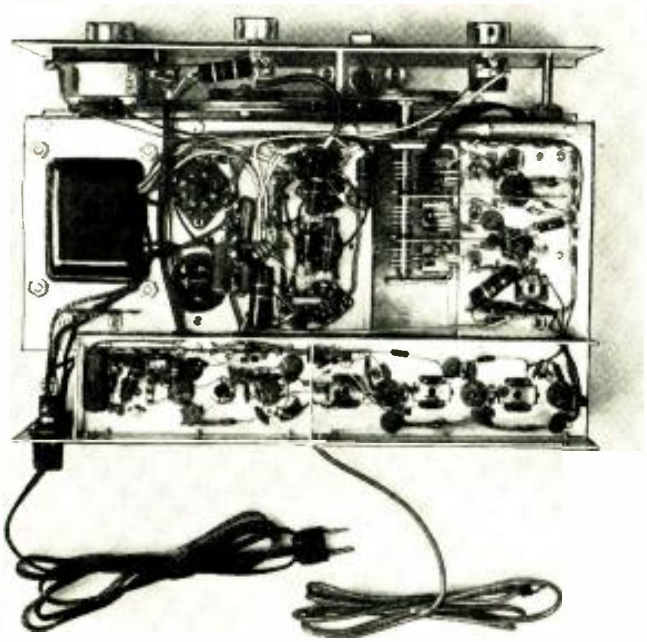
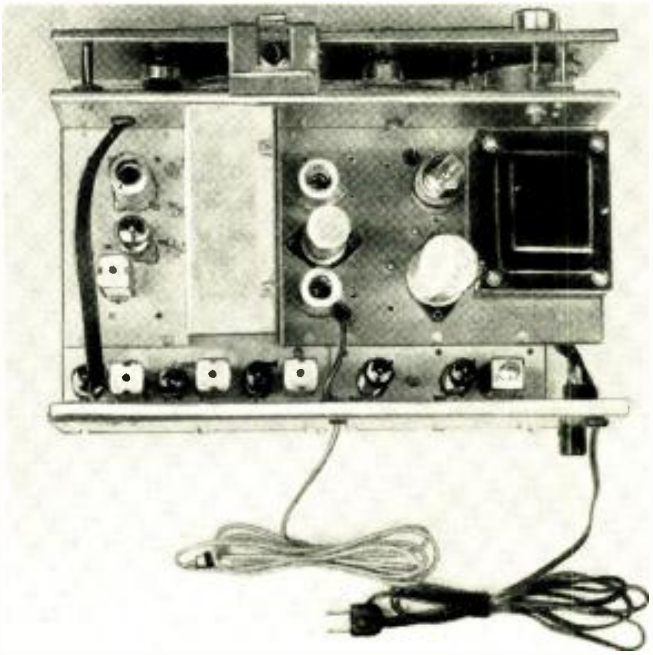


Fig. 4. Under chassis view of unit. Note generous use of shielding.



TRANSISTOR AMPLIFIER FOR METERS

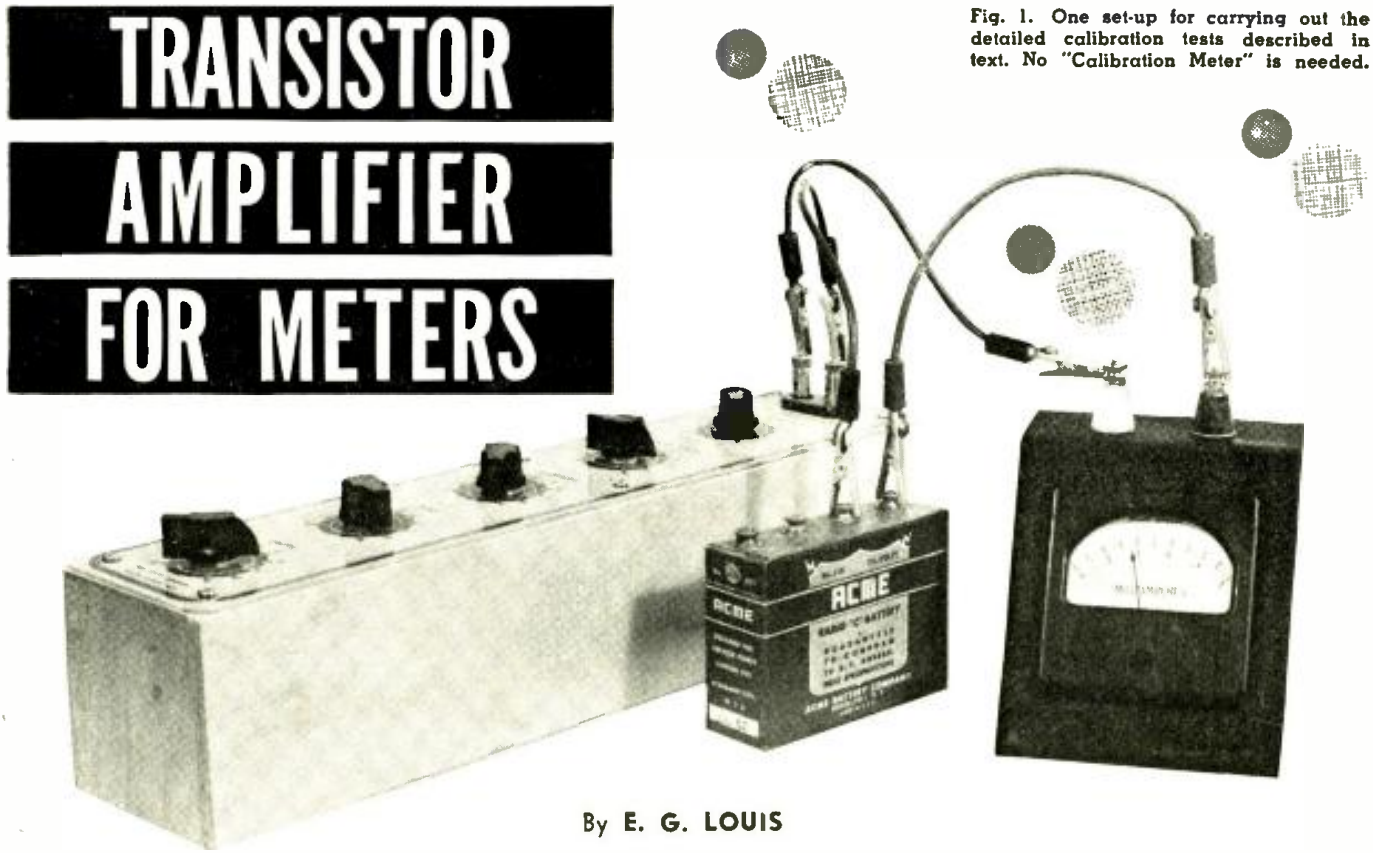


Fig. 1. One set-up for carrying out the detailed calibration tests described in text. No "Calibration Meter" is needed.

By **E. G. LOUIS**

A simple amplifier circuit which can be added to standard 0-1 ma. meters to increase sensitivity by a 10:1 ratio.

FEW meters are as popular as the standard 0-1 milliampere instrument. In fact, it is hardly likely that there is an experimenter's laboratory, a ham's workshop, or a school or commercial laboratory where at least one of these meters cannot be found.

But the same thing is not necessarily true of the more sensitive instruments—meters requiring 500 microamperes or less current for full scale deflection. Too often, however, the more sensitive instrument will be required, either for conducting a series of experiments, for circuit development work, or for proving in and testing a new piece of electronic equipment.

Unfortunately, the comparatively high cost and greater susceptibility to mechanical damage of the more sensitive meters may make it impractical for many laboratories to keep a quantity of these meters on hand. Certainly the purchase of a 0-50, 0-100, or 0-200 microampere meter represents a strain on the budget of the average electronics experimenter and ham.

There is one solution, *i.e.*, the use of the common and easily available 0-1 ma. meter together with a low impedance *current amplifier* to increase its sensitivity. The *Raytheon* CK722 transistor is ideally suited for this application. A current amplification of 10:1 is comparatively easy to achieve with this component, while at the same time maintaining the low impedance input so necessary in meter circuits.

It thus becomes possible to increase the sensitivity of the average meter by a factor of ten to one. A 0-1 ma. meter can be given a full-scale sensitivity of 100 microamperes. Where a more sensitive basic movement is used, even greater sensitivity is possible. A 0-500 microampere meter can be given a sensitivity of 50 microamperes.

On the other hand, where a less sensitive meter is employed, not as much sensitivity is possible. Thus, if a 0-2 ma. meter is employed, a full-scale sensitivity of only 200 microamperes is obtained.

Because of the small size of the transistor and the simplicity of the circuit used, the entire amplifier can generally be assembled in the meter cabinet. The meter shown in Fig. 5 calibrated 0-1 ma., has an actual sensitivity of 0-100 microamperes, yet the entire amplifier circuit used to obtain this sensitivity, including batteries, does not even partially fill the cabinet, as can be seen in the rear view of the instrument, given in Fig. 4.

The average technician should have no difficulty in assembling, testing, and calibrating a similar instrument in less than an hour's time, using the schematic diagram given in Fig. 2.

Table 1. The author's calibration table obtained when checking meter shown in photos.

VOLTAGE (B)	RESISTOR	CALCULATED CURRENT	METER READING
1.4 volts	14.000 ohms	100 μa.	1.0 ma.
1.4 volts	18.660 ohms	75 μa.	.749 ma.
1.4 volts	28.000 ohms	50 μa.	.50 ma.
1.4 volts	56.000 ohms	25 μa.	.25 ma.
1.4 volts	100.000 ohms	14 μa.	.142 ma.
* 0	0	0	0

* Meter leads shorted together.

Circuit Description

Referring to Fig. 2A, the CK722 transistor has been connected as a grounded emitter, direct-coupled current amplifier, with the basic meter movement, M_1 acting as the amplifier load. Variable resistor R_1 is used to set the full-scale meter reading, while operating power is supplied by battery B_1. (An alternative connection for the calibrating resistor, R_1, is given in Fig. 2B, and may give better results in some circumstances.)

In operation, as long as there is no base current flow, the emitter-collector current flow is negligible and may be considered to approach "0" for practical purposes. This condition exists when base (—) and emitter (+) leads are open (as shown in Fig. 2A) or shorted together.

Now, when the base and emitter leads are connected in series in a circuit in

which direct current is flowing, this current becomes the "base current" for the transistor, permitting a collector current flow that is proportional to its value. As the base current increases, the collector current increases in direct proportion, although of much larger amplitude (approximately ten times greater). Thus, the meter reading indicates a value that is proportional to the base current flow.

Since the maximum battery current drain is equal to the full-scale deflection of the meter (in the model shown, 1 ma.), battery life is quite long, and it is entirely feasible to use small cells.

Construction Hints

Assembly and wiring of the meter amplifier is perfectly straight-forward and no special precautions are necessary. Since d.c. is used throughout, both lead length and layout are non-critical, and the builder may follow his own inclinations as to the arrangement of components. It is suggested, however, that standard good construction practice be followed.

The author used small penlight cells (*Burgess* #7) for the voltage source (B_1, Fig. 2), wiring two in series. However, any other suitable batteries may be employed, even regular flashlight batteries. If the larger size batteries are used, the builder may have to experiment somewhat with the arrangement of components within the meter cabinet, taking care that no leads are shorted.

Crowding of parts is permissible, since there are no heat dissipation problems.

If available locally, the builder should consider one of the *Mallory* mercury cells (such as types RM1000, RM1200, etc.), as these have a much longer operating life than standard batteries.

Although practically any meter may be used in the basic circuit, the builder may find it necessary or desirable to change the supply voltage (B_1), and the size of the calibrating resistor R_1 to obtain the best results with his particular instrument. Both the series (Fig. 2A) and the shunt (Fig. 2B) calibration connections should be tried, with the final connections made using the circuit that gives the best results.

In general, the meter should give a full scale reading for the desired base current flow, and the supply voltage and calibrating resistor should be adjusted accordingly. For example, if an 0-1 ma. meter is to be given a sensitivity of 100 microamperes, full scale, then a reading of 1 ma. should be obtained when there is a base current flow of 100 microamperes.

If the meter reading is less than 1 ma., either the supply voltage should be increased or the calibration resistance decreased (using the series connection). In extreme cases, both steps may be necessary.

On the other hand, should the meter reading be off-scale (above 1 ma.), with a base current of 100 microamperes, then the series resistance should be increased, or the battery voltage reduced, or both.

Thus, in this way, it is possible to compensate for different types of meters and for minor variations in transistor characteristics.

Calibration and Adjustment

Once the wiring is completed and the meter checked for "full-scale" reading, detailed calibration tests may be carried out. The general set-up shown in Fig. 3 may be used. A similar set-up, but without the "Calibration Meter," is shown in Fig. 1.

Battery *B* is a voltage source capable of supplying the necessary current; an ordinary $1\frac{1}{2}$ volt dry cell is satisfactory for use here. A resistor decade box or resistor substitution box is included in the circuit to limit current flow to the values needed for calibration.

The "Calibration Meter" is a sensitive meter and should have a range approximating the full-scale range of the modified meter. However, this instrument is optional and may be omitted from the circuit if an accurately known voltage source and precision resistors are used. While the resulting calibration will not be as accurate as that obtained with a meter, it is generally satisfactory for practical work.

Next, the current through the circuit is varied from "0" to the full-scale reading of the "Modified Meter" by changing the series resistance of the decade box. Each current value, together with the actual meter reading, is recorded in a table. Table 1 was made up in the course of checking the meter shown in Figs. 1, 4, & 5.

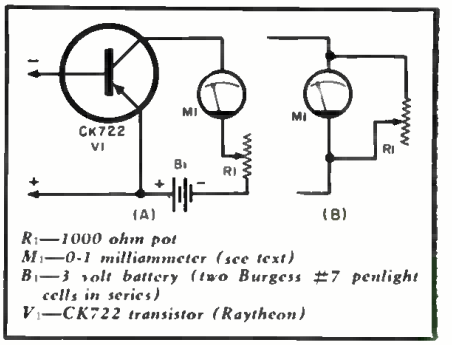
In the model, it was found that the calibration checks followed the scale reading so closely that it was only necessary to take the position of the decimal point into account when reading the meter. In many cases, this will be found to be true, for the operation of the transistor is linear over almost the full range from zero to maximum collector current.

In determining the calculated current values given in Table 1, no effort was made to take the internal base-emitter resistance of the transistor into account. This is generally permissible because the impedance of the transistor will usually be low compared to the series resistance used during the calibration procedure.

Where the meter calibration is such as to prevent using the printed meter scale directly, one of several alternative steps may be taken. A "calibration chart" or graph may be prepared for the meter, giving actual current values in terms of meter readings. A multiplying factor other than ten might be employed. Or a new scale can be drawn for the meter.

Once the modified meter has been

(*Continued on page* 118)



R_1—*1000 ohm pot*
M_1—*0-1 milliammeter (see text)*
B_1—*3 volt battery (two Burgess #7 penlight cells in series)*
V_1—*CK722 transistor (Raytheon)*

Fig. 2. (A) Schematic diagram of transistor meter amplifier connected as a grounded emitter, direct-coupled current amplifier, with basic meter movement acting as the amplifier load. (B) An alternative connection for the calibrating resistor, R_1, of (A).

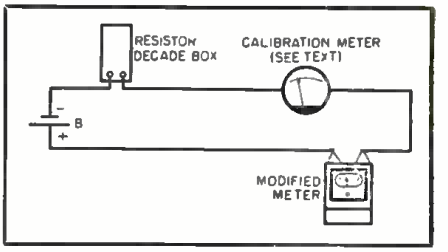


Fig. 3. Calibration set-up using a "Calibration Meter" and resistor decade box.

Fig. 4. Rear view of meter case showing how amplifier circuit has been built in.

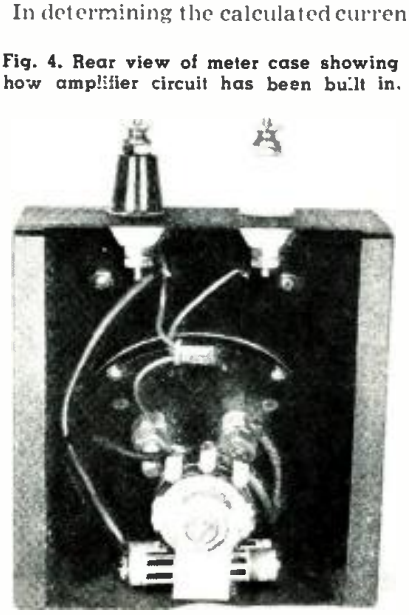
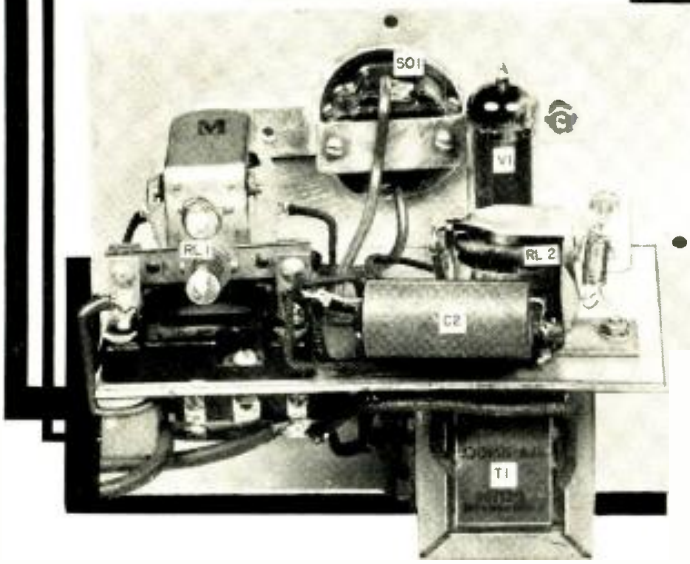


Fig. 5. Front view of 0-1 ma. meter whose sensitivity has been increased to 0-100 μa.

ELECTRONIC MEMORY

By **ED BUKSTEIN**
Northwestern Television and Electronics Institute



Rear panel and front views of the "electronic memory" unit. It is housed in a 4" x 5" x 6" metal cabinet. A single tube is used. The time delay can be adjusted by the user.

A compact and simple time delay relay which will operate lamps and lighting fixtures after pre-determined time lag.

THIS "electronic memory" fits into a 4 by 5 by 6 inch metal cabinet with room to spare, and "remembers" to turn off the lights after you have left. The unit should eliminate the cause of many bruised shins and stubbed toes, and should be appreciated by anyone who has ever (1) been a foreman, guard, or other last-man-out who turns off the lights and feels his way out of the building, (2) parked the family car in the garage and then groped through a dark jungle of clothes lines, forgotten toys, lawn mowers, rakes, etc., (3) turned off the house lights and stumbled through a dark porch or corridor to the walk, (4) switched off the bedroom lights and groped towards the bed.

The front panel of the memory unit contains a toggle switch and outlet. The lamp or other lighting fixture to be controlled is plugged into this outlet. When the toggle switch is in the "on" position, the line voltage is available at the outlet and the light is on. When the toggle is switched to the "off" position, a sixty-second time delay begins. During this interval, the line voltage is still available at the outlet and the light remains on. At the completion of the time delay interval, the unit turns off the light and also disconnects itself from the power lines so that no standby power will be consumed.

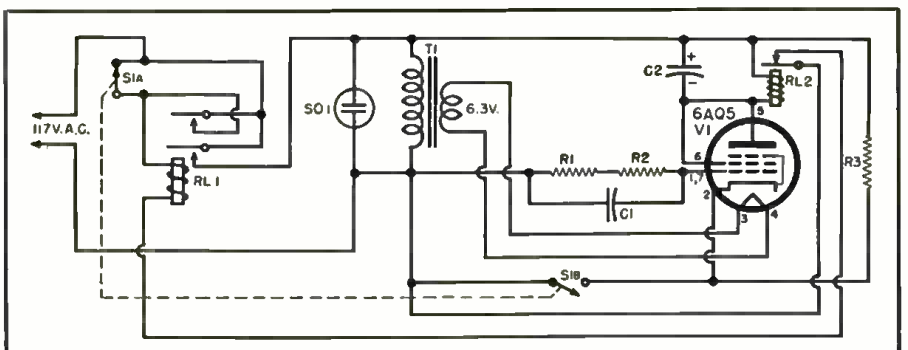
As shown in the diagram, the toggle switch is a double-pole, double-throw type. The two opposite sections of the switch are used so that when one is open the other is closed (S_{1A} and S_{1B} in the diagram). When the toggle is in the "on" position, S_{1A} is closed and relay RL_1 is energized. The contacts of this relay apply the line voltage to the outlet and also to the time delay circuit. During the half cycle of line voltage when the grid of the 6AQ5 becomes positive, grid current charges capacitor C_1.

When the toggle is thrown to the "off" position, S_{1B} closes. Capacitor C_1 is now connected between the grid and cathode of the 6AQ5. The polarity and magnitude of the charge on C_1 are such that the tube is biased beyond cut-off. After an interval of time, however, the charge on C_1 will have leaked off through the resistors connected across it. The 6AQ5 will now draw plate current and energize relay RL_2. The normally-closed contacts of this relay now open and interrupt the current flow through RL_1. When RL_1 de-energizes, the outlet and the time delay circuit are both disconnected from the power lines.

The length of the time delay is determined by the time constant C_1-R_1-R_2. For the intended application, a sixty-second time delay is a reasonable interval. For special applications however, it may be desirable to either increase or decrease the interval. This can be easily accomplished by changing the value of C_1 or of the resistance in parallel with it. Increasing either the capacitance or resistance will increase the time delay, and *vice versa*.

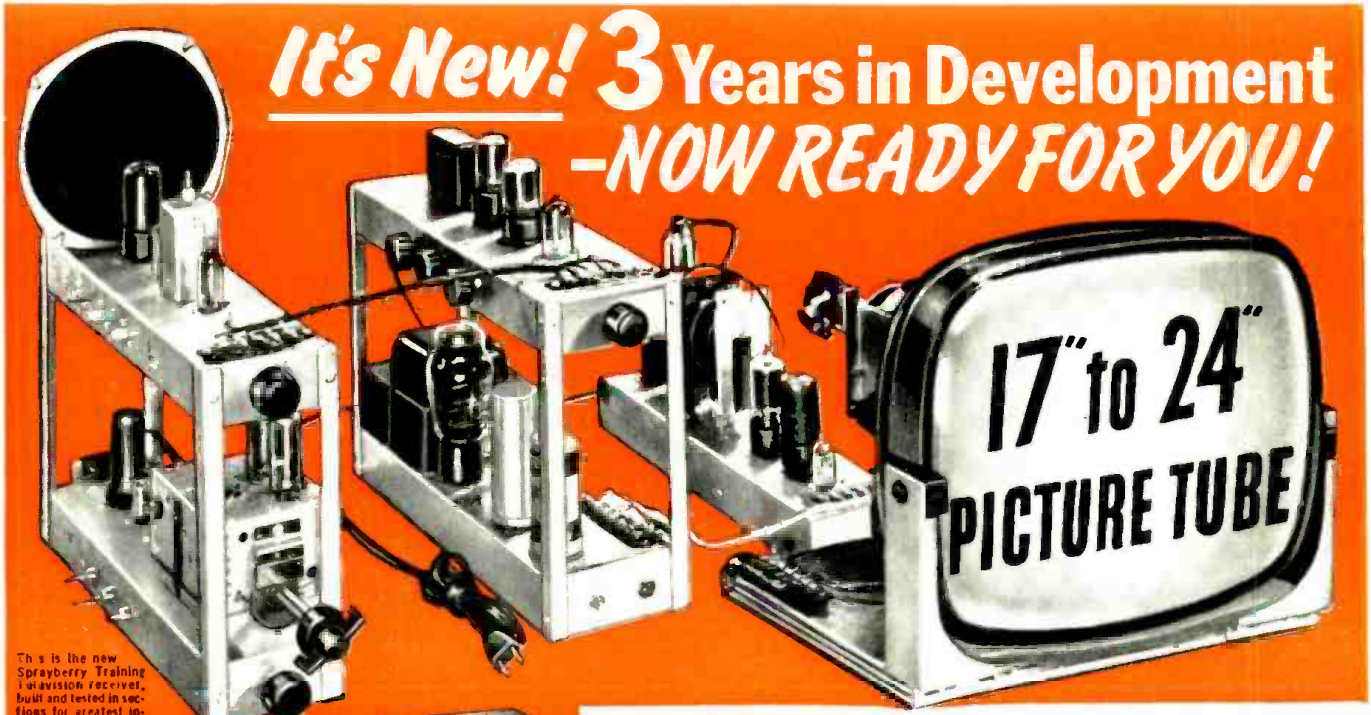
Almost every home has a few dark areas in the attic, basement, hallway, side entrance, etc. The "electronic memory" can add a new feature of safety and convenience to the home. It is easy to build and relatively inexpensive. -30-

Complete schematic of relay. Variations in timing intervals are possible. See text.



R_1, R_2—15 megohm, ½ w. res.
R_3—10,000 ohm, 2 w. res.
C_1—.5 μfd., 200 v. capacitor
C_2—15 μfd., 150 v. elec. capacitor
RL_1—117 volt a.c. relay, d.p.s.t. contacts
RL_2—Plate relay, 2000 to 5000 ohm coil, normally-closed contact
T_1—Fil. trans., 6.3 v. @ 2 amp.
S_{1A}, S_{1B}—Opposing sections of d.p.d.t. toggle switch (see text)
SO_1—117 v. outlet (socket)
V_1—6AQ5 tube

It's New! 3 Years in Development —NOW READY FOR YOU!



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New Equipment! New Lessons! Enlarged Course!

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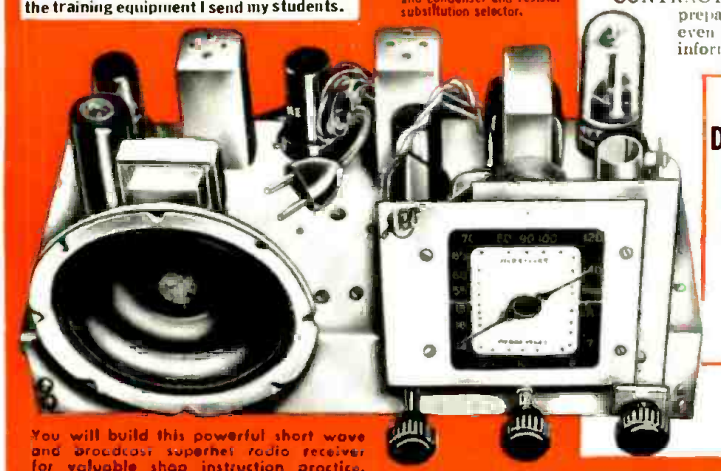

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Frank L. Sprayberry
President, Sprayberry Academy of Radio

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The complete facts are so big and so important to any man seeking training in Radio-Television that I urge you to mail the coupon below at once for my big all-new 56 page FREE CATALOG and FREE Sample Lesson. Get the full story of this remarkable new and up-to-the-second Training Plan. You'll read about my 3 NO OBLIGATION PLANS or "packaged unit" instruction for both beginners and the experienced man. You'll learn how I can now prepare you in as little as 10 MONTHS to take your place in this fast moving big money industry as a Trained Radio-Television Technician. You'll see that you take no risk in enrolling for my Training because you DO NOT SIGN A BINDING TIME PAYMENT CONTRACT. I have been training successful Radio-TV technicians for 22 years . . . I can prepare you, too, to get into your own profitable Service Shop or a good paying job, even if you have no knowledge of Radio-Television. Mail the coupon . . . I rush full information FREE and without obligation. (No salesman will call.)

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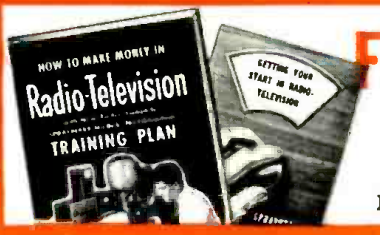

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Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Include New Catalog and Sample Lesson FREE.

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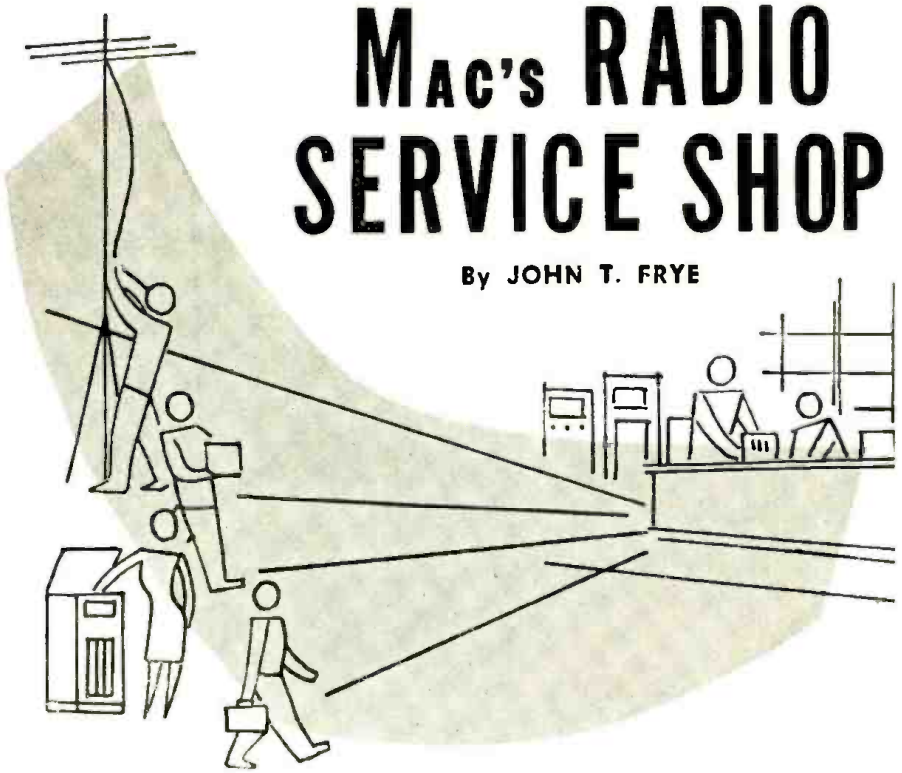
MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



CALLING ALL INVENTORS

A FREEZING RAIN during the night had turned the out-of-doors into a crystal fairyland. Every tree was an immobile fountain of ice; the eaves of every building wore gleaming, sparkling fringes of icicles.

However Amanda Perkins, secretary, office manager, customer buffer, and Chief Worrier of Mac's Radio Service Shop, was oblivious to all this congealed beauty outside. Seated at her desk with her back to the windows, she was playing a staccato tune on the typewriter as she engaged in her daily little game of trying to get through all the correspondence by lunch time.

That was why she did not see the door open stealthily behind her to admit the curly red head of Barney, the shop's service technician, j.g. The boy stepped inside and closed the door behind him with a quietness that was amazing coming from one who was usually about as quiet and gentle as a bulldozer. Holding a small icicle delicately between thumb and forefinger, he tiptoed across the room and gently dropped it down the back of Miss Perkins' dress.

Instantly she gave a loud shriek, exploded out of her chair, and began frantic movements of her body as she tried to dislodge the melting bit of ice.

Mac, who had watched the whole procedure through the open door of the service department came rushing into the office brandishing a length of pipe mast and demanding, "Where's the mouse, Amanda? Just show him to me, and I'll clobber him for you!"

Barney, wearing a look of shocked surprise on his face during all this pandemonium, finally said, "Why, Amanda, I didn't know you could rhumba; or is that a new hula you are showing us?"

At this Miss Perkins suddenly became ominously quiet as she glared at her tormenters. Then she walked deliberately over to her desk and picked up a heavy paper weight. That was all the hint Mac and Barney needed. With one accord they leaped through the door of the service department and slammed it behind them.

Mac grinned at Barney leaning weakly against the door and asked in his best imitation of the "Life With Elizabeth" announcer, "*Aren't* you ashamed?" Barney was still laughing too hard to do more than shake his head vigorously.

"Well, then I'd better find an outlet for some of this surplus energy of yours," Mac said as he picked up a small pamphlet from the service bench. "As a person who is always eager to think about anything except work, you should find this right up your alley. Ever hear of the National Inventors Council?"

"Don't think so."

"It was created in 1940 by the Secretary of Commerce with the concurrence of the President to establish a means by which the natural inventive talent of the American people could be used to aid the war effort. The chief function of the Council is to receive and evaluate ideas and inventions that may be of use to the military forces. In this capacity it welcomes suggestions from inventors on practically everything from 'toothpicks to tanks.' Since the Council has been in business during the past fourteen years, the public has submitted more than 300,000 proposals, some of which have resulted in tremendous savings in men, materiel, time, and money.

"In order to channel inventive thinking somewhat, the Council periodically issues lists of military problems that are current. I have such a list here. Hoping to concentrate your inventive genius still further, I have gone through the list and checked off those items that would seem to lie in the domain of electricity and electronics."

"Fine, fine!" Barney said smugly. "Toss a couple over the plate."

"Often I hear fellows who are studying for a commercial radio license gripe about the questions devoted to batteries on the grounds that batteries are pretty much out of date. Apparently the army does not know about this, for a lot of their inventive needs are connected with batteries. For example they say they need a battery with a very long shelf life and one that will give a constant power output over a widely varying range of temperature; and to the army that means a range of from —100° F to 160° F above zero.

"They are particularly interested in a battery that will perform well at extremely low temperatures. For example, they would like a new electrolyte that could be substituted for the one ordinarily found in an automotive (lead-acid) battery that would have a low viscosity at —65° C and that would work well at this temperature without any damage to the battery. At the same time they would like to have a new miniature battery that would provide more service life per unit of volume and weight."

"How about the RM cells and the low-temperature batteries I've read about?"

"These are mentioned. It is stated the initial production of RM cells was spotty and that while some batteries gave good performance, others did not provide any useful life at all because of defects. My dad, who wears a hearing aid using these batteries, strongly seconds this opinion. He says that when you put in a fresh battery you can never be sure whether it is going to last two hours or two weeks. Low temperature batteries provide some life at —40° F, but not sufficient life to be of practical value. Incidentally, the army is willing to approach this problem from another direction. If you can think up a good way to heat drycells so that the full output can be obtained in extremely cold regions, the army would like to hear about it. They have already tried using heat tablets, activated charcoal blocks, sterno-type and chemical heaters without much success.

"How about the new solar and atomic batteries?"

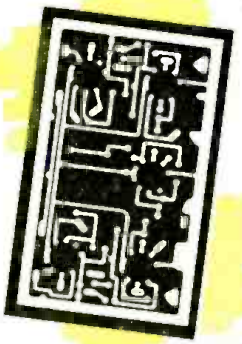
"They show promise but are not suitable to field applications at their present stage of development. The army would very much like to have a new, efficient, compact, light, and quiet source of power to replace heavy batteries and noisy internal-combustion, engine-driven generators for front line use."

NEW 1955

Heathkit Engineering Features

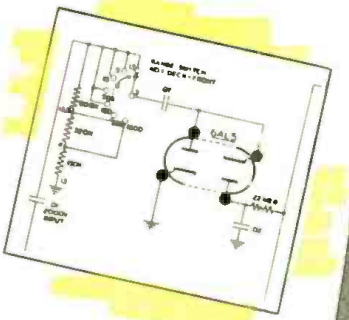
New PRINTED CIRCUITS

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.

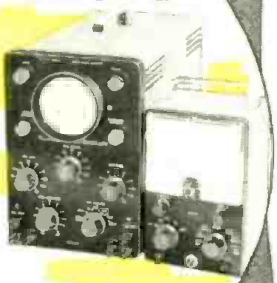


New HIGH READABILITY PANELS

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.

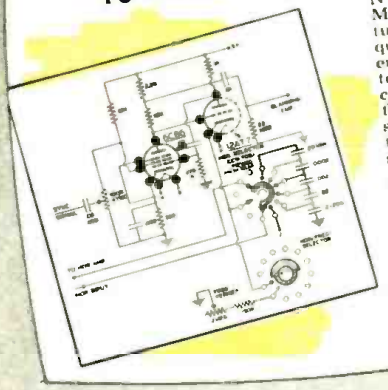


New STYLING New COLOR

New styling and coloring is responsible for tremendous improvement in Heathkit appearance. The new instrument panel color combination is high definition white lettering in 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 piecesetting trend in Heathkit styling.

New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

New 1955 Heathkit Model O-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 15, Mich.

"What else do they need?"

"Well, as an old treasure-locater builder, you may be interested to know the army still wants a device or technique that will positively detect the presence of explosives, as such, buried beneath the earth's surface. I don't think they would be much interested in that gadget you built that goes out after 'pieces-of-eight' and comes up with a roll of rusty fence wire. Along the same line they would like to have a rapid method by which they can determine the density of surface layers of soil to a depth of three feet in six-inch increments without taking actual samples. All attempts to do this electronically so far have failed. On a little different tangent, they would like to have a blasting cap that cannot be initiated by electromagnetic or radar waves."

"Anything else?"

"A lot else. There is need for a recorder that will work over a frequency range of from 5 to 1000 megacycles. A non-heterodyning type of frequency divider is wanted. So is a high voltage power supply that will put out 40,000 volts at up to 50 microamperes of current and yet will be so small and light that it will not add seriously to the burden of the man who must carry the electronic equipment this power supply operates. A microwave oscillator capable of 1 kw. of c.w. output is needed. The army would like to have a 12" cathode-ray tube in which the glass envelope is much lighter in weight, shorter, and more rugged. A coaxial r.f. switch of broadband characteristics to handle one to ten kw. of power is on the list. So is a frequency insensitive rotating joint for coaxial and waveguide circuitry."

"I'd like one of those myself for my ten-meter beam," Barney interrupted.

"Yes, and on Field Day you and the army both would like an ultra lightweight field antenna mast or radiator, say one that collapses to only 10 feet in length but that can be extended to any height up to 100 feet and that requires a minimum of guying, preferably none at all at lower extensions. The army would also like to have a coil impregnant that is cheap, easily applied, and unaffected by heat or humidity; and one that will not, on the other hand, affect the "*Q*" or the physical or electrical performance of the coil on which it is used. The military thinks it would be nice if someone would come up with a semi-conductor material for use in transistors whose color would reveal its conductivity type: *n*-type being one color and *p*-type being a different color. Do you get the idea?

"An indicator for carbon-monoxide gas is needed. So is a humidity indicator. So is a rugged, portable, lightweight ammeter that will be 20 to 100 times more sensitive than the conventional D'Arsonval type; yet no external power supply or electron tube amplifiers can be used to accomplish this."

NEW *Heathkit*

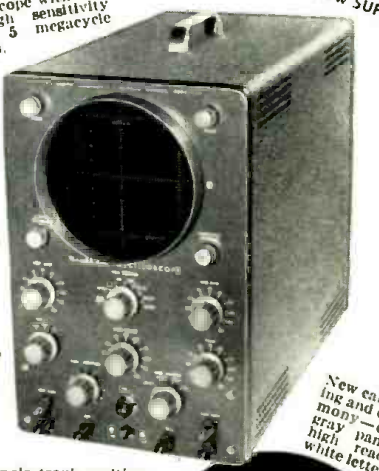
5" PUSH-PULL

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.

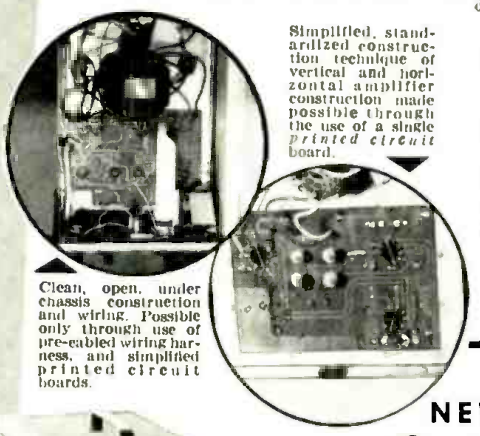
PRINTED CIRCUITS: Two printed circuit boards used in this fine instrument to insure stable, consistent performance. Problems solved by pre-engineering of boards, and their use guarantees completed unit that will have same characteristics as lab development model. Printed circuits simplify construction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

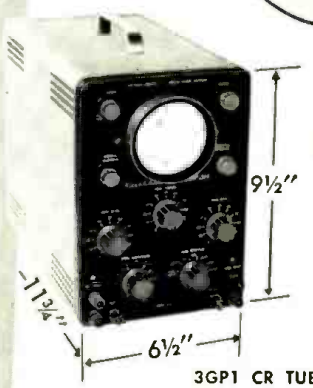


Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single *printed circuit* board.

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.



NEW *Heathkit*

3" PRINTED CIRCUIT

OSCILLOSCOPE KIT

MODEL OL-1

$29.50 Shpg. Wt. 15 lbs.

3GP1 CR TUBE

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.

NEW *Heathkit*

5" PRINTED CIRCUIT

OSCILLOSCOPE KIT

MODEL OM-1

$39.50 Shpg. Wt. 24 lbs.

5BP1 CR TUBE

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

BENTON HARBOR 15, MICHIGAN

"Looks like a spot to use transistors," Barney commented.

"Possibly. There is also a growing need for something to replace our diminishing supply of natural piezoelectric quartz. One possibility is the development of a high quality synthetic quartz. Another is the application of magnetostriction units to the control of frequency. Whichever is used, it must have an accuracy equal to that of natural quartz oscillators: approximately .02% within the temperature range of —65° to +160° F. We also need a new high resistance material with a resistance of at least 100,000,000,000 ohms per centimeter with a low temperature coefficient, good resistance to vibration and shock, capable of being formed into units with a resistance accuracy of 20%. These resistors are needed for use in radiation detection instruments."

"All that stuff is rather small caliber for an inventor of my type," Barney objected. "Don't they need some really big inventions?"

"Oh sure. They would like to have a complete new type of communication that does not depend on electrical impulses, electromagnetic waves, sound waves, or any other method known at present. That should hold you for a while. Then you can work on a new system for converting either light or heat into electrical energy. Of course the *Bell Laboratories* are kicking this around, too, but I am sure you like a little competition. On your day off you can play around with either a destructive ray that will produce death at 500 yards without excessive power input or with a device that will convert speech directly into writing. I think perhaps *IBM* has done some work on this, but the army wants a device that is simple to operate and is not bulky—which makes it quite a large order."

"I think I'll help the army out on a few of these things," Barney announced importantly. "Where do I submit my ideas or write for more information?"

"Just address the National Inventors Council U. S. Department of Commerce, Washington 25, D. C.," Mac answered; "but before you start inventing, you had better figure out how you can get back into Amanda's good graces."

"Don't worry about that; it's already taken care of," Barney said airily. "Tomorrow morning I intend to present her with the personally-autographed picture of Liberace I managed to have him sign when he played in Center City a couple of weeks back. Knowing how much she likes to hear him play, I got it especially for her; but I've been waiting to give it to her until the right moment arrived. Now I think it's here! If that doesn't melt her down, nothing will."

"That's my boy!", grinned Mac. "Old Don Juan had nothing on you when it comes to being a smooth operator. I don't know how you do it—but six or sixty—the gals love it!" —30—

NEW *Heathkit* VACUUM TUBE VOLTMETER KIT

PRINTED CIRCUIT DESIGN

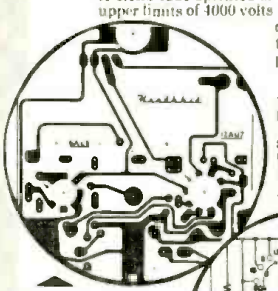
New charcoal gray baked enamel panel with high readability white lettering. New soft feather gray cabinet, subdued pilot light indicator.

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.

RANGES:

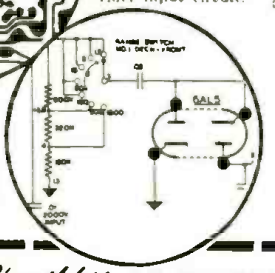
Seven voltage ranges, 1.5, 5, 15, 50, 150, 500 and 1,500 volts DC and AC RMS. Peak-to-peak ranges 4, 14, 40, 140, 400, 1400, 4000. Ohmmeter ranges X1, X10, X100, X1000, X10K, X100K, X1 meg. Additional features are a db scale, a center scale zero position, and a polarity reversal switch.

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.



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

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.

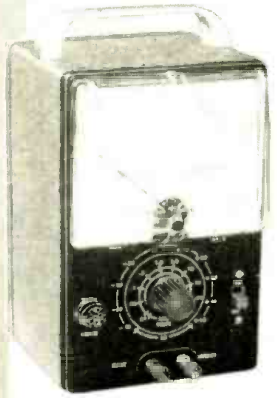
The new V-7 also sets the pace as a kit instrument style leader. Smart, good-looking charcoal gray panel and soft feather gray cabinet. High readability panel with sharply contrasting white calibrations. The pleasing, eye catching, modern styling is in harmonious balance with the outstanding circuit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

HEATH company

BENTON HARBOR 15, MICHIGAN

Technical BOOKS

"VADE-MECUM, TELEVISION & SPECIAL TUBES", Dr. J. A. Gijsen, ed., *P. H. Brans, Ltd.*. Antwerp. 244 pages. Price $5.00. Paper bound. 11th Edition. Available in the U. S. from *Editors and Engineers, Ltd.*, Summerland, California.

With this volume, the trilogy comprising radio tube characteristics (9th Edition), and equivalents (10th Edition) is complete. This book covers tubes for television and special purposes and includes data on cathode-ray tubes, crystal devices, controlled rectifiers, special u.h.f. tubes, gas discharge tubes, phototubes, radiation counters, thermocouples, ballast tubes, and various miscellaneous tubes.

For those not familiar with this work, it would be well to explain that the "Vade-Mecum" covers data on tube types manufactured by companies throughout the world, presented in tabular form, with explanatory material translated into German, French, English, Italian, Spanish, and Dutch.

Companies engaged in the manufacture of export model radio and TV receivers, service technicians who have occasion to service foreign-built equipment, amateurs converting surplus radio gear, etc. will all find this book an invaluable aid in providing equivalent tubes for all types of electronic circuitry.

* * *

"ANALYZING AND TRACING TV CIRCUITS" by Milton S. Kiver. Published by *Howard W. Sams & Co.*, Indianapolis. 130 pages plus 14 TV receiver schematics. Price $3.00. Paper bound.

Technicians who have found the author's previous volumes of help in speeding troubleshooting and servicing will welcome the appearance of this basic and hard-hitting handbook.

The book is especially suitable for the beginning technician since it covers basics before venturing into specific applications. The first chapter covers things that every technician should know about every circuit. In this category is information on resistors, inductances, capacitors, and tubes—what they do in the circuit, why they operate as they do, plus all sorts of valuable and important data on these components.

From this point of departure, the author buckles down to specifics and covers such vital topics as the differences between schematics and the actual sets, how to follow the d.c. power lines in a set, where the boost voltage fits in, the a.g.c. system, deflection systems, troubleshooting procedures in logical order, the unfamiliar circuit, etc.

A valuable appendix which gives the complete schematics on 14 commercial television receivers, completes the book. Readers of this magazine are

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.

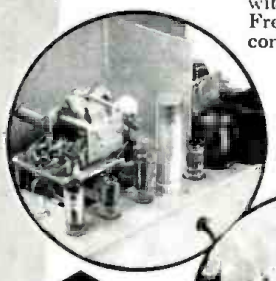
Electronically operated, smooth continuously variable sweep circuit. No vibration, hum or noise.

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

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.



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

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

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.

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 50 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.

MODEL TS-3

$44.50

Shpg. Wt. 18 lbs.

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 leyel. 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, seleetivity, 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

BENTON HARBOR 15, MICHIGAN

familiar with Mr. Kiver's lucid style and comprehensive approach to the problem. This text conforms to the author's usual high standard of technical excellence and understandability and is, therefore, recommended as a valuable and indispensable servicing aid.

* * *

"HIGH FIDELITY" compiled by Trend Staff. Published by *Trend Incorporated,* Los Angeles. 127 pages. Price $ .75. Paper bound.

This is a non-technical discussion of high-fidelity equipment prepared for the layman-music lover.

It represents a compilation of articles prepared by various authorities in the field. There are fourteen chapters devoted to such subjects as high-fidelity, the cost of a hi-fi system, how hi-fi works, home music installations, the loudspeaker system, amplifiers, broadcast music, magnetic recording, records, how to install a hi-fi system, modernizing radio-phonographs, available "do-it-yourself" kits, hi-fi for the car, and hi-fi definitions in addition to all sorts of miscellaneous but important audio data.

The book is beautifully illustrated with photographs of actual installations, available commercial equipment, etc. in addition to line drawings of suitable enclosures, system layouts, etc.

Those interested in hi-fi reproduction from a layman's point of view will find this book wonderfully helpful and remarkably complete.

* * *

"THE OSCILLOSCOPE" by George Zwick. Published by *Gernsback Publications, Inc.*, New York. 187 pages. Price $2.25. Paper bound.

The widespread acceptance of television has made the oscilloscope one of the truly essential tools of the technician. To fully understand this instrument and its function requires more of the technician than just a casual perusal of the instruction manual accompanying his scope.

This handbook is intended to supplement and enlarge on the material contained in such manuals as it covers the "how's" and "why's" of scope operation and application.

The book is divided into eight chapters, the first four of which are basic discussions of waveforms, the CR tube, sweep systems, and typical scopes. The balance of the book is devoted to specific application data and covers alignment, scope techniques, tests and measurements which can be made with the scope, and experiments using the scope.

The text is written in simple, easy-to-understand form and is lavishly illustrated with line drawings, photographs, and schematic diagrams.

Those attempting to service TV receivers without a thorough-going understanding of their most valuable ally, the scope, would do well to study this manual carefully in order to derive the maximum benefit from this indispensable tool. —30—

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 line-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
BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* HIGH FIDELITY PREAMPLIFIER KIT

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 12⅛" wide x 5⅛" deep x 3⅜" 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

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 prewound coils with the oscillator and amplifier are switched simultaneously by 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.

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.

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. Shpg. 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.

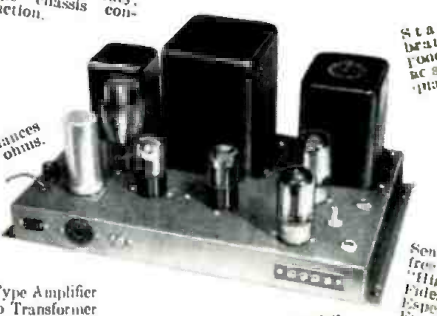
Heathkit ANTENNA COUPLER KIT

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
BENTON HARBOR 15, MICHIGAN

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



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.

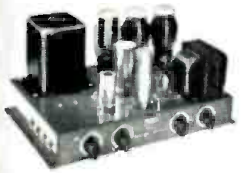
CONSTRUCTION:
Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble 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 Aerosound 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 Aerosound 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 Aerosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **$49.75**

HEATH company
BENTON HARBOR 15, 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.

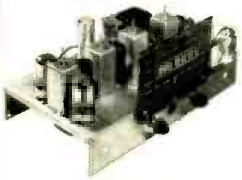
RECEIVER CABINETS

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.

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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 insure postage for weight shown.

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

TV Color Converter

(*Continued from page* 39)

ed. Finally, the r.f. wiring was put in place.

Important: All resistors carrying fairly heavy loads were grouped on terminal strips below the power supply section, as far from tuned circuits as possible, to avoid the possibility of heat causing detuning of circuits. This is a vital matter in a color set because detuning and accompanying shift will cause color contamination.

The crystal is mounted alongside the chassis where it is out in the open and "runs cool"—again to avoid frequency shift.

The heavy black lead which loops around under the chassis is the delay line. Fig. 9 shows how this component is constructed from a 23-inch piece of RG-59 U coaxial cable. As shown, the center wire lead, and its polyethylene sheath, is pulled from the cable, leaving only the metal braid and its plastic cover. These two pieces serve as the foundation of the delay line. First, they are slipped *temporarily* over a metal rod to provide sufficient stiffness for winding. This winding, which should be put on accurately with a lathe, is made of No. 36 enameled wire. It is wound for a length of 22 inches, 128 turns-per-inch. As shown in the drawing, the leads connect to opposite ends of this coil winding. The winding itself is covered with a layer of *very thin* dielectric paper (pulled from old condensers) and this, in turn, is covered with a layer of aluminum foil. The latter is grounded to the inside braid as shown in the drawing, being careful not to short the winding to the grounding foil. Tape completely.

Wiring a set as complicated as this is a job in which even an expert can go astray. One bit of insurance is to tape a piece of vellum (a kind of semi-transparent drawing paper available at any art store or engineering supply house) over the diagram, and then draw in each lead with a colored pencil as it is done. This process is a little tedious—but not as tedious as trouble-shooting for built-in errors. Once the set is wired, the chassis can be given a rough check by comparing pin voltages with those shown in the diagram of Fig. 3.

When the color chassis is completed, the next step is to tie it to the *Norelco* projection units. These are the standard type, readily available from electronic parts jobbers. The hook-up requires three.

As shown in Figs. 10 and 11, the units are mounted side by side, as close together as possible, with hinges between them. Then the chassis are

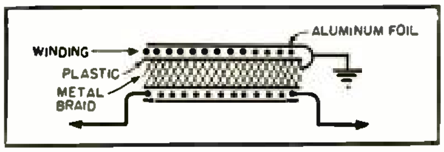


Fig. 9. Details on the construction of the time delay line used in the Y channel. The line is made from a piece of coaxial cable from which the center conductor has been removed and an external winding added.

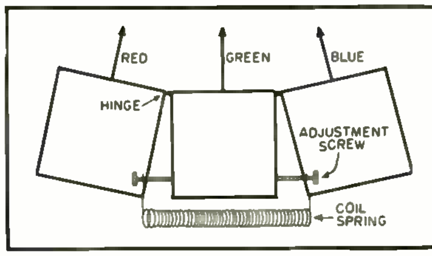


Fig. 10. Three TV projection units can be set up as shown here and used with the converter to give colored TV pictures.

Fig. 11. Front view of the three projection units set up for use with the color converter described in this article. Color filters made of Plexiglas are mounted directly in front of each projector. Touch-ups are provided for registration.

spring-loaded, as shown in Fig. 10, and adjustment screws provided so that the outer two projection units can be pointed in slightly—so that the images from all three units fall on top of each other on the screen. The fact that the units are some distance from the screen, and that the middle unit (green) carries 59% of the illumination, makes the very slight "keystoning" of the two outer units a theoretical rather than a practical worry.

Each of the units has a colored filter in front of it. (Colored Plexiglas was found to work the best—even better than photo filters.) The vertical and horizontal adjustments on the projection units, plus the mechanical position of the projection housings themselves, are all utilized to get the best possible registration of the projected images.

Both vertical and horizontal sweep voltages for the three projection units are picked up from the black-and-white chassis. The vertical sweep is used to drive the vertical yokes on the *Norelco* units—and the yokes are connected *in series*. The horizontal yokes are driven *in parallel*. Doing this will probably require substituting a different output transformer for that originally in the set. In the receiver described here, an *RCA* 231T1 transformer is used with the proper tap to provide the correct impedance match. The grids of the *Norelco* units are driven by the color output signals from the color converter chassis.

If everything checks out OK, we're ready for the final step—tuning up the chassis. Complete step-by-step instructions will be given in next month's concluding article.

(To be continued)

SERVICING SWITCHES

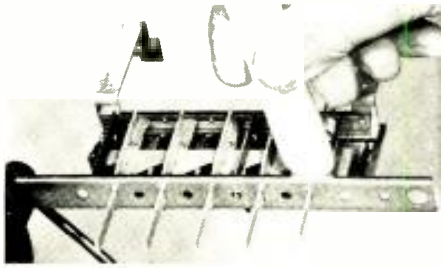
THE switching arrangement of a push-button tuned radio (with switches on bottom side) is shown removed from receiver.

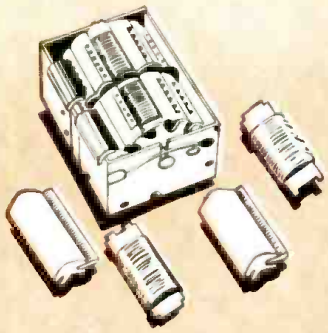
On this type of switching, with springs and locking devices, one switch rod will stay in when pushed but any other rod will be released.

Some push rods rotate the radio gang condenser directly to pre-set stations, while others, as shown, operate pre-set trimmer condensers across the antenna tuning circuit with the gang condenser cut out for push-button operation.

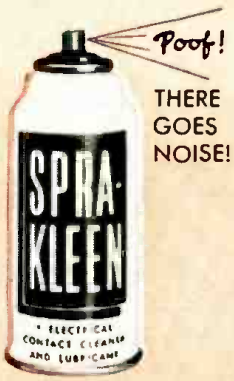
Switch contacts on the bottom of the mechanism illustrated should be cleaned at intervals, switch rods should be checked for binding in slots and springs must be kept in good condition. . H. L.

Check and clean switch contacts periodically to insure good operation of radio.





G-C TUNER-KLEEN'R For every Standard Coil tuner. Cleans both stationary and rotary contacts at every twist of the channel selector. Easy to install, means extra profit, better reception.
No. 9132.....Net $1.00



G-C SPRA-KLEEN The original power spray electrical contact cleaner and lubricant. Eliminates noises in TV tuners, contacts, controls, relays and switches. No waste, no need to remove parts.
No. 8666 6 oz. can.....Net $1.00

G-C PORTABLE WIRE REEL New, convenient way to handle wire coiled on spools. Just slip spool onto reel and pull out what you need. No more twisted or tangled wire when you go out on a job!
No. 9111.....Net $2.40

G-C SPEEDEX WIRE STRIPPERS New automatic "766" series has delayed return action to prevent crushing of fine stranded wires. Easy to use, with easy-grip handles for easy operation. Interchangeable blades. Specify wire size.
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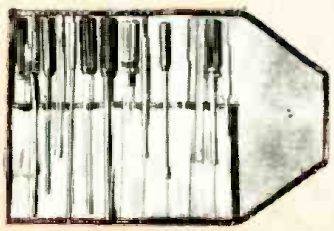

G-C DELUXE ALIGNMENT TOOL KIT Handy roll type case with 16 most-used tools. Tool tips are extra thin, of best grade hardened spring steel for long useful service. Value of tools sold separately $15.00.
No. 8280.....Net $7.74

G-C GENERAL SKRATCH STIK Easy to use, in handy carry-with-you case. Removes scratches on walnut, mahogany, oak—all shades and colors. Avoid embarrassment on the job . . . wipe Skratch Stik on that accidental scratch!
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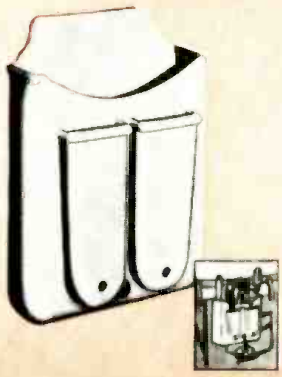

G-C "TUX" TOOL KIT Made of remarkable new "Alathon" polyethylene. Flexible, tough, will not lose shape. Keep your tools with you, your tape on a chain. Lightweight.
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G-C ILLUMINATED INSPECTION MIRROR Penlight batteries make this tool independent of cords or connections. Adjustable 1" hinged mirror mounted to 6" transparent lucite rod. No shock. On-off switch. Length 12¼". Bulb, less batteries.
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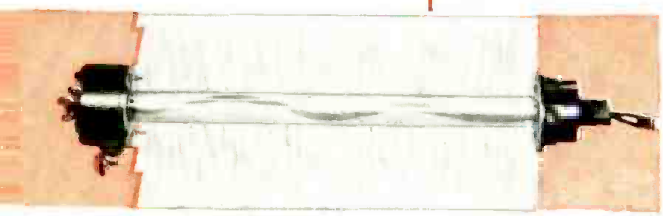

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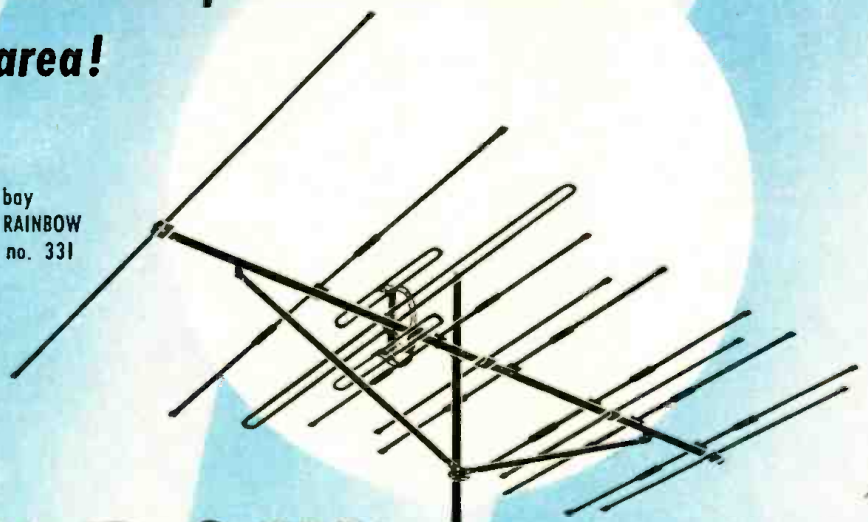
this great all-channel antenna discovery is smashing sales and performance records in every TV area!



Single bay
SUPER RAINBOW
model no. 331

Stacked
RAINBOW
model no. 330-2

the CHAMPION

RAINBOW*

brilliant black-and-white performance — and really ready for COLOR!

these 3 revolutionary, power-packed design features — found in no other antenna today!

1. **New spacing formula:** Radical new spacing arrangements between the directors and reflectors has, for the first time, extended the full efficiency and high gain of the basic narrow band Yagi over the *full width of an entire VHF band.*
2. **New "triple power" High Band directors and reflectors:** Three-section directors and reflectors, with insulated segments, provide combined power of three High Band Yagis, operating side by side, in phase.
3. **New "inter-mix" design:** Combines — into one single antenna — two separate, *independent* sets of directors and reflectors, one for High Band, one for Low Band. Each parasitic system operates *only* on its own band. Fullest efficiency — no compromise design.

PLUS Channel Master's patented, super-gain TRI-POLE . . . the unique triple-power dipole that made the Champion America's most wanted antenna.

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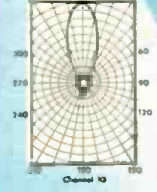
*Patent No. 2,691,730
Other Patents Pending

CHANNEL MASTER creative engineering

Here's how the RAINBOW out-performs the famous Champion:

	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over 1-Bay Champion	1-Bay RAINBOW	0 DB	0 DB	0 DB	+1 DB	+2 DB	+3 DB	+2.5 DB	+1 DB	+.5 DB	+.5 DB	+1.5 DB	+2. DB
	1-Bay SUPER RAINBOW	+1 DB	+1 DB	+1.5 DB	+2.5 DB	+3.5 DB	+3.5 DB	+3 DB	+2 DB	+1.5 DB	+2 DB	+3.5 DB	+4. DB
	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over Stacked Champion	Stacked RAINBOW	+1.5 DB	+2 DB	+1.5 DB	+1.5 DB	+2 DB	+.5 DB	+.5 DB	+0 DB	+0 DB	+0 DB	+1 DB	+1. DB
	Stacked SUPER RAINBOW	+2 DB	+2.5 DB	+3 DB	+3 DB	+4 DB	+.5 DB	+1 DB	+1 DB	+2 DB	+2 DB	+2.5 DB	+3. DB

horizontal polar pattern (relative voltage)



for fringe and super-fringe areas:
Super Rainbow, model no. 331
$37.50 list
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$75.70 list

for suburban and near-fringe areas:
Rainbow, model no. 330
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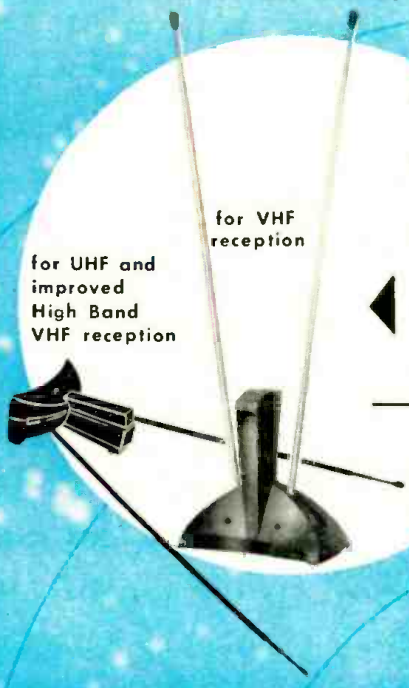
something new in indoor antennas



- features 3 telescoping sections.
- tilt-proof polystyrene base — cannot tip over.
- handsomely packaged for display.

the ALL-VU*

*all VHF . . . all UHF

the only indoor antenna with this "2-Way" feature.

model no. 381 **$6.95 list**

the PRE-VU

for all-channel VHF reception only.

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ALUMast

Aluminum Masting. The new idea in antenna masting—

can never rust!

- in telescoping sections
- in swaged 5, 10, and 14 foot sections

Lightweight ALUMast is ⅓ the weight of steel, making it so easy to install — it swings right up! Stronger than steel, ALUMast is easier to stock and actually more economical.

brings you today's 5 newest installation ideas

for . . . more effective installations

. . . greater customer satisfaction

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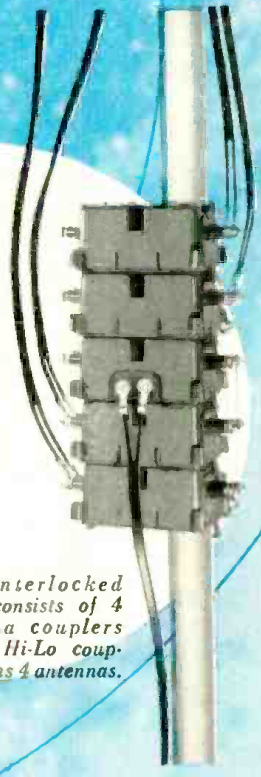
SELECTENNA COUPLING SYSTEM

permits unlimited antenna combinations with only one transmission line!

- for the first time, you can tie together an unlimited combination of antennas, including separate antennas operating on the *same band.*
- ideal for areas currently using rotators, manually-operated selector switches, and "omni-directional" antennas.

list price: **$5.42** each including hardware and wire for joining couplers.



This interlocked stack consists of 4 antenna couplers and 1 Hi-Lo coupler; joins 4 antennas.

TV ROTATOR

with features found in no other rotator today:

- flexible worm gear, built-in thrust bearing.
- removable motor, electrical and mechanical stops.
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Beautifully-styled cabinet has great consumer appeal — is smallest on market (2¾" x 4"). Finger-tip control bar.

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HIGHLY-SENSITIVE LINK-COUPLED LOOP ANTENNA

By **L. S. HANNIBAL**

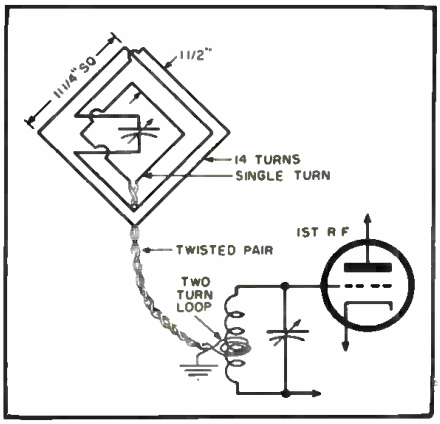
Try this loop antenna to pull those elusive broadcast signals out of the ether.

FOR several years the writer has wrestled with the problem of picking up an AM hi-fi San Francisco Bay area station which was badly blanketed by a local 50 kw. broadcast station—one of the type that, to all intents, "slobbers" over considerably more of the band than is desired. Wave traps, bandpass couplings, and the like were all tried repeatedly without much effect. None could give the desired 20 kc. separation which was necessary in this instance. Both regenerative r.f. amplifiers and crystal filters were duly considered, but were promptly dropped when a link-coupled loop antenna was given a chance trial.

This loop consisted of 14 turns of No. 20 wire, spaced with an eighth inch clearance between turns, on an X-frame, with each diagonal 16 inches long. A small tuning capacitor from an old 1924 broadcast receiver was used to tune the loop. A single-turn, link-coupling loop was wound inside the 14 turns with 1½ inches of space between each coil. This single turn was fed by a twisted pair to a two-turn coil wound loosely about the first r.f. coil on the broadcast receiver. One leg of the twisted pair was grounded securely where it entered the chassis in order to reduce capacity pickup.

In practice, tuning consists of adjusting the set and loop tuning capacitor for maximum desired signal. Then the set is detuned sufficiently to pick up the undesired signal. The loop is then rotated to a null point for the unde-

Complete details for building loop antenna.



sired signal. This setting in bearing can be quite sharp and, in this instance, was less than one degree. Once the loop's position was established the desired hi-fi station was tuned in without crosstalk or scratching.

A vernier dial will be found of value in tuning the loop's tuning capacitor. (This capacitor is mounted directly on the loop's X-frame. The 1½" coupling between the loop and link permits the loop to tune quite sharply. Placing the link coupling nearer to the tuning loop reduces selectivity, but increases signal input to the set. This also reduces background noise, but aggravates crosstalk or rasping from the local broadcast station.

The effectiveness of this loop system can be appreciated when it is realized that a San Francisco Bay station of 10 kw. power beamed on a north-south axis can be picked up quite satisfactorily 110 miles in an easterly direction under the blast of a 50 kw. station about 4 miles distant from the writer's residence. —30—

440 MEGACYCLE TRANSISTOR

THE time when home TV sets will use tiny transistors instead of a large array of vacuum tubes came closer to realization with the announcement by Bell Telephone Laboratories of a transistor which will operate at 440 mc.

Known as an "intrinsic barrier" transistor, the new unit can increase an electrical signal a thousandfold. Frequencies as high as 3000 mc. are theoretically possible.

The new transistor adds a fourth layer to the basic "p-n-p" wafer. This intrinsically pure layer acts as a "shock absorber" for high voltage electrical charges. This chemically pure part of the germanium crystal remains neutral while the three adjoining sections become positively or negatively charged. This "intrinsic" region in the midst of the transistor permits the faster movement of positive charges, isolates the input and output areas, and reduces the stored energy to make functioning at higher frequencies possible. The increased separation of input and output areas also permits operation at higher voltages. —30—

A Bell Labs engineer uses a "dry box" to assemble the new u.h.f. transistor. He is shown placing a metal casing over the unit to assure long life. This assembly technique is used to avoid any contamination.

Now...complete

Protection from the REAR...

with a broad-band antenna that rejects unwanted signals from rear and sides...and

It's another Kay-Townes First!

Now...for the First Time!

A full automatic snap-out antenna that is mechanically safe!

Elements are double locked in position and nested in channel to prevent dropping or falling apart.

Manufactured and Distributed in CANADA by
DELHI METAL PRODUCTS, LTD.
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the antenna for which all America has been waiting...

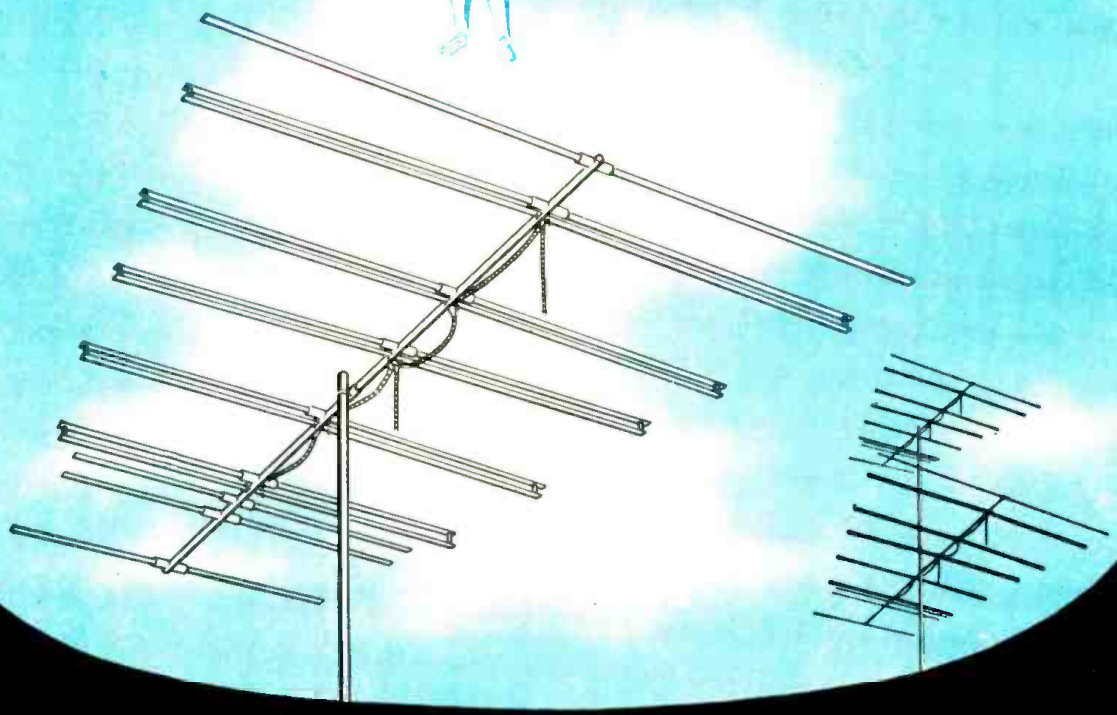
this is the PROBLEM

New TV stations by the score *plus* stepped-up power on existing stations is increasing the difficulty of reception in many areas. Co-channel interferences and the resulting loss of reception quality cannot be overcome by ordinary antennas now available.

MODEL	CHANNEL NUMBER
RG-1-L	2-6
RG-1-H	7-13
RG-1-LH (RG-1-L and RG-1-H in combination)	2-13

KAY TOWNES

REAR GUARD



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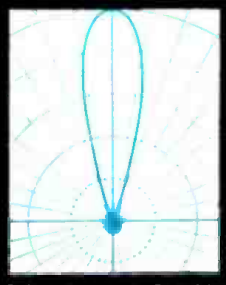

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WHAT'S New in Radio

The products described in this column are for your convenience in keeping up-to-date on the new equipment being offered by manufacturers. For more complete information on any of these products, write direct to the company involved.

TRANSISTOR OSCILLATOR

General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass. is

currently offering a pocket-size transistor oscillator for audio-frequency testing, the Type 1307-A.

Completely self-contained, including batteries and output meter, the oscillator is small enough to be held in one hand. Two frequencies, 400 and 1000 cycles, are available with a maximum output of at least 2 volts across a 600-ohm load. The output voltage is adjustable and is read on the meter.

The unit uses a *p-n-p* junction transistor in a Hartley oscillator circuit. The output voltage is set by an adjustable resistance in series with the battery supply, thus conserving battery life when only low output is needed. Under average conditions, battery life is over 100 hours.

PEAK-TO-PEAK V.T.V.M.

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y. has added a new peak-to-peak vacuum-tube voltmeter to its *Eico* line of test equipment in wired and kit form.

Designed expressly for TV servicing, the new Model 249 comes with the company's dual purpose a.c./d.c. "Uni-Probe" which performs all functions—a half turn of the probe tip selects d.c. or a.c. ohms.

The circuit features stable push-pull

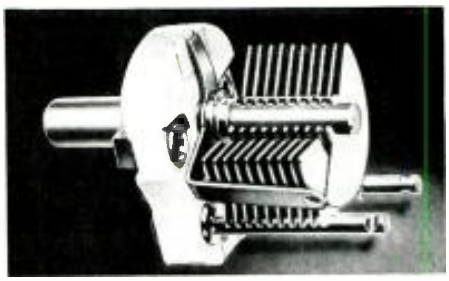
triode bridge circuitry, with accuracy unaffected by line voltage variation. It reads peak-to-peak voltage of complex and sine waveforms, r.m.s. voltage of sine waves, d.c. voltage and resistance. It provides for center-scale zero adjustments for TV-FM alignment and for calibration from outside the cabinet. The 7½" meter is electronically protected against burn-out.

Additional information on the Model 249 or Model 249K (kit) is available from the company.

VARIABLE CAPACITORS

The APC and MAPC types of variable capacitors are now available with extended shafts, according to *The Hammarlund Manufacturing Company*, Inc., 460 W. 34th St., New York 1, N. Y.

At the request of amateurs, experimenters, and electronic equipment builders, the line has a half-inch shaft extension for knob control. The APC trimmer is designed for applications



where a compact air dielectric trimmer is required. The MAPC type is similar to the APC except that it is a miniaturized version.

ATR'S "SHAV-PAK"

American Television and Radio Co., 300 E. Fourth St., St. Paul 1, Minn. is now offering a new inverter which has been tradenamed the "Shav-Pak."

The unit is especially designed for operating standard a.c. electric shavers in autos, buses, trucks, boats, and planes. The unit plugs into the cigarette lighter receptacle on the dash and is small enough to be kept in the glove compartment.

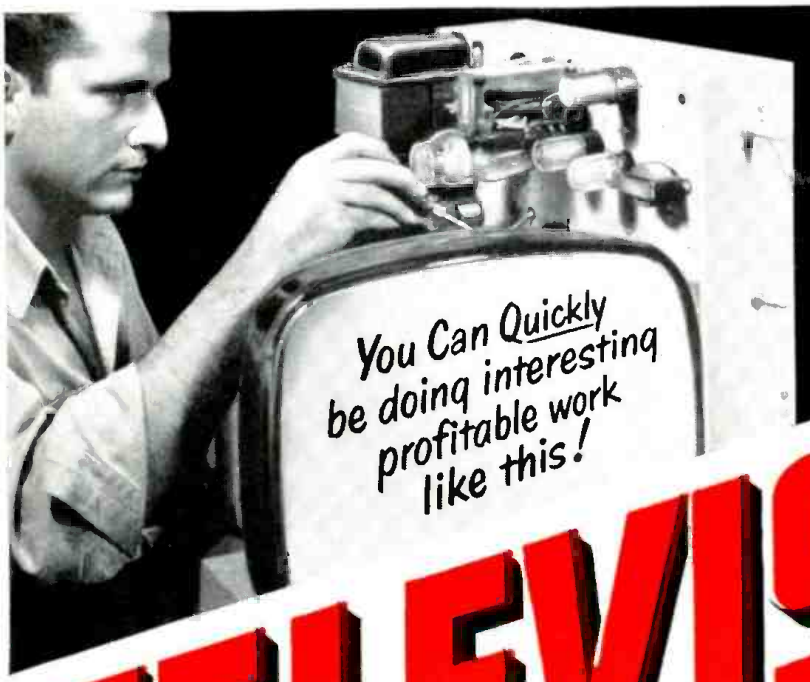
A circular on the "Shav-Pak" is available on request.

SINGLE-SIDEBAND GENERATOR

A single-sideband generator especially designed for operation with the company's Model 5100 transmitter has been announced by *Barker & Williamson, Inc.*, 237 Fairfield Ave., Upper Darby, Pa.

Designated as the Model 51SB, the generator offers SSB operation on all frequencies provided in the 5100. Tuning and operation are fast and uncomplicated, according to the company. No test equipment is required.

(*Continued on page 152*)



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Certified Record Revue

(Continued from page 60)

recording of some years ago, on the *Oceanic* label. Here she is "Salome" again, but a more matured, more experienced, and vastly more effective "Salome." Hers is a passionate, intense, and dedicated performance. She immerses her identity in the role and makes of "Salome" a terrifying and believable creature. Her voice is a beautifully trained and responsive instrument. While she hasn't the great power of Ljuba Welitsch, the voice is strong enough for the requirements of the role and she displays an infinitely greater range of color and expression. Every nuance of the role is clearly delineated and in the Final Scene, the purity of her voice blazes forth, unsullied by bombast or strain. The rest of the cast sings superbly in this recording. I could have wished for a little less pontificating from the "Jokanaan" of Hans Braun, a minor fault. Patzak and Dermota were particularly effective in their portrayals and *London* has even gone to the expense of having such a stalwart as Ludwig Weber in the comparatively minor role of "1st Nazarene." The Vienna Philharmonic has rarely sounded better, and their playing was a miracle of precision coupled with sumptuous tone. Perhaps this is a sort of testament to the incomparable Strauss of the late Clemens Krauss. Few will deny his particular gift for interpreting the works of Richard Strauss. Where others obscured . . . he revealed. Where others conducted with their heads, he used his heart. This kindly and genial man is gone, but his Strauss will not soon be forgotten. The sound on this recording is considerably better than the recent *Columbia*, yet surprisingly, is not up to the very highest standards of *London* opera recording. String tone is generally quite good, smooth and free of annoying wiriness. But the dynamics are less than you would expect and there are inexplicable moments when the range seems somewhat restricted. Good percussion in "Salome's Dance," solid bass drum and very clean cymbals. All in all, a most memorable and moving experience. A comfortable recording and one which can stand repeated listenings as well as the test of time.

STRAUSS, RICHARD
ALSO SPRACH ZARATHUSTRA
DANCE OF THE SEVEN VEILS (SALOME)

The Chicago Symphony Orchestra conducted by Fritz Reiner. RCA Victor LM1806. RIAA curve. Price $5.95.

While we are on the subject of Strauss and "Salome," let's take a listen to this disc, the first in a new collaboration between *Victor* and the Chicago Symphony Orch. This is an extraordinary record in more ways than meets the eye at first glance. For one thing this represents a new departure in policy for *RCA*. They are now *naming* the equipment and the recording techniques employed in the making of the record. What makes this really incredible is the fact that the information about the recording as printed on the jacket, is virtually an endorsement of the *Mercury* "Olympian" technique! As related on the jacket, *RCA* utilized a condenser mike (presumably a *Telefunken*) at the approximate distance over the conductor's podium as has been *Mercury's* wont. The heated cutter, variable pitch, and other matters of technique are also discussed. The result? The best doggone sound that *Victor* ever turned out! This is no discredit to *Victor* or their engineers. There is certainly no patent or monopoly in the idea of using an overhead

Telefunken mike. Nor is this the whole story on the search for better sounding recordings. Rather this new sound shows that *Victor* made a study of various new techniques and was not above admitting and adopting to a technique previously foreign to them. There is certainly nothing wrong in this . . . the best thing that could ever happen to the industry is free competition. The sound that *Victor* obtained bears witness to this. Really exceptional quality. The "Zarathustra" is full of rip-snortin' hi-fi effects. Huge brass sonorities, very solid percussion, very live "breathy" woodwinds, and a superb string tone. Dynamic range and frequency range are far beyond previous *Victor* recordings. Reiner is, of course, an old hand with Strauss. In "Zarathustra" he plays the game fairly close to the vest. No errant tempi for him, nor overblown dynamics. If the Clemens Krauss-*London* version did not exist, this would certainly be the recording of choice. But a little too much fussiness obscures the broader meanings and shadings in the score, and on the whole, Reiner's is a much more impersonal version. The *London* recording was more than hi-fi for its day, but in this department it is outgunned by this present recording. Except for the low C in the basses which begins a fugal development (and which come through with greater intensity in the *London*), this has greater dynamics, greater clarity and resolution. Transients of tympani and bass drum and cymbal are much cleaner and have more impact in this recording. The "Salome's Dance" is given a supercharged reading by Reiner and it is not likely to be outsounded by any competing version. The Chicago Orchestra plays magnificently for Reiner, although it would be unkind not to mention that part of this precision is certainly a legacy from Rafael Kubelik. Altogether a most auspicious start for *Victor* with a new recording technique. The record conformed perfectly to the RIAA curve and surfaces were quiet.

BARTOK
CONCERTO FOR ORCHESTRA

Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG 50033. RIAA curve. Price $3.95.

Here is an absolutely stunning performance of what many believe to be Bartok's greatest work. It would be a picayune and biased critic who could find fault with this recording. The performance is a triumph of the first order for Dorati. He is white-hot in the intensity of his interpretation. Yet he never allows his obvious zeal and devotion to the score to obfuscate, nor to amend or reshape the philosophy of Bartok. It is a respectful performance, nowhere at variance with the composer's wishes or intent. This reverent approach is undoubtedly a reflection of the friendship that existed between Dorati and Bartok. As a work by Bartok, the "Concerto for Orchestra" is somewhat of a paradox. By this I mean that although this is perhaps the most intricate and complex of all Bartok scores, with more than its share of dissonance and atonality, it is also the Bartok that is most readily assimilated by the public. Believe me when I tell you that if you've never been able to "take" Bartok, this is the score that can change your mind. In its infinitely varied color and contrasts, Bartok has utilized the widest resources of the modern orchestra. In the strings alone, you will hear more unusual techniques than in almost any other composition you can name. Pizzicato, spiccato, double bridging . . . the whole bag of tricky violin gymnastics can be heard. The other choirs in the orchestra are similarly treated. The complexity of the score calls for a virtuoso orchestra and the Minneapolis responds magnificently. You will find that in the course

of a season, few orchestras will program this work, because of the difficulties involved. The Minneapolis under Dorati plays the work quite frequently and this experience accounts for the cohesive and fluent ease of their performance. Soundwise, this is an incredible recording. It will tax your pickup and speaker system to the utmost. The exceptionally clean string tone, the brilliant blare of weighty brass, the super-articulate woodwinds and the impact and accuracy of the very large percussion section is accented by the violently contrasting dynamics. One of the most distortion-free recordings I have ever heard. Everything considered, this recording is a tremendously exciting and stimulating experience and is unreservedly recommended. The RIAA curve was adequate for the recording with a slight bass boost adding an extra fillip of balance. Quiet surfaces.

BRAHMS
CONCERTO FOR VIOLIN AND ORCHESTRA IN D MAJOR
Nathan Milstein, violinist with Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P-8271. RIAA curve. Price $5.70.

The newest and best of the thirteen recorded versions of this concerto in the LP catalogue. This is a pretty strong statement, considering such formidable competition as the Stern-Beecham effort on *Columbia* and the Menuhin-Furtwangler on *Victor*. Nevertheless, the warm, fluent reading of Milstein and the sympathetic collaboration of Steinberg and the Pittsburgh Symphony, justifies the praise. No "tempo tampering" here, no razzle-dazzle. Just superb straightforward musicianship and integrity of purpose. *Capitol* has furnished the recording with a warm, glowing sound, quite different from their usual technique. A splendid balance is maintained between orchestra and soloist and the acoustic perspective gave just the right "presence." The RIAA curve did not need adjustment. Quiet surfaces.

WALTON
CONCERTO FOR VIOLA AND ORCHESTRA
William Primrose, violist with The Royal Philharmonic Orchestra conducted by Sir Malcolm Sargent.
HINDEMITH
DER SCHWANENDREHER
William Primrose, violist with Columbia Chamber Orchestra conducted by John Pritchard. Columbia ML4905. NARTB curve. Price $5.95.

Here we have two prime examples of the artistry of the great William Primrose. To be sure, these works are modern and not the usual province of Primrose. But before you flee, let me hasten to add that these works fall into the category of "lyric or listenable modern." Neither the Walton nor "Der Schwanendreher" will assault your ear with very much atonality or dissonance. Throughout both of these interesting works, Primrose displays the virtuosity which makes him the premier exponent of the viola, and his tone in the opening movement of the Walton has to be heard to be believed. Rich and darkly resonant, it is a thing of ineffable beauty. Primrose gets effective and understanding orchestral support from both organizations. First class sound is a feature of both these works, and there are some amusing and clever hi-fi effects to be heard in the scherzo of the Walton. Both works have been recorded at very high amplitudes without, however, the usual penalty of "pre-echo," to mar the sound. Acoustic perspective and solo/orchestral balance are nicely handled. Highly recommended to the audiophile of an inquiring and unprejudiced

mind. The NARTB curve did not require adjustment. Moderately quiet surfaces.

MOZART
SYMPHONIES #25, #29, #33
Vienna State Philharmonia conducted by Jonel Perlea. Vox PL8750. NARTB curve. Price $5.95.

The beginning or budget-minded audiophile certainly owes a debt of gratitude to *Vox*. For some time now they have been putting out super bargain records . . . records with more than 60 minutes total playing time. Contrast this with the early days of LP when some records had as little as 18 to 20 minutes covering a 12" disc! In money alone, this *Vox* policy has been saving some people as much as 60% of the cost of acquiring certain works. Nor has *Vox* slighted the quality of the recordings with the extra time. As in their other issues of this type, this potpourri of Mozart symphonies is well recorded and the performance does not need any apologies. Perlea is a most versatile fellow. Here he is tilting with the delicacy and charm of Mozart and his last record was the fire and thunder of Tchaikovsky's "1812 Overture"! His readings are solid and substantial, with little of conductorial eccentricities to quibble about. His competition is tough to be sure . . . Beecham and von Karajan among others. But if they outdo him in polish and understanding, he has the edge in the better sound he is afforded. Good clean string tone and excellent woodwind reproduction characterize these symphonies, and the whole adds up to a most attractive buy. The NARTB curve was adequate. Good surfaces.

BERLIOZ PROGRAM
Orchestre des Concerts Lamoureux conducted by Willem Van Otterloo. Epic LC3054. NARTB curve. Price $5.95.

This is another good bargain record, with no less than seven familiar Berlioz pieces for your money. Included are such favorites as the "Trojan March," "Dance of the Sylphs," the "Roman Carnival Overture" and the "Rakoczy March." Otterloo seems to know his way with these scores and gives a competent, if not overly inspiring, reading of them. The orchestra plays quite well and the sound is the best from *Epic* to date. Good balance is maintained and the string tone has little of the edginess that was objectionable in some of the previous *Epic* releases. Some nice sharp percussion, in those works calling for it. Another good buy for the beginning audiophile, who is trying to augment his usually meagre library. The NARTB curve was better with a little bass and treble cut. Moderately quiet surfaces.

SCHUBERT
SYMPHONY #9
NBC Symphony Orchestra conducted by Arturo Toscanini. RCA Victor LM1835. RIAA curve. Price $5.95.

The retirement of Arturo Toscanini and the disbanding of the late, lamented *NBC* Symphony was a severe blow to the musical world. How great this loss is, is heightened and brought close to home when you realize there will be no further recordings like this great Schubert "9th." The only crumb of satisfaction is that we *do* have a brilliant new recording of this work, to supplant the older Toscanini version which was notably deficient in sonic virtues. As I have said before, I have not been among those who blindly worshipped everything the Maestro conducted. But in certain areas, he was incomparable. I have always felt that his reading of the Schubert "9th," was the ultimate in our time, the model to be held up to the light for lesser men to see and profit therefrom. Nor has time dimmed the luster of his performance in this present recording.

There is still the insight, the understanding. Still the inflexible beat and the firmness of purpose. Still the heaven-storming power and beauty. And all this transcendental performance is cloaked in splendid wide-range sound. What a great pity that Toscanini and his men could not have been afforded this kind of recording over the past few years. The sound of the *NBC* is newly revealed in clean luminous string tone, great brass sonorities and percussion with solid authority. Dynamic range is at last appropriate to the music and Toscanini's demands. We can be thankful that at least this once, Toscanini was able to erect a sonic edifice that will stand as a monument to his extraordinary genius. To paraphrase a famous beer ad . . . if you like Schubert, you'll love this recording. The RIAA curve did not need adjustment. Very quiet surfaces.

Pre-recorded Tapes

RODGERS, RICHARD
VICTORY AT SEA

NBC Symphony Orchestra conducted by R. Bennett. RCA Victor pre-recorded tape, ½ track, 7½ ips. Price $14.95.

Still more of the tape in the first *Victor* pre-recorded tape release. For me this has the least musical substance of what has been offered, but at the same time, is the most striking example of the superiority of tape over disc. The music is consciously programmatic, to be used as a background score for the superb documentary film of the same name. As with much of this type of music, it can't help but fall into the trap of too much bombast and cliche. There are some moments where the melodic gift of Dick Rodgers shines through, but for the most part it's obscured by "mood" music. However, this very fact makes it a good demonstration tape. All sorts of colorful orchestration is used throughout the work, and audiophiles will delight in the clean, edgeless string tone, the soaring French horns, the bright punchy brass and the crisp and precise percussion. As with the other tapes, the great dynamic range is the most notable feature. There was no evidence of overload or distortion and the tape hiss level was barely noticeable. More next month, possibly some of the pop material like Sauter-Finegan. —30—

CHECK V.O.M. CONNECTION

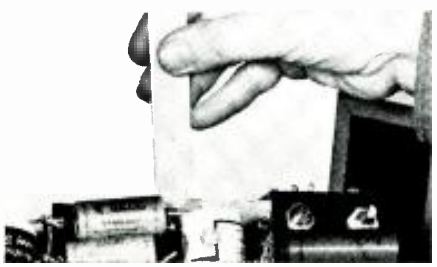
By H. LEEPER

WHEN your volt-ohmmeter seems unstable or inaccurate, check the connections on the dry cells used on the low ranges of the ohmmeter. The operator of an instrument, such as the vacuum-tube meter shown, may forget about these batteries.

New cells are, of course, needed at intervals.

It is best to check the voltage of such batteries with a voltmeter other than the one contained in the same case, as certain connections are made in some instruments which would result in meter damage. —30—

Check batteries in your instruments often.



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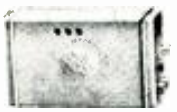

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¾-INCH PIPE SIZE SOLENOID VALVE. 18 to 24 VDC @ 3A or 24V. to 12V. 6A, or 12V. to mechanism **$2.95**

TRANSFORMER. 115 v., 60 cycles to 24 v., .6A., for above solenoid & many other uses. . **98¢**

SELENIUM RECTIFIER. 30 VAC max. 1.2A, full wave. For above transformer & solenoid. . . **$1.98**

POWER FROM THE SUN

Brand new development, brand new units (not surplus). Thumbnail size SUN BATTERY puts out 2 ma into 10 ohms in average sunlight. Series-parallel them for greater output. With data sheet. . **$1.98; 3/$5.00**
CRYSTAL MIKE GIVEAWAY! Sensitive hearing-aid capsule sealed in compact, flat container with tinned terminals. Crisp clear hi-level output. Ideal for lapels, ties, tuckaways. Individually tested, guaranteed. Only **$2.95**
JUNCTION TRANSISTORS, not surplus, no rejects, regular factory-tested production with guaranteed Alpha of 0.9. IMMEDIATE DELIVERY! Only **$4.95**

CRYSTAL DIODE, 1N6D. New. J.A.N. approved. G.E. 40 ma. EACH. . . . . **69¢**
5 FOR **$2.95**

DC ROTARY VOLTAGE CHANGER. 6 VDC to 12 VDC @ 10 A.; 12-24 VDC @ 5 A.; 24-12 VDC @ 10 A.; 12-6 VDC @ 15 A. Suitable for car, marine, aircraft, radio receivers. No need to change dynamotor, hand change motor, relays, etc. New, each. **$5.95**

INVERTERS—400 CYCLE AC

1 Phase: Continental DMF 3506M, 24 to 30V DC in at 5.5 to 4.5A. Cont. Duty. Output 115V, 400 cy. 50VA. Brand New. Only **$39.50**
3 Phase: Ieland 1056A. Input 28.5V. 12A. Output 115V, 400 cy. 115VA. Voltage and frequencies regulated. Cont. Duty. Like New. . **$39.50**
1 and 3 Phase: Ieland 1028S. Input 27.5v. 60A. Cont. Duty. 3 Phase Output 115V. 400 cy. 750VA. 1 Phase output 26V. 200 cy. 50VA at 40RF. Voltage and frequency regulated. Brand New. Only **$89.50**

B-CAST, LIGHTHOUSE, AERO

MN-26C Remote controlled navigational direction finder and communications receiver. Manual DF from 150 to 1500 kcs. 24 v self-contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right indicator, plugs, loop transmission line, flex shafts, and schematics.
Receiver & Loop Brand New, with tubes. (Accessories may be used.) **$69.50**
(Shipping wt. 75 lbs.)

BABY WINCH

Highly versatile. Use as winch, barbecue spit drive, beam rotator, or any other use which requires a low speed, high torque source of power.
Has two output drives. One is sprocket-toothed wheel, other is ratchet-coupled cable drum. Both reversible by electric switching. 24 VDC motor runs perfectly on 8 to 24 V. 60 cy AC. Complete with simple instructions. NEW. . **$9.95**

HERE'S YOUR AMPLIFIER!

Accept our years of building and testing amplifiers as your guide to the best, and yet a surprisingly inexpensive amplifier. BROOKS Model 224. Output tubes are—hold your hat—2A3 push-pull! Crazy? No. Just study load lines and you will agree. Low Rs, low distortion. Just enough feedback. An amplifier, not an oscillator. Has everything. Unique separate bass and treble controls, 6-position phono equalizer on built-in preamp, choice of 6 inputs. Neat and compact and all in one package! And all for only (Audiophile's net) **$129.99**

Prepaid. No Shipping Cost!

$45.00 HI-FI HEADSET AT $7.95

Uses annular grooved plastic fibre cones with voice coils as in speakers and padded chamois ear muffs to obtain spacing for correct acoustical load. Gives finest music reproduction, 600 ohms. Checked out with freshly laundered ear pads and long flexible fabric cord with phone tips. (Shpg. wt. 3 lbs.). **$7.95**

G. L. ELECTRONICS, INC.

905 S. Vermont Ave., Los Angeles 6, Calif.

Minimum order $2.50 total. 25% deposit required.
All prices F.O.B. Los Angeles. Calif. buyers add sales tax.

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 Carrying Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-84, 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 carrying, 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.....

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.

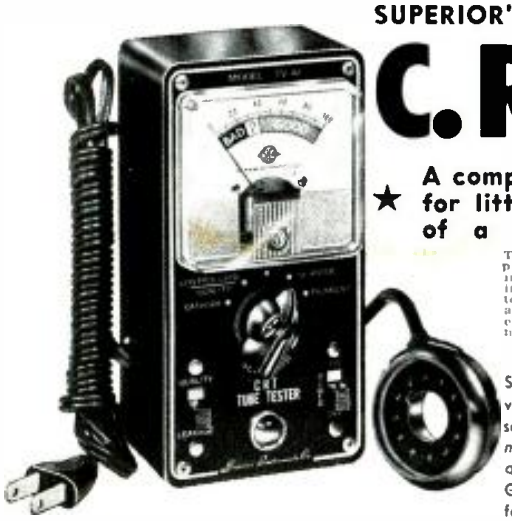
EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute

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.

$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!!**

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.

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

SPECIFICATIONS:

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

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 Carrying Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-84 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 carrying, 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.

MANUFACTURERS' LITERATURE

The various listings presented in this section are for your convenience. The bulletins, unless otherwise indicated, are available to all our readers. For prompt attention write directly to the manufacturer for this literature.

MOBILE ANTENNA HARDWARE

K-W Engineering Works, 3145-A North 48th Street, Milwaukee 16, Wisconsin, has issued a data sheet covering its "Universal" mobile antenna hardware line.

The catalogue sheet covers mobile antenna base sections, antenna extensions, and accessories designed to provide the amateur radio mobile operator with a complete range of base sections and extensions from 6 to 36 inches in 6 inch steps, plus collets, female and male couplings, etc.

SEALED PANEL METERS

A new 2-color, 2-page data sheet describing its 1½-inch sealed square panel meter has been released by *DeJur-Amsco Corp.,* 45-01 Northern Blvd., Long Island City 1, N. Y.

The publication describes features and gives detailed specifications, actual size illustrations, schematic diagrams, ranges, resistance, and ordering information on the line. The instruments are designed for front or rear mounting and are available with various scale markings.

The Electronic Sales Division of the company will provide a copy of this data sheet, Model 152, on request.

COLLINS TRANSMITTER

An 8-page booklet describing the company's new 17L-4 v.h.f. transmitter has been released by *Collins Radio Company* of Cedar Rapids, Iowa.

The booklet describes in detail the 25-watt, 360 channel, v.h.f. transmitter for aircraft communication. The publication includes a block diagram, outline drawing, complete specifications, and performance data on the transmitter as well as details and specifications on associated equipment to be used with the unit.

GLASS PRODUCTS DATA

Corning Glass Works. Corning, N. Y., has announced the publication of a new catalogue of glass products for the electronic industry.

The catalogue includes descriptive and application information for fixed glass dielectric and trimmer capacitors; accurate grade, high temperature, power, and high-frequency resistors, and other components made of glass.

Also included in the new publication is descriptive material covering new compositions and production methods in glass such as glass-to-metal seals, soldering metal-to-glass, photosensitive glass, and fused silica.

Copies of the new catalogue (NP-54) are available from the New Products Technical Information Department of the company.

MOBILE POWER PLANTS

D. W. Onan & Sons, Inc., Minneapolis 14, Minn., is offering a special issue of its company publication, "Power Points Digest," which discusses the use of electric generating plants in mobile service.

Many interesting mobile installations are described in this pocket-size, two-color, 20-page booklet. When writing for a copy of this publication, please specify Vol. 10, No. 4, of "Power Points Digest."

BACKGROUND MUSIC

Magnecord, Inc., 1101 S. Kilbourn Avenue, Chicago 24, Ill., has prepared a colorful 12-page brochure describing its new background music service.

The purpose of the promotion piece is to present dramatically the major advantages of the company's background music. Emphasis is placed on the scientifically blended musical programs from the *RCA Victor* library of recorded music, and performance features of the new *Magnecord* continuous music reproducer. The instrument automatically plays eight hours of music, continuously or intermittently, without musical repetition, using magnetic tape reels.

RADIO SHACK'S CATALOGUE

Radio Shack Corporation, 167 Washington St., Boston 8, Mass., is now offering copies of its 1955 electronic parts mail-order catalogue.

The new edition lists and illustrates 30,000 radio, TV, and electronic products in 224 pages and has a 32-page roto section devoted exclusively to hi-fi custom music systems. It includes a manufacturers' index on the front cover, an 18-category thumb index, and an extensive product listing. The front cover index has over 250 manufacturers and the product index lists over 1500 items.

The catalogue is available without charge upon request.

PRINTED CIRCUIT REPAIR

Admiral Corporation's national service department, 201 E. North Water Street, Chicago 11, Ill., has just published a six-page illustrated manual covering the service and repair of printed circuits used in all of the company's radios and in many of its TV receivers.

Copies of the new printed circuit service manual, No. S559, are available

Remember QUALITY CANNOT BE UNDERSOLD

This is our 34th YEAR as RADIO PARTS Distributors

DOUBLE CONYAGI

The equivalent of 40 dipoles

Newest development for long distance TV reception. MONEY BACK GUARANTEE. This is a BIG ANTENNA. Reflectors 9 feet long. Conical elements over 10 feet long. Solid rugged wind proof construction.

List Price $49.95 ..... **$15.95**

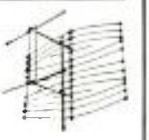
CONICAL TV ANTENNA

10 Element conical . . . rugged through-out. Only **$3.95**

Doudble bay array, with stacking bars **$7.25**

4 Bay array, with harness and stacking bars **$14.95**

RADAR TYPE TV ANTENNA



For UHF and VHF
RECEIVES ALL CHANNELS

212 miles reception recorded. 125 miles common. This unbeatable antenna has been reinforced to withstand 150 mile winds.

Satisfaction guaranteed or your money back. Less Mast, List Price $49.95.
Your Cost **$19.95**

300 OHM TWIN LEAD

55 Mil, 100 ft. **$1.59**
1000 ft. **9.85**
20 Ga., 80 Mil, 100 ft. **1.89**
1,000 ft. **16.95**

UHF TUBULAR 300 OHM LINE

1,000 ft. **$29.50**
100 ft. **$3.95**

All Channel Foam Line, 100 ft. for $6.95. 50 ft. for $3.95.

FOUR CONDUCTOR

Rotor Cable Clear or Brown. Very Special. 1,000 ft. **$14.95**
100 ft. **$1.95**

UHF BOW TIE ANTENNA

Factory assembled, single-bay Each **$2.39**
Two-bay array with matching device **$4.59**

TV MASTS AND HARDWARE

Bargain Chimney Mount ..... Net $1.49
Vent Mount $1.89
Stainless Steel Chimney Mount. Net **$2.50**

Twin lead ins ..... each 3c
Mortar nail insulator ..... each 8c
Mast ins ..... each 15c

Ten foot mast. Seamless, expanded end, sturdy enough for the largest arrays. Only ..... each **$2.39**

5 ft. DURABLE MAST, heavy gauge 1¼ diam, with interlocking end. Slip two sections together for a ten-footer. 5 sections = 25 ft. Each section $1.25

PREMIER Unconditionally Guarantees All Tubes For One Full Year

VERY BEST BRANDS AVAILABLE FOR IMMEDIATE DELIVERY. INDIVIDUALLY BOXED.

0A46	1.19	6AC5GT	.89	6F5GT	**59c**	6X8	1.29	12BH7	.89	35Y4	**95c**
0Z4	**59c**	6AC7	1.49	6F6GT		6Y6G	**69c**	12BY7	.89	35Z3	
0Z4O		6AF4	1.19	6F7	1.59	6Z4/84		12BZ7	1.19	35Z4	.69
1A5GT	.75	6AG5	.99	6F8G	1.59	7A4	.95	12F5GT	.69	35Z5	.59
1A7GT	.79	6AG7	1.49	6G6G	.95	7A5	1.19	12H6	.69	35/51	.79
1B3GT	.95	6AH6	1.89	6H6GT	.89	7A6	.89	12J5GT	**69c**	36	**95c**
1B5	**29c**	6AJ5	2.95	6J5GT	.59	7A7	**79c**	12K7GT		37	
1H4		6AK5	.89	6J6	.79	7A8	.89	12K8	.89	38	**88c**
1H5GT	.59	6AK6	1.19	6J7G	.85	7B4	.89	12Q7GT	.89	39/44	
1J6GT	**59c**	6AL5	**69c**	6J8G	1.19	7B5	.89	12S8	.89	41	
1L4		6AQ5		6K5GT	.69	7B6	.89	12SA7GT	.69	42	**69c**
1L6	1.29	6AQ6	.79	6K6GT	.59	7B7	**89c**	12SC7	.95	43	
1LA4	1.19	6AQ7	1.19	6K7GT	.69	7B8		12SF5GT	.69	45	
1LA6	1.19	6AR5	.79	6K8GT	1.19	7C4	1.29	12SF7	.89	45Z5	.69
1LC5	.69	6AT6	.59	6L5G	.95	7C5	.89	12SG7	.89	46	
1LC6	**1.19**	6AS5	.89	6L6G	**1.39**	7C6	**79c**	12SH7GT		47	**89c**
1LD5		6AU5GT	1.29	6L6GA		7C7		12SJ7GT	**69**	50A5	.95
1LE3	1.19	6AU6	.59	6L7	1.19	7E5		12SK7GT		50B5	**69c**
1LH4	1.19	6AV5GT	.89	6N6G	1.29	7E6	**79c**	12SL7GT		50C5	
1LN5	1.19	6AV6	.59	6N7GT	1.19	7E7		12SN7GT	.95	50C6G	1.29
1N5GT		6AX4	.69	6P5GT	.69	7F7	.89	12SQ7		50L6	.79
1P5GT	**79c**	6AX5	.79	6Q7GT	.69	7F8	1.49	12SQ7GT	**69c**	50X6	.69
1Q5GT		6AX5	.69	6R7GT	.69	7G7	1.19	12SR7GT		50Y6	.95
1R5	.95	6AY5GT	.89	6S4	.59	7H7	.95	12Z3	.95	5Y3	
1S4		6B4G	1.29	6S7GT	**1.19**	717	**1.19**	14A7	**95c**	5Y4	**79c**
1S5		6B8GT	1.19	6S8GT		7J7		14AF7		7AL7	
1T4	**69c**	6BA6	.59	6SA7GT	**69c**	7K7	.89	14B6	**89c**	70L7GT	**1.49**
1U4		6BA7	.89	6SC7		7N7	.69	14B8		71A	**79c**
1U5	.59	6BC5	.69	6SD7GT	.99	7Q7	1.19	14C5	1.19	75	.69
1V		6BD5GT	.89	6SF5	.59	7S7	1.19	14C7	**95c**	76	
1X2A	**89c**	6BE6	.59	6SF5GT	.59	7V7	.79	14F7		78/6D6	.95
2A3		6BF5	**69c**	6SG7	.69	7W7	1.19	14W8	**1.29**	80	.69
2A7		6BF6		6SH7	**69c**	7X6	.95	14Q7	.95	83	1.49
2B3	.89	6BG6	**1.89**	6SH7GT	.69	7X7	**79c**	14W7	1.19	84/6Z4	.69
2B7	.89	6BG6G		6SJ7	.79	7Y4		14X7	1.19	85	.79
2E5	.89	6BH6	**69c**	6SJ7GT		7Z4	.89	19BG6	**1.89**	VR90	
2X2/879	.79	6BJ6		6SK7GT	**59c**	12A7	1.49	19BG6G		VR105	**$1.19**
3LF4	1.29	6BK7	1.19	6SL7GT	.69	12A8	.69	19T8	.89	VR150	
3Q4	.69	6BL7	.79	6SN7GT	.79	12AH7	1.49	24A	.69	VT51	**29c**
3Q5GT	.89	6BN6	1.19	6SQ7		12AL5	**59c**	25AC5GT	1.19	VT52	
3S4	.69	6BQ6G	1.19	6SQ7GT	**59c**	12AT6		25BQ6	**1.19**	117L7	1.49
3V4	.95	6BQ6GT	1.19	6SR7GT		12AT7	.89	25BQ6GT		117N7	1.89
5T4	1.29	6BQ7	**1.29**	6SS7	.99	12AU6	.69	25L6GT	.59	117P7	1.89
5U4G	.69	6BZ7		6T8	.89	12AU7	.79	25W4GT	.69	117Z3	.59
5V4G	.89	6C4	.59	6U5		12AV6	.59	25Z5	.69	117Z6	1.19
5W4		6C5GT		6U6GT	**69c**	12AV7	.89	25Z6GT	.69	715B	5.00
5W4GT	**59c**	6C6	**69c**	6U7G		12AW6	1.19	32L7GT	.95	807	1.49
5Y3GT	.49	6CB6		6U8	.89	12AX4	.69	26	**59c**	866A	1.49
5Y4G	.59	6C8	1.29	6V3	1.29	12AX7	.69	27		1299	
5Z4G	**97c**	6CD6G	**1.89**	6V6GT	.69	12AY7	1.89	35A5	.95	1619	**49c**
5Z3		6CF6		6W4GT	.59	12BA6	.59	35B5		2051	.95
6A7	.89	6CL6/7	**1.19**	6W6	.69	12BA7	1.19	35C5	**69c**		
6A8GT	1.29	6D8G	1.19	6X4	**59c**	12BE6	**69c**	35L6			
6AB4	.69	6E5	.69	6X5GT		12BF6		35W4	.59		
6AB7	1.19										

10% DISCOUNT ON ORDERS OF 100 TUBES OR MORE—
5% DISCOUNT ON 50 TUBE ORDERS

FILTER CONDENSERS

FP Type or Tubular with Leads—Fits Stocks Always

8 mfd.	450V.	.35	10 mfd.	50V.	.19
8-8	450V.	.45	20-	50V.	
10-	450V.	.39	25-	50V.	.19
10-10	450V.		50-	50V.	.25
20-	450V.	.45	100-	50V.	.29
20-20	450V.	.49	20 mfd.	150V.	.35
30-	450V.	.45	20-20	150V.	
30-30	450V.	.59	30	150V.	.45
40	450V.	.49	30-30	150V.	.49
40-40	450V.		40	150V.	.49
60	450V.	.69	40-20	150V.	
60-40	450V.	.89	40-40	150V.	.49
80	450V.	.69	50-30	150V.	.49
80-40	450V.	1.29			

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PILOT LIGHTS. Type No. 47 10 for 39c; 100 for $2.95

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8BP4	18.95	16LP4A 16"	24.20	20DP4 20"	
10BP4B 10"	14.95	16RP4 16"	21.95	20HP4 20"	29.45
12JP4 12"	17.95	16TP4 16"		21AP4 21"	
12LP4B 12"		16WP4A 16"	22.20	21EP4 21"	30.10
12UP4A 12"	19.40	16YP4A 16"		21FP4 21"	
14BP4 14"	20.40	17BP4A 17"	22.95	21MP4 21"	31.95
14CP4 14"		17CP4 17"	25.40	21WP4 21"	36.95
14GP4 14"	21.90	17GP4 17"		21YP4 21"	
14HP4 14"		17HP4 17"	26.90	21ZP4 21"	31.95
15AP4A 15"	22.50	17LP4 17"		24AP4 24"	53.95
16AEP4 16"	22.50	17TP4 17"	26.90	24CP4 24"	62.50
16AP4A 16"	22.60	19AP4B		24DP4 24"	
16DP4A 16"		19DP4B	28.80	27EP4 27"	78.50
16EP4A 16"	22.20	19FP4B		27GP4	
16GP4B 16"	24.20			27LP4	**79.95**
16JP4A 16"				27NP4	
				27RP4	

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Flyback Transformer TV Horizontal output, universal replacement, 14,500 V.

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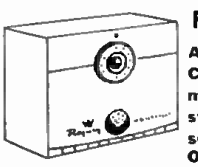

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15 Month Guarantee

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24" Kit, Rectangular	79.95
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COMPONENTS CATALOGUE

Herman H. Smith, Inc., 2326 Nostrand Ave., Brooklyn 10, N. Y., has issued a new components catalogue listing its complete line of plugs, jacks, connectors, switches, terminals, and hundreds of other electronic components and accessories.

The 24-page publication includes schematic dimensional diagrams which will be of interest to the engineer as well as the purchasing agent.

When writing for a copy of this publication, please specify Catalogue No. 55.

WIRE AND CABLE DATA

Chester Cable Corp. of Chester, N. Y., has issued a six-page folder describing and illustrating its line of wires and cables for the radio, electronic, and television industries.

Included in the listings are TV lead-in; coaxial cables; microphone cables; intercom, control, and audio cable; twisted pairs; phono pickup arm cable; h.f. lead wire; antenna loop wire; telephone cable, etc.

VARIABLE INDUCTANCES

An informative four-page bulletin describing shop and laboratory application of a kit of eight permeability-tuned inductances covering a range of from 1 to 1000 μhy. is now available from *United Technical Laboratories* of Morristown, N. J.

The bulletin is a reprint of John T. Frye's article "Using Calibrated Variable Inductances" which appeared in the August issue of RADIO & TELEVISION NEWS.

NEW "RADIO'S MASTER"

The new 1954-1955 (19th) edition of "Radio's Master" has been released by *United Catalog Publishers, Inc.,* 110 Lafayette St., New York 13, New York.

This 1440-page catalogue, bound in hard covers, contains more than 85,000 items, over 9000 illustrations—all with full descriptions and specifications.

The catalogue may be purchased from parts distributors throughout the country. For a list of distributors handling this catalogue, write the publishers direct.

"CONTROLA-TONE" FLYER

Controla-Tone Company, 111 No. Tacoma Ave., Tacoma 2, Wash., is now offering a small flyer which explains and describes its new, improved L-pad model remote volume control.

This two-color folder illustrates how the unit can be installed and used with any TV receiver.

SOLA BOOKLET

Sola Electric Co., 4633 W. 16th Street, Chicago 50, Ill., has released copies of its latest publication, "The *Sola* Constant Voltage Transformer; Theory of Design and Operation."

The 20-page, fully-illustrated booklet has been written for electrical engi-

neers and others interested in the underlying electromagnetic relations of the *Sola* constant voltage principle. It contains schematic diagrams, vector diagrams, performance curves, and photographs illustrating typical assemblies. —30—

The "Globe Scout"

(*Continued from page 55*)

There are several precautions to be observed when tuning up the transmitter so that proper operation is insured. When tuning the oscillator on the 20-, 15-, or 10-meter bands, two resonance points will be found. One point of resonance is double the 40-meter crystal frequency and the other is triple the 40-meter crystal frequency. The doubling resonance point is at approximately ¾ full capacity, or when the indicator arrow is toward the left side of its scale. The tripling resonance point is at approximately ¼ of full capacity, or when the arrow is toward the right side of its scale.

When operating on the 20- or 10-meter band, tune the oscillator to the doubling resonance point. When operating on the 15-meter band tune the oscillator to the tripling resonance point.

When tuning the final plate control on the 160-meter band two resonance points will be observed. One will be toward maximum capacity or when the arrow is toward the left side of its scale. This is the 160-meter resonance point. The other resonance point is close to minimum capacity of the tuning capacitor, the arrow towards the right side of the scale. On the 15-meter band there are also two resonance points. One resonance point is at 20 meters and will be found at approximately ½ of full capacity. The other and correct resonance point is at approximately ¼ of full capacity or with the arrow facing towards the right side of its scale.

Summing up, the tuning capacitor settings for each band are given in Table 1 with the fractions indicating the approximate quantity of full capacity.

A long wire antenna is not recommended when operating in a TV fringe signal area. A doublet or folded dipole, half-wave antenna at the operating frequency will give much better results. The long wire, or end-fed antenna, may be used only if it is approximately ½ wave long at the operating frequency.

The main objective is to reduce the standing wave ratio on the feed line to a minimum; this will automatically reduce harmonic radiation and TVI. This point cannot be over-emphasized as it is very important in the suppression of TVI and BCI and, at the same time, permits a much better signal radiation from the antenna. A little extra time spent on a properly tuned antenna system will more than repay the operator in better QSO's and less radiated interference. —30—

Tube Checker

(*Continued from page 50*)

ment is calibrated so that all good tubes read "6" on the meter with the proper input signal.

The tube types to be plugged into each socket are printed on the instrument, together with the correct input for each tube. The most common tubes are listed on top, the others in back. For example: "6AU6-3" would appear next to one of the 7-pin sockets, indicating the 6AU6 goes there and the input control is set at 3.

Two other controls used are a selector switch for 6 or 12 volt heaters, and a selector switch to read either half of a twin tube. This last switch is inoperative for single tubes.

The meter has a 1 milliampere, 50-ohm movement. It is protected from accidental overload by a spring-return "push-to-read" switch. This normally shunts the meter with a 5-ohm resistor, and reduces the reading by a factor of 10. If the shunted reading is higher than 1 on a 0-10 scale, the operator knows something is wrong, without banging the needle of his instrument. In a later model, now under construction, a tuning eye is used as the indicator instead of the "push-to-read" switch.

The instrument has another excellent feature. The 6AG5 socket has a 5-megohm resistor in series with its grid. This has practically no effect on a good tube, but a gassy tube will show very little output. This is due to the excessive loss in the grid circuit of a gassy tube. A great many troubles in sync circuits and a.g.c. circuits can be traced to this cause. The tubes tested in the 6AG5 socket are very often used in TV receiver sync and a.g.c. circuits.

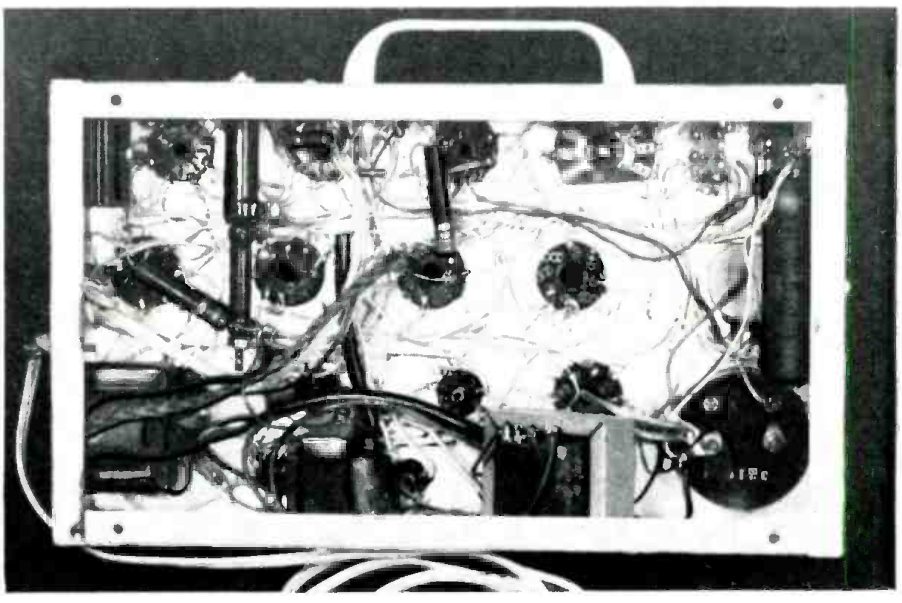
A circuit diagram of the tube checker is shown in Fig. 2. The pin connections of the 15 test sockets are listed in Table 1. The letters in the table refer to points in the circuit diagram.

The 6AC7 socket will also take the 6SJ7, 6SK7, 6AG7, 6SG7, 6SH7, and 6SS7. The 6BL7 socket also takes the 6SL7, 6SN7, and 6BX7. The 6K6 socket takes the 6V6, 6J5, 6F6, 6W6, and 6SA7. The 6BQ7 socket will also test the 12AT7, 12AU7, 6BK7, 6BX7, 12AV7, 12AX7, and 12BH7. The 6AU6, 6CB6, 6AH6, 6AK5, 6AK6, 6BA6, 6BC5,

TUBE TYPES	SOCKET	TUBE SOCKET PIN CONNECTIONS								
		1	2	3	4	5	6	7	8	9
6AC7	8-pin	—	A	C	F	C	B	D	I	
6BL7	8-pin	G	J	C	H	K	C	A	D	
6K6	8-pin	A	A	I	B	F	C	D	C	
6H6	8-pin	—	A	G	L	H	—	D	L	
6SQ7	8-pin	—	F	C	—	—	I	A	D	
7A5	loctal	A	I	B	C	B	F	C	D	
7F7	loctal	A	C	J	G	H	K	C	D	
6BQ7	9-pin	J	G	C	A	D	K	H	C	
6T8	9-pin	—	—	—	A	D	—	C	F	I
6U8	9-pin	I	—	—	A	D	—	—	C	F
6AB4	7-pin	I	—	A	D	—	F	C		
6AL5	7-pin	L	G	A	D	L	—	H		
6AT6	7-pin	F	C	A	D	—	—	I		
6AG5	7-pin	E	C	A	D	I	B	C		
7B6	loctal	A	I	G	C	—	H	C	D	

Table 1. Pin connections for the fifteen test sockets used in the checker.

Fig. 3. Two 6 v. filament transformers can be used instead of 12 v. unit, T.



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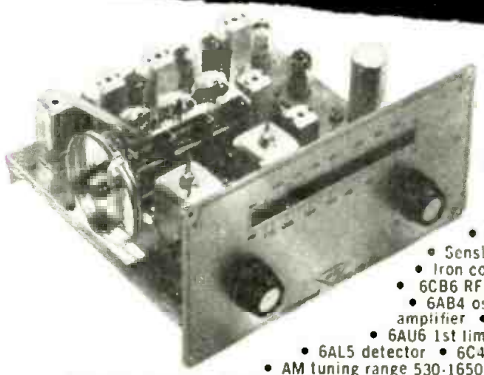

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- 6CB6 RF amplifier
- 6AB4 mixer
- 6AB4 oscillator
- 6AU6 1st I.F. amplifier
- 6AU6 2nd I.F. amplifier
- 6AU6 1st limiter
- 6AU6 2nd limiter
- 6AL5 detector
- 6C4 cathode follower output
- AM tuning range 530-1650 kc
- 6BA6 RF amplifier
- 6BE6 converter
- 6BA6 1st I.F. amplifier
- 1N34 or 1N60 crystal diode detector
- Tuned RF stage
- Chassis dimensions: 9¾" long, 5" high, 8" w.

Complete kit of parts including tubes, pictorial and schematic diagrams **$37.50**

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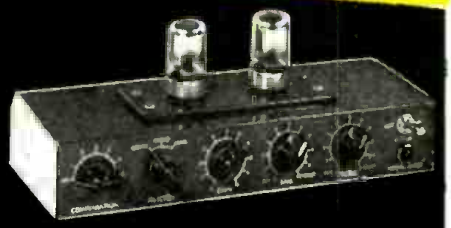

- Floated tubes to prevent tube microphonism
- 3 input connectors—magnetic, crystal, radio
- Input selector switch
- Overall gain control
- 6 position equalizer switch for GE and Pickering cartridges
- High-low tone controls approx. 15 db
- Tubes: 2-7F7
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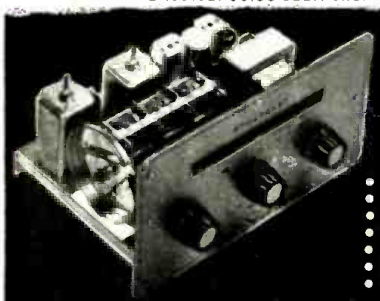
Kit with complete, illustrated instruction book **$15.95**



New V-5 AM Receiver Kit

- Self-contained AC power supply
- Tuning range 530-1650 kc
- 6BA6 RF Amplifier
- 6BE6 converter
- 6BA6 1st I.F. amplifier
- 6AL5 detector
- 6C4 cathode follower output
- Sensitivity 5 microvolts
- Iron core tuned coils throughout
- Dimensions 9¾" x 5" x 5⅞"
- ±65 selenium rectifier
- 3 section variable cond.
- Tuned RF stage

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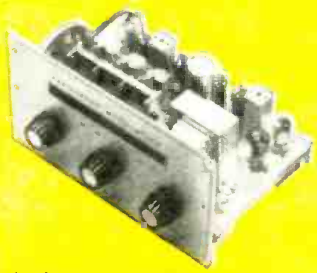
New V-9 FM Receiver Kit



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- Tuned RF stage
- Iron core tuned I.F.—disc. trans.
- 6CB6 R.F. amplifier
- 6AB4 mixer
- 6AB4 oscillator (temp. compensated)
- 6AU6 1st I.F. amplifier
- 6AU6 2nd I.F. amplifier
- 6AU6 1st limiter
- 6AU6 2nd limiter
- 6AL5 detector
- 6C4 cathode follower output
- ±65 selenium rectifier
- Dimensions 9¾" x 5" x 5⅞"

Complete kit of parts including AC power supply, tubes, pictorial and schematic diagrams..... **$29.50**

New A-465 Field Strength Meter 0-100 Microvolts Full Scale

- 12 Channel High Gain (standard coil) cascode turret tuning front end
- 6BQ7—RF
- 6J6 oscillator-mixer
- 6CB6 high gain 1st I.F.
- 6AU6 high gain 2nd I.F.
- 1N34 crystal diode (meter rectifier circuit) 2nd detector
- 6AU6 amplifier (for earphone or scope use) picture carrier only
- Signal indicator, 6" large face, 0-500 microammeter
- Self-contained power supply 115 volts, 60 cycles
- Calibrated in relative microvolts—2 scales: 0-100 microvolts and 25-30,000 microvolts
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- 300 or 72 ohm output
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- 1 volt minimum across the band
- 50 ohm terminated output cable
- Large 6" dial, accurately calibrated in megacycles and spot channels
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6BH6, 6BJ6, 6BE6, and 6AJ5 can all be checked in the 6AG5 socket. The 6AT6 socket also tests the 6AV6; the 6SQ7 socket, the 6SR7. In the 7A5 socket, the following tubes may be checked: 7C5, 7A8, 7A4, 7A7, 7B4, 7B5, 7B7, 7C7, 7AG7, 7G7, 7C6, 7H7, 7J7, 7L7, 7Q7, 7S7, 7B8, 7T7, 7V7, and 7W7. The 7F7 socket also checks the 7H7, 7N7, and 7AF7. The 6C4 and 6J6 may be tested in the 6AB4 socket; the 7E6 and 7X7, in the 7B6 socket. The 6H6, 6AL5, 6T8, and 6U8 sockets accept no other tubes. In addition, any 12-volt tube can be tested in the same socket as its 6-volt equivalent. —30—

SSB Audio Test Unit

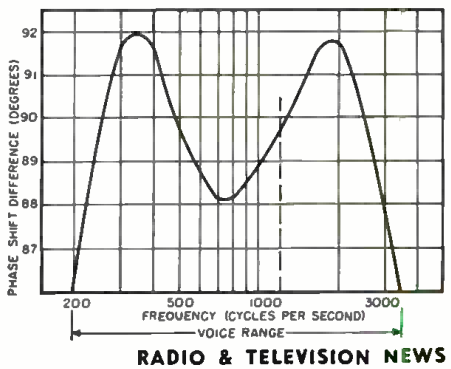
(Continued from page 51)

the proper value as the capacity is so large; a few micromicrofarads only change the frequency a few cycles. A toroid coil was used because it could be fastened close to the chassis without changing inductance, and it is a very stable inductor. Toroids are available commercially at 1.5 henrys. The core material is available so you can wind your own less expensively with a shuttle—and lots of patience. Besides saving a little of your hard earned cash, the project is interesting and instructive.

Varying the plate voltage over a 20 volt range does not change the frequency more than a few cycles. The possibility of using the small air pi-wound inductors or iron inductors was not investigated because of the lower "*Q*" and was assumed they would not be as stable as the toroid type; also the oscillator would be much larger physically.

Owners of the SSB exciters will appreciate the simplicity of this oscillator which can either be plugged into the microphone jack or used with a toggle switch so that either the microphone or the audio signal will go to the output jack J_5. When the signal of 1225 cycles is fed into the microphone jack, the maximum audio output is .1 volt r.m.s.; back the gain knob down about a third to prevent overloading the SSB exciter. Ripple adjustments to the 20A exciter can now be carried out according to the instruction book, or you can have a tone signal to tune your transmitter controls. —30—

Fig. 2. Response of the average commercial 90° phase shift network used in SSB exciter.



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Transistor Meter Amplifier

(Continued from page 75)

calibrated and checked, the complete instrument may be used as an ordinary meter (except for the occasional battery replacements) in most applications calling for the more sensitive instrument. Thus, the instrument described is used as an 0-100 microammeter in experimental test work. However, this is not the only possible application.

If a sensitive meter having a full-range reading between that obtained in the modified instrument (meter and amplifier) and that obtained with the basic meter movement is desired, one of two methods may be used to reduce the sensitivity of the modified instrument. The easiest method is to simply connect a shunt across the "meter" terminals of the completed instrument to change its range to the one desired.

An alternative method is to connect a shunt resistor across the basic meter movement (M_1 in Fig. 2A). The resistance value to use in either case can best be determined experimentally, taking the desired range and the existing full-scale range into account.

Irrespective of the method used, care must be taken that the maximum current ratings of the transistor and the basic meter movement are not exceeded.

An instance of where it might be desirable to change the basic range of the modified meter can be given, using the model shown in the photographs as an example.

Suppose that a meter having a full-scale deflection of 200 microamperes is required for a particular series of tests. This range is between the range of the modified meter (0-100 microamperes) and that of the basic meter movement (0-1 ma.). To obtain this range, the modified meter would be used, together with a shunt resistor across the external terminals.

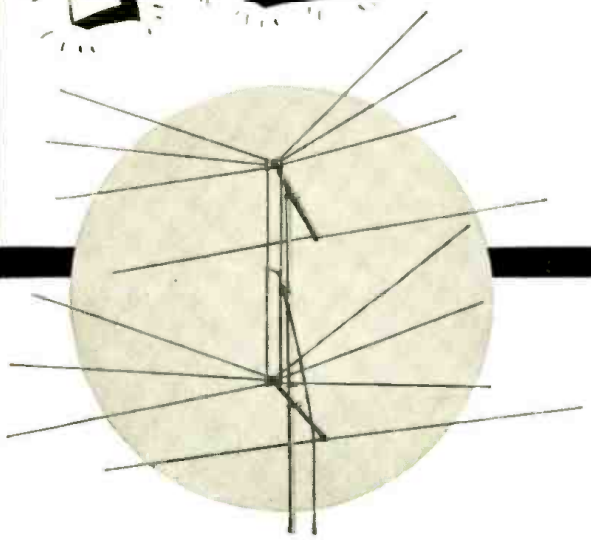
The modified meter may also be employed in a voltmeter circuit by using a series multiplier resistance. This makes it possible to obtain a voltmeter having a rating of 10,000 ohms/volt using a 0-1 ma. basic movement (which normally will give no more than 1000 ohms/volt sensitivity).

To determine the resistance required for a particular voltmeter range, simply divide the voltage range desired by the full-scale meter current in amperes. As an example, the multiplier resistor required to give a 5-volt range to a 0-100 microampere meter is determined as follows:

$$R = \frac{5}{.0001} = 50{,}000 \text{ ohms.}$$

Another method is to consider the modified meter in terms of its "ohms-per-volt" rating and to simply multiply by the voltmeter range desired. A 0-1 ma. meter has a 1000 ohms/volt rating, a 0-500 μa. meter has a

NEW PHILCO Super Performance TV ANTENNAS



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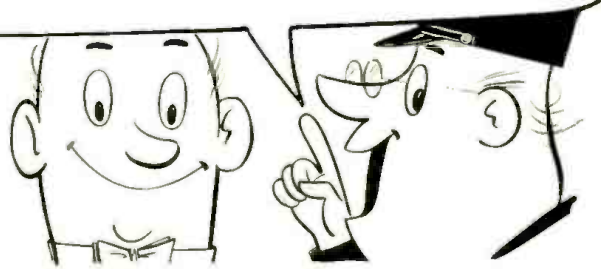

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2000 ohms/volt rating, a 0-200 μa. meter has a 5000 ohms/volt rating, a 0-100 μa. meter has a 10,000 ohms/volt rating, and a 0-50 μa. meter has a 20,000 ohms/volt rating.

Using the example given, the ohms/volt rating of the 0-100 μa. meter is 10,000 ohms/volt. For a 5-volt meter, the resistor would be 5 x 10,000 or 50,000 ohms.

It should not prove too difficult to build a complete multimeter, including current, voltage, and ohmmeter ranges, using the basic transistor amplifier circuit described, but adding appropriate selector switches, multiplier resistors, etc. Such an instrument might be called a "transistor meter" to distinguish it from its blood-brother, the "vacuum-tube voltmeter."

The basic transistor meter amplifier described is capable of considerable modification to suit it to particular needs. It may even be feasible to "cascade" two or more direct-coupled transistor amplifiers to obtain truly fantastic sensitivities, although the author has carried out no experiments along these lines at this writing.

In any case, the transistor meter amplifier extends the usefulness of basic meters in another direction. In the past it has always been feasible to reduce the sensitivity of a basic meter, but not to increase it. This difficulty has now been overcome. —30—

Choosing Your Enclosure

(Continued from page 47)

throughout the room which will completely unbalance the music from one side of the room to the other. Splattering and fluttering of high frequencies may result due to many successive back and forth reflections.

At the other extreme, a completely "dead" room would be just as undesirable. In the bathroom with its hard, tiled walls, your voice will ring out. In a well-crowded clothes closet, your voice is muffled. The same thing is true of your music room. Too many drapes, curtains, or too much carpeting may so completely deaden the room that all the life and brilliance of the music will be lost. Good music halls require a small, controlled amount of reverberation. So does *your* music room. Keep the draperies and other hangings down to a reasonable minimum. It is good practice to prevent parallel wall surfaces from being perfectly reflective. Hard plaster surfaces should be partly covered by acoustical material so that reflections between parallel walls are eliminated. In general, if about 30 per-cent of the wall area is draped so that there are no opposing reflective surfaces, good sound reproduction will result. The floor should, of course, be carpeted for, after all, it is your *living* room and after going to the trouble of assembling a good sound system you want to be able to relax in surroundings as comforting to the eye as to the ear. —30—

HI-FI ON A TEACART

(This Month's Cover)

BUSY housewives who enjoy good music of their choice even while performing their daily chores will be intrigued by the novel "hi-fi teacart" shown on this month's cover. Most homemakers are used to wheeling their cleaning equipment with them from room-to-room—why not do the same for the entertainment unit that helps to lighten her tasks as much as her vacuum cleaner or floor waxer?

Pictured on the cover are the essential ingredients for a simple, portable hi-fi system that can be moved from room-to-room with ease. The idea is of interest to the audio dealer as an unusual and salable merchandising gimmick and to the audiophile as a convenient method of mounting standard components to provide portability to his hi-fi system.

Before our eagle-eyed reader-technicians swamp us with letters pointing out the missing interconnections, may we say that Mrs. Audiophile has just been surprised with this exciting Christmas present from hubby and he refuses to hook it up until he gets outside of his turkey dinner.

We were particularly impressed with the excellent color photography represented by this cover. We also felt that many of our readers would be interested in the idea developed here and that they might wish to follow suit and mount their audio gear on a teacart in a similar manner.

We are indebted to *Regency* for submitting an outstanding composition for our annual Christmas cover. The audio equipment used in this particular setup includes the new *Regency* HF-150 high-fidelity amplifier, the *Webcor* "Diskchanger," and the *Jensen* "Duette" reproducer.

—30—

International Short-Wave

(*Continued from page 70*)

level 1659 with interval signal; English noted 1715-1730 parallel 7.671 which was weaker signal. (Cox, Dela.) Heard opening in *English* to North America 1745 on 9.700. (Pearce, England) Announces *English* for North America as 1745-1800, 1930-1945, 2000-2030, 2300-2330. (Ferguson, N. C.)

Burma—Rangoon, 4.777A, noted 0900 in Burmese; 0915 started *"Voice of Burma"* session in *English;* fair level. (Morgan, Calif.) Relays BBC news 1000 and closes 1015 with "God Save the Queen"; fair level but with CWQRM in N. Z. (Harwick)

Canada—Montreal noted in *English* 1345-1400 over CHOL, 11.720, and CKCS, 15.320. (Wilcox, Mo.)

Cape Verde Islands—CR4AA, Praia, noted 1645 to 1700 closedown in Portuguese, when played "A Portuguesa." (Mathieu, Mass.) Noted opening in same manner 1500. (Pearce, England)

Ceylon—Radio Ceylon, 9.520, noted 1050 with music. (Pearce, England) Opening Hindi Service there 2030, with QRM to and from Copenhagen on same channel. (Morgan, Calif.) Heard on 7.110 with VOA relay 0900. (Morgan) Heard on 11.770A at 2030-2045. (Sutton, Ohio)

China—Radio Peking's 2200 news is noted only on 15.385 now; 15.060 then carries Home Service in Chinese in parallel (at 2350) with 11.830; the 0400-0430 *English* session is generally audible on 6.105, 6.201, 7.500; 6.700 (this channel varies, but transmitter is same one reported as on 6.800, 6.780, 6.750, 6.746) has Home Service then. Noted on 15.08 at fair level 1700 in Chinese to as late as 2230. Home Service heard 0300 on 9.040, 9.080, 7.500, 6.230, 6.200. (Balbi, Morgan, Calif.)

Colombia—HJKH, 5.070A, Sutatenza, has fine signal 1800-0200 sign-off (some days closes 0100). (Saylor, Va.) HJBB, *"Voz de Cucuta,"* 4.815, noted 2030 at fair level; HJFC, *"La Voz Armenia,"* 6.010, noted 2115 in Spanish. (Nyquist, Sweden)

Cook Islands—ZLIZA, 6.180, 500 watts, is scheduled Tues. and Thurs. 2000-2100, Wed. 2330-2400. (*N. Z. DX Times*)

Costa Rica—TIFC, 9.647, good in *English* from around 2200; requests reception reports. (McGraw, Ohio; Himber, Calif., others)

Cuba—COCO, measured 9.532, Havana, noted 0710 in Spanish. (Ferguson, N. C.)

Czechoslovakia—Radio Prague, 9.550, noted with *English* to North America 1930-2000. (Kelley, North Shore SWL Club, Jacksonville, Fla.) And parallel over 11.760; has repeat at 2305 over 9.550, 9.655A. (Foster, Ill.) *English* for Europe noted 1400-1430 on 9.504. (Pearce, England)

Denmark — Copenhagen broadcasts to the Faroe Islands on Sun. 0900-1000 over 9.520. (Radio Sweden)

Dominican Republic—HI2L, 5.055A, Ciudad Trujillo, is good level around 2230, announces for *"Voz del Tropico."* HI1Z, 6.112, is fair level in Spanish around 2130. (Foster, Ill.) Has disc session 1730-1800 daily in both Spanish, *English.* (Powers, Ohio)

Ecuador—HCJB, 9.743, noted 0600 at fair level in Quebec. (Fleischman)

Egypt—Radio Cairo, 9.475, noted with news 1330. (Crago, Md.; Young, N. Y., others) Has news 0800 on 17.725 for Southeast Asia. (Pearce, England) Heard on 9.790A at 1715 in Arabic. (Morgan, Calif.)

El Salvador—YSAXA, 11.945, San Salvador, noted Tues. with Spanish-*English* lesson 1915-1930 (may be other days too). (Powers, Ohio)

Ethiopia—Niblack, Ind., has logged *Radio Addis Ababa* on *new* 15.342AV at 1357 when identified in *English;* usually is buried by VOA relay at Tangiers on 15.345.

Finland—Helsinki's 6.120 outlet is heard in Sweden QSA3 around 0900-1000. (*DX-Radio,* Sweden) OIX4, 15.190, noted 0600 with news. (Sutton, Ohio)

France—Paris, 11.700, is good level in *English* for British Isles 1500-1600. (Lilley, Md.) And parallel over 6.045 (*best*) and 9.625. (Sutton, Ohio) Paris, 11.920, noted at strong level ending Arabic session 1400. (Niblack, Ind.)

French Equatorial Africa — Radio Brazzaville noted *back* on 9.440 parallel 11.970 around 1700-2040 closedown and again after 2400. (Balbi, Calif.; Ferguson, N. C., others) Has musical request sessions Sun. 0545-0630 (should be on 15.595, 6.025) and 1815-1900, should be on 9.440, 11.970). (Catch, England, others) Requests should be sent to P.O. Box 108, Brazzaville, Fr. Equatorial Africa.

French West Africa—Radio Dakar, 4.950, is heard in Japan 1500 or 1530 to 1600 when closes with "La Marseillaise." (JSWC) Noted again on 9.562A with news in French 0230.

Germany—RIAS, 6.006, Berlin, is solid signal at 1757; news in German 1800. Stuttgart, 6.030, is fair level with news in German by man 1800. (Cox, Dela.) *Sudwestfunk,* 7.265, Baden-Baden, noted 1740 with dance music; at 0300 with news in German; NWDR, Hamburg, 6.075, noted 1645 with news in German, with light music when tuned 0115. (Pearce, England) Cologne, 5.980, noted 0130 with news in German; on 11.795 at 1745 with news in German and music. (Sanderson, Australia)

Greece—Radio Athens is again using 9.607 (instead of 11.718) for news 1245-1300 closedown. (Astrom, Jonsson, Sweden; Pearce, England) *Forces Station,* 7.420, Athens, heard closing 1704 with Greek National Anthem. (Pearce)

Greenland — Astrom and Jonsson, Sweden, say a Greenland station is heard on 3.200 and 1500 kc. at 0430-0645.

Guatemala — TGNB, 9.668, noted 2240 in *English.* (Brooks, Kans.) Is again using TGNC, 11.850, in parallel.

(*Continued on page 126*)

Lafayette's CHRISTMAS GIFTS

Collaro
THE WORLD'S FINEST 3 SPEED AUTOMATIC RECORD CHANGER

SPECIAL **29.50** LIST PRICE 54.50

Lafayette scores again with an almost unbelievable price on the Collaro 3-speed Automatic record changer. We made a spectacular buy and we are passing the savings on to you. Here's the finest changer made. Manufactured in England—with a world-wide reputation. It plays all sizes and all speeds automatically. It's packed with quality features that the Hi-Fidelity enthusiast will appreciate: Jam-proof ball bearing mounted tone arm; automatic shut-off after last record; powerful fan cooled hum-shielded 4-pole motor with self-aligning oilite bearings; automatic muting switch; weighted ball-bearing mounted constant speed turntable; rubber drive couplings—and more! Base size 13⅝" x 12¼". Depth below base 2½". Shpg. Wt. 19 lbs. Available either less cartridge with plug-in shell, or with famous turnover Ceramic or G.E. Triple-Play cartridge.

COLLARO Model 3/531 changer ..... Net 29.50

COLLARO Model 3/531 with Turnover Ceramic cartridge ..... Net 31.50

COLLARO Model 3/531 with G.E. Triple Play RPX-050 cartridge installed ..... Net 32.50

45 RPM SPINDLE

Slips on in place of regular spindle, eliminating use of center inserts on 45 RPM records.

GSA Spindle ..... Net 3.23

NEW POCKET AC-DC VOM MULTITESTER

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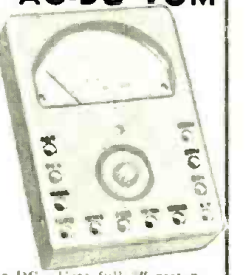

This instrument is one of the best buys that Lafayette has ever offered in a Wide Range AC-DC MULTITESTER. An ideal portable unit that meets the need for a compact, yet rugged test instrument. Has ease of operation usually FOUND ONLY IN MORE EXPENSIVE INSTRUMENTS. Has 1000 ohms/volt sensitivity on both AC or DC. Uses full 3" rectangular meter with large, easy to read scale. Uses 1% precision resistors. Jeweled D'Arsonval microamp meter movement. Ranges: AC-DC and output volts 0-5, 0-25, 0-250, 0-1000V; DC current 0-1, 0-10, 0-100 D.C. MA. Resistance 0-10K and 0-100K ohms. In handsome sturdy bakelite case. Size 4⅛" x 5¼" x 1¾". Supplied Complete with test leads and batteries. A Must for every serviceman, shop, Laboratory or exhibitmenter—and at Lafayette's Price you can afford to own one. Shpg. Wt. 2½ lbs.

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Lafayette Greatest Tape Buy Ever!

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Genuine Plastic Base
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$1.89 per roll plus postage (000's offerings)

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Outstanding Value! The Cardwell ES-1 UHF converter covers the entire UHF spectrum—channels 14-83. Has 6AF4 oscillator, 6CB6 IF amplifier and 1N72 crystal diode. Features printed circuit oscillator, high overall gain (3 to 4 times), high sensitivity, constant L/C ratio tuner, 25-1 gear drive. Has AC cord and plug, 3-pos. switch for UHF, VHF and OFF. Handsome wood cabinet 8¼ x 6¼ x 3½" with easy reading dial. Shpg. Wt. 4½ lbs.

CARDWELL ES-1 Converter—Lots of 3 each 13.95
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3 LENS TURRET MICROSCOPE

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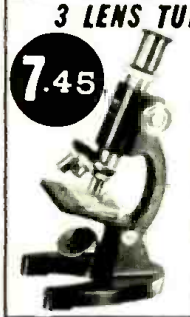

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Precision built for accuracy and long lasting service. Triple position turret holds 3 achromatic color-corrected objectives for magnification of 100X, 200X and 300X power! Heavy base and stand—inclines through 90°. Dual knob focusing by rack and pinion. Adjustable plano sub-stage mirror. High-grade microoptics used throughout! Complete with fitted wooden carrying case and slides. Shpg. Wt. 4½ lbs.

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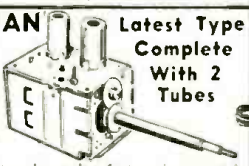
Latest Type Complete With 2 Tubes



Brand new—covers entire VHF spectrum. It is an exact duplicate of thousands now in use in many chassis including the Sylvania 300 and 320 series. Has 7" long concentric shafts. Excellent gain, noise factor, image and I.F. rejection. For 10 mc IF systems. Complete with 6BC5 and 6X8 tubes and shields. Shpg. Wt. 1 lbs. Worth 3 times the price!

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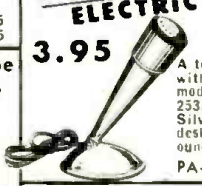

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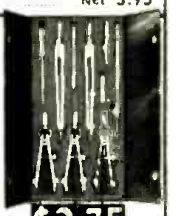

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Made in Germany, of heavy brass, nickel plated and polished. Instruments include 5½" Compass with pencil and pen points and lengthening bar. 5½" Divider, three 3½" sidewheel bow dividers with needle point, pen point and pencil point. 5" Ruling pen, extra handle for pen or pencil, capsule with extra leads. Interchangeability of these many parts makes this an exceptionally versatile set. Your money back—if this set is not worth twice our price!

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(LP) (78)
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Replacement for All G.E. RPX-050 Triple-Play Cartridges!
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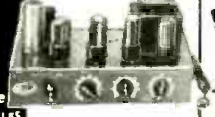

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FREQUENCY RESPONSE: 20-20,000 CYCLES

Designed for installations where high quality reproduction is required. Separate tone controls for bass and treble. Inverse feedback circuit. Specifications: Power Output 10 watts or 32 db less than 3% distortion. Frequency Response: 20 to 20,000 cps ± 1 db. Tone Control: produces maximum bass boost of + 8 db at 100 cps. Treble Control produces maximum treble boost + 10 db at 10,000 cycles. Hum: —70 db below rated output. Tube Complement: 1-6SC7, 1-6SL7, 2-6V6GT, 1-5Y3GT. Power Consumption 70 watts 110-120 volts 60 cycles. Shpg. Wt. 15 lbs. Complete with 3D diagrams and instructions.

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2¼ x 2¼ NEGATIVES
With F3.5 Coated Lens
A 69.50 VALUE!
only at Lafayette
Stock No. F-32 **29.95**
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- Built-in Flash Synchronization
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F-15, 7 x 35 with case ..... Net 22.50
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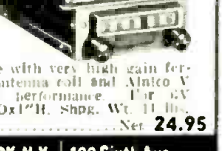

This universal mounting auto radio fits under the dash of most cars and trucks. Has a 4 tube plus rectifier circuit using one each 6BE6, 6BA6, 6AT6, 6AS5 and 6X2. This superhet circuit has fine sensitivity and very low battery drain. Complete with very high gain ferrite antenna, double tuned antenna coil and Alnico V PM speaker. Outstanding performance. For 6V operation. Size 5¼"Wx8¾"Dx1"H. Shpg. Wt. 11 lbs.

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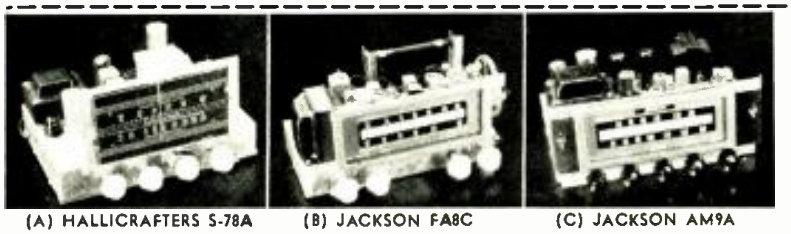

(A) HALLICRAFTERS S-78A (B) JACKSON FA8C (C) JACKSON AM9A

PICK YOUR CHASSIS FROM THESE THREE EACH ONE AN OUTSTANDING McGEE VALUE!

9-TUBE HI-FIDELITY $39.95 LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

12 Watts Audio • Separate Tone Controls

(C) Jackson Model AM9A, 12 watt high fidelity audio amplifier and broadcast tuner combined, at less than you would normally pay for the amplifier alone. Push-pull 6V6 output. Frequency response from 30 to 15,000 cps. Inputs for crystal or G.E. variable reluctance Pickup and crystal or dynamic microphone. Separate bass boost and treble tone controls. Radio-phono switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power transformer. 9½" illuminated slide rule dial with etched glass scale. 3 gang condenser with tuned R.F. stage and loop antenna. Receives broadcast 550 to 1650 kc. Size 13" long, 6" high and 9½" deep. Complete with tubes: 2-6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2-6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included.
Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 19 lbs. Sale price, $39.95
Model AM9A with our CU-14Y 12" coaxial PM speaker, both for $49.95.
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11-TUBE FM-AM HALLICRAFTERS

Regular $89.50

McGEE's SALE PRICE $69.95 LESS SPEAKER

★ HIGH FIDELITY ★ AUTOMATIC FREQUENCY CONTROL

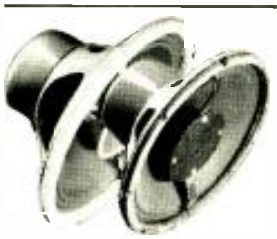
(A) Hallicrafters Model S-78A, 11 tube FM-AM superhet custom chassis. Size 7⅜" x 12½" x 11" deep. Complete with tubes, knobs, escutcheon, diagram and instructions. Receives broadcast 540 to 1700 kc, plus FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches 3.2 ohm or 500 ohm. High fidelity response, 50 to 14,000 cps. Bass boost tone control. A full 11 tube transformer powered chassis with push-pull 6K6 audio. This chassis found in $400 to $600 radio combinations. Has input for crystal phono pickup. Self-powered Preamplifier necessary for G.E. variable reluctance cartridge, $3.95 extra.

S-78A Hallicrafter 11 tube FM-AM chassis. Ship. wt. 22 lbs. $69.95
S-78A Hallicrafter with our CU-14Y 12" coaxial PM speaker $79.95
S-78A Hallicrafter with our P15-CR 15" coaxial PM speaker $89.95
3/352 Collaro 3 speed record changer, less cartridge, $38.95 extra.
3/352 Collaro changer with G.E. RPX-052 Golden Treasure cartridge, $58.95 extra. 45 RPM spindle for Collaro changer, $2.50 extra.

8-TUBE JACKSON FM-AM $39.95 LESS SPEAKER

REGULAR $59.95 VALUE– ONLY 1000 TO SELL

(B) Model FA8C, Jackson 8 tube FM-AM custom chassis. Receives broadcast 540 to 1600 kc. and FM 88 to 108 mc. 9" etched glass slide rule dial. Chassis size 7" x 13" x 7" high. Full superhet circuit with AVC. Complete with tubes: 12AT7, 6BE6, 2-6BA6, 6AL5, 6AT6, 6AQ5 and 6X4. Output transformer matches 3.2 or 8 ohm speaker. Input for crystal pickup with radio-phono switch on front of chassis. Full size "High-Q" ferrit loop stick antenna mounted on chassis. Separate antenna for FM. Has bass boost tone control. Knobs, escutcheon, diagram and instructions included.
Model FA8C, 8 tube FM-AM radio chassis. Ship. wt. 12 lbs. Sale price $39.95.
Model FA8C with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model FA8C with our P15-CR 15" coaxial PM speaker, both for $59.95.



McGee's Famous
12 AND 15 INCH COAXIAL P.M.
HIGH FIDELITY SPEAKERS

$12.95 12-Inch Model CU-14Y

$23.95 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR, McGee's Sale Price, $23.95.

REG. $48.75 COLLARO CHANGER

3-SPEED HI-FI, IMPORTED FROM ENGLAND

McGEE'S SALE PRICE $38.95

Regular $65.00 list Collaro Model 3/352, 3 speed automatic record changer on sale at McGee for only $38.95. Famous imported English changer popular among audio enthusiasts all over America. Plays all 3 speed and all 3 sizes. Intermixes 10" and 12" records of the same speed. Shuts off automatically after the last record. Heavy duty motor and turntable gives even speed operation. Rubber pallet on turntable. Compensating spring shifts weight of tone arm for LP and standard records. Plug-in head can be fitted with your favorite high fidelity cartridge. Each changer shipped with a complete service sheet. Large 45 RPM spindle $2.50 extra. Changer size, 14¾" long, 12¼" wide. 4¾" above motor board and 2⅞" below. Ship. Wt, 20 lbs. Model 3/352 Collaro changer, less cartridge $38.95. With G.E. RPX-052 Golden Treasure variable reluctance cartridge $58.95.

ENGLISH GARRARD CHANGERS

RC-80 WITH GE RPX-052 $68.51

Garrard "Triumph" Model RC-80, 3 speed automatic record changer. Plays all 3 sizes automatically and shuts off after last record. Heavy duty AC phono motor and weighted turntable gives constant speed. Muting switch silences pickup during change cycle. Complete with two separate plug-in shells for either crystal or G.E. variable reluctance cartridge. Overall size, 13¼" wide, 15½" deep and 8" high. 2½" below motor board and 5½" above. 105-125 volt, 60 cycle AC. Ship. wt, 20 lbs. Large 45 RPM spindle $3.43 extra. Model RC-80 Garrard changer, less cartridge $48.51. With flip-over crystal cartridge $52.46. With RPX-052 G.E. Golden Treasure cartridge $68.51.

RC-90 WITH GE RPX-052 $88.11

Garrard "Crown" Model RC-90, new 3 speed automatic record changer. All of the features of the RC-80, plus many new developments. Has new adjustable speed control to regulate speed faster or slower on all 3 speed settings. Manual position for playing single records. New 4 pole heavy duty AC motor and heavy turntable eliminates wow. Complete with two separate plug-in shells for desired cartridge. Finished in cream and brown. 15½" long, 13½" wide. 5¼" above motor board and 3⅞" below. Ship. wt, 19 lbs. Large 45 RPM spindle $3.43 extra. Model RC-90 Garrard changer, less cartridge $68.11. With flip-over crystal cartridge $72.06. With G.E. Golden Treasure variable reluctance cartridge $88.11.

SALE!
RADIO PHONO COMBO CABINETS
For $800.00 Class Sets
(Pictured to the Left)

WALNUT RADIO-PHONO-CABINET
Made for $900.00 Class Capehart
Cost Over $200.00 to Build

$59.95

No. K-275 (left illustration). Walnut radio-phono cabinet 42" h. 42" w. 22" deep. Made for Capehart selling for $900. Radio chassis area 14" h. 11½" w. Changer compartment 14"x 26" w. 12" baffle completely enclosed. Cabinet weighs approx. 175 lbs. Ship. wt. 275 lbs. Sale price $59.95.

WALNUT RADIO-PHONO CABINET
Made for $700.00 Class Capeharts

$59.95

8-175B (right illustration). Walnut radio-phono cabinet 37" h. 40" w. 21" deep. Radio area 14½" wide. Changer compartment 25½" wide. Hinged top lifts in two sections. Baffle for 2 12" speakers. Made for $700 Capehart combination. Ship. wt. 160 lbs. Sale price $59.95.

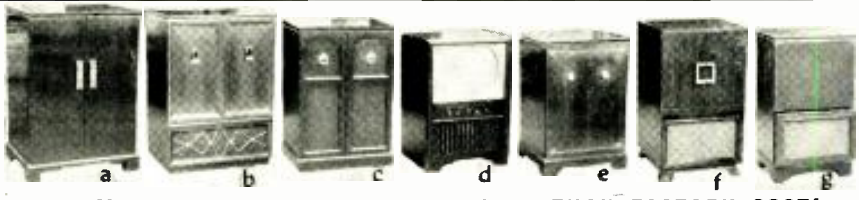
$100.00 LIST BUICK AUTO RADIO

$39.95

6 AND 12 VOLT MODELS

No. 981320. 7 tube 6 volt Buick radio. Custom made for '50, '51, '52 Buick. Also '53 Buick special only. Cost over $100 retail. Push-button tuning, tone control, built-in 8" speaker, PP 6V6 audio. Ship. wt. 20 lbs. For a limited time, sale price only $39.95.

No. 981323. 8 tube 12 volt Buick radio. Custom made for all '53 Buicks except the Special. Cost over $100 retail. Magic Selectronic single push-button tunes set electronically. Built-in 8" speaker, tone control, PP 12V6 audio. Ship. wt. 20 lbs. Sale price $39.95.



a b c d e f g

TELEVISION CONSOLE CABINETS AT LESS THAN FACTORY COST!

FOR YOUR TV CHASSIS—MODELS FOR 27 INCH TO 16 INCH CHASSIS

27" MAHOGANY FULL DOOR CAB...$59.95

(a) No. 27-MA. Mahogany with full doors for 21", 24" and 27" TV. 43" h. 30½" w. 23" deep. Chassis area 27¾" w. 25" h. 18¼" deep. Baffle for 10" speaker. A beautiful cabinet that cost the factory over $100. Made for a $600 TV set. Ship. wt. 90 lbs. Sale price $59.95. Blank panel $5.00 extra.

27" ¾ DOOR MAHOGANY CAB.....$59.95

(b) No. 27-34MA. Mahogany with ¾ doors for 21", 24" and 27" sets. 43" h. 31½" w. 22⅜" deep. Chassis area 27½" w. 26⅜" h. 21" deep. Baffle cut for 2 10" speakers. Made for one of America's largest TV builders. Cost over $100. Ship. wt. 90 lbs. Sale price $59.95. Blank panel $5.00 extra.

21" MAHOGANY FULL DOOR CAB....$44.95

(c) No. 21-FDT. 21" full door mahogany. 39" h. 27" w. 22" deep. Chassis area 24" w. 21½" h. 18¾" deep. Baffle for 12" speaker. Panel cut for 21" tube. Made for a $395 set by a famous TV factory. Ship. wt. 75 lbs. Sale price $44.95.

21" MAHOGANY CAB.....$24.95

(d) No. 21-OFM. 21" Mahogany open front. 37" h. 25½" w. 20½" deep. Chassis area 24" w. 21½" h. 18¾" deep. Baffle for 10" speaker. Small overall, but plenty big enough for 21" set. Made for a $295 TV set. Ship. wt. 65 lbs. Sale price $24.95.

17" MAHOGANY FULL DOOR CAB....$29.95

(e) No. AH-430. Mahogany with full doors. 36" h. 24" w. 21¾" deep. Chassis area 22" w. 21¼" h. 18¾" deep. Baffle panel. Holds 17" TV easily. Baffle for 10" speaker. Ship. wt. 80 lbs. On sale at less than it cost a famous TV factory. Sale price, $29.95.

17" WALNUT ½ DOOR CABINET....$24.95

(f) No. AH-85A. Walnut with half doors. 36" h. 20¾" w. 21½" deep. Chassis area 19" w. 18¼" h. 18¾" deep. Blank panel. Will hold most 17" sets. Baffle cut for 10" speaker. Ship. wt. 65 lbs. An attractive well proportioned cabinet on sale at only $24.95.

17" TV CAB. WITH PHONO DRAWER.$19.95

(g) No. SE-21. TV-phono comb. 40" h. 24" w. 18½" deep. Blank panel, TV chassis area 19" w. 20¾" w. Changer drawer 19¾" w. 13" deep. Baffle for 10" speaker. Mahogany finish. Ship. wt. 75 lbs. Sale Price $19.95.

MIKE-PHONO-BROADCAST OSCILLATOR $7.95

Sensational new 1955 model microphone-phono oscillator for the broadcast band. Have own miniature radio station that broadcasts only in your own home. Plugs in to 110 volt house current. Input jacks for crystal mike or record player. Priced with tubes 12K8 and 70L7. Stock No. LE-3, ship. wt. 3 lbs. Sale price $7.95. Crystal mike and desk stand $4.95 extra.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

OUR NEW ADDRESS IS 1901 McGEE St., KANSAS CITY, MISSOURI

McGEE'S YEAR END BARGAIN SALE! TERRIFIC VALUES

TRAVLER PERSONAL PORTABLE RADIO $14.95

McGee's Xmas Special.....

Model 5300, Travler personal portable radio. Attractive two tone gold and brown case of sturdy plastic with metal grill. 4 tube superhet with full size 3" Alnico V speaker. Has ferrit stick loop antenna for added sensitivity. Exceptionally fine tone and good volume for a radio so small. Case size, 6" x 9" x 2" thick. Uses new 67½ volt 'B' battery and 2 new long style 1½ volt flash cells for 'A.' Handy carrying handle folds into case when not in use. Model 5300 Travler superhet personal portable radio. Ship. wt. 4 lbs. Sale price only $14.95. Battery kit $1.95 extra.

50-WATT BOOSTER AMPLIFIER

50-WATT BOOSTER AMP. $39.95

2-Mike Pre-Amp $12.95 Extra. Not a Kit, but a Manufactured Amp.

A sensational value. A 50 watt booster amplifier with push-pull, parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X pre-amplifier to allow the use of 2 microphones and one low level input. The amplifier has one input jack with 1 volt input giving 50 watts of audio. Amplifier has a 6 lb. potted case high fidelity output transformer with taps at 4-8-16-60 and 250 ohms. 225 mil power transformer and 5U4G rectifier. Includes tubes: 4—6L6, 7N7 and 5U4G. Two variable tone controls for master volume and bass boost tone control. Chassis size, 8" x 6½" x 14½". Model No. PA-55N. Ship. wt. 26 lbs. Sales price, $39.95. PR-2X, 2 mike input pre-amplifier plugs is directly to the PA55N 50 watt booster amplifier. Allows use of 2 microphones, either crystal or dynamic and one low level input. Furnished with 4 ft. connecting cable and plug for remote control of the 50 watt booster. Chassis size, 5¾" x 3½" x 2½". Model PR-2X, Sale price, $12.95.

TRUMPETS AND SPEAKERS FOR AMP

25 Watt HORN AND DRIVER

25-Watt Weather-Proof Out-Door Speaker $27.95

25 watt driver and 3½ foot air column re-entrant trumpet. The standard type outdoor trumpet and driver most widely used. Drivers are 100% weatherproof. Trumpet is spun aluminum. Offered to you at a considerable saving. Ship. wt. 20 lbs. Stock No. MCG-H25, Sale price $27.95.

12" PM AND LEATHERETTE BAFFLE, $7.95

LOTS OF 10, $7.50 EA.

Heavy 12" PM speaker and the finest leatherette covered wall baffle that we have ever offered. New woven plastic grill. Baffle covered with top quality tan leatherette. Conventional slanting wall type baffle with 12" speaker. Stock No. CA-12, $7.95. Lots of 10, $7.50.

Order From This 2-Page Ad.

DEALERS-SERVICEMEN WRITE US—For Our Big Catalog and Bargain Flyers!

Bel-Com 2-Way Loudspeaker Intercom $7.95

FUN FOR THE KIDS—PRACTICAL FOR ADULTS

Here is the ideal Christmas gift for the children as well as a practical intercom for the home or office. New Bel-Com self-powered 2 station intercom housed in sturdy one piece burgundy color molded cases. Each unit has a carbon microphone and 4" Alnico V PM speaker. Gives normal room volume with distances up to 150 ft. with just 4 regular flashlight batteries. No AC power required. 2 No. 6 dry cells may be used for distances greater than 150 ft. System comes complete with two stations, 25 ft. of 3 wire cable and batteries. Extra 3 wire cable 1½c per ft. Stock No. BL-4, 2 station intercom complete only $7.95. Packaged in attractive gift carton.

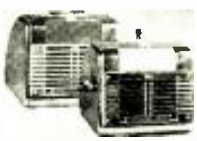
78 RPM-AMPLIFIED RECORD PLAYER $8.95

3-TUBE AMPLIFIER

6 x 9 Speaker. Leatherette Cabinet. Buy at Less Than Parts Cost. Now, you can have a good quality low cost record player for the kids' room. Only $8.88 buys this 78 RPM record player. Completely wired tube amplifier with 12AV6, 50B5 and 35W4 tubes. Separate tone and volume controls. Leatherette covered cabinet 9½" x 12" x 18½" high, made to set on the floor. Heavy 6 x 9" speaker, crystal pickup arm and 78 RPM single speed phono motor. Ideal for the children's playroom. All you do is fasten the speaker, phono motor, pickup and amplifier into the cabinet. Cabinet is cut, no holes to drill. Only a few minutes required to assemble. Complete with simple instructions. Offered at less than the cost of the parts. Stock No. CPR-78K, Ship. wt. 15 lbs. Sales price $8.88. Shipped via Express only.

3-STATION INTERCOM MASTER $16.95

SUB-STATIONS $3.95 EACH



Powerful 3 station intercom master housed in a chrome plated metal cabinet 7½" x 6" x 5". Full 3 tube amplifier for AC-DC operation. Press-to-talk switch is on top of cabinet. Volume control, off-on switch and station selector are located on either side. May be used with one to three sub-stations. Master is quiet except when talk-listen switch is pressed, or when call-back switch is pressed at the sub. Ship. wt. 10 lbs. Model MPM-A3, 3 station master, $16.95. Matching sub-station, Model PM-A5, complete with 5" Alnico V PM speaker and call-back switch. $3.95 each or 3 for $10.00. Requires 3 wire intercom cable, $1.95 per 100 ft., 500 ft. for $8.95.

10 WATT PORTABLE P.A. SYSTEM

10" PM SPEAKER CRYSTAL MIKE

$34.95

PA-12, 5 tube 10 watt portable P.A. system. Push-pull 7C5's. U.L. approved amplifier with good frequency response. Inputs for crystal microphone and phono. Separate volume controls and variable tone control. Heavy 10" Alnico V PM speaker. Amplifier fits in bottom of case. Case size, 21" x 16" x 13". Snap-on removable back. Complete with tubes, crystal mike on non-removable desk stand and connecting cables. Stock No. PA-12. Ship. wt. 40 lbs. Sale price only $34.95.

6-TUBE 2 BAND RADIO KIT $14.95

6 tube 2 band AC-DC radio kit, complete with speaker and plastic cabinet. Popular with schools and colleges for training in radio. Receives broadcast and 6-18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12K8, 2—125K7, 12SQ7, 50L6 and 35Z5, diagram and instructions. Cabinet 13" x 6¾" x 6¼". Ship. wt. 12 lbs. Model ME6-2, Net $14.95.

RADIO-TV SERVICEMEN CLASSIFIED BARGAIN LISTINGS. SPECIAL PRICES, MOSTLY BELOW REPLACEMENT COST. SOME AT A FRACTION OF THEIR PRODUCTION COST. BARGAIN LISTINGS!

FAMOUS STANDARD COIL CASCODE TV TUNERS $12.95 EACH 2 FOR $25.00

TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 1 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode model. Available with either 2⅞" or 4¼" shaft length. A tremendous purchase makes our low $12.95 price possible. Specify shaft length desired. Stock No. TV-2000-3. Sale price $12.95 each, 2 for $25.00.

NEW RCA TUNER $7.95

Brand new famous 201E1 RCA 13 channel tuner complete with 3-6J6 tubes. Completely wired, ready to connect to video I. F. strip. Tuners are all new and have convertor coil for separate sound, as used in the RCA 630 TV chassis. Stock No. RCA-13P tuner complete with 3-6J6 tubes. Sale price only $7.95.

Builders-Experimenters! TV Tuners Less Tubes $2.95

TV tuners for experimenters and builders. Your choice of our Type 4 Sarkes-Tarzian tuner or General Instrument Stock No. GI-13X for only $2.95, less tubes. Type 4 uses 2-6AG5 or 2-6BC5 and a 12AT7 tube. Has ¼" diameter channel selector shaft and screwdriver adjustment for fine tuning. It does not have the concentric fine tuning shaft. Sale price, less tubes $2.95. The GI-13X, General Instrument tuner is of the tuning condenser type instead of a coil switching arrangement. No tubes or convertor coil included. Complete with fine tuning concentric shaft and diagram. Sale price, less tubes only $2.95. 3-6J6 tubes required.

24"-27" MAHOGANY TV CABINET $39.95

Large mahogany open face cabinet for 27" or 24" television chassis. 44" high, 30¼" wide and 24¼" deep. Will hold a TV chassis 29" high, 29" wide and 23½" deep. Offered at a fraction of the manufacturers cost. Limited quantity available. Has room for 8" or 10" speaker. This cabinet and other TV cabinets listed might also be converted to a high fidelity speaker baffle. Stock No. KL-27X. Ship. wt. 90 lb. Sale price $39.95. Blank front panel available at $5.00 extra.

STANDARD COIL TV BOOSTER $7.95

Model B-51, Standard Coil TV booster only $7.95. Brand new in factory cartons. Utilizes printed circuit high frequency circuits for improved performance. Average gain 6 or 7 volts on low channels and 5 or 6 volts on high channels. One knob tuning and channel selection. Has 6AK5 tube. Modern design dark brown plastic cabinet 8"x4¼"x4½". For 110 volt 60 cycle AC operation. Ship. wt. 5 lb. Sale price $7.95, 2 for $15.00.

78 RPM phono motors with turntable, for 110 volt, 60 cycle operation. Stock No. NR-1. Sale price $1.29 each. 5 for only	$5.00
Portable cases intended for tape recorders of various types. Stock No. NR-2, $2.99 each. 3 assorted for	$6.99
General Electric Model ±1201, 12", 14.5 oz. Alnico V magnet, PM speaker. Stock No. NR-3	$14.95
12" RCA PM speaker with 3.2 oz. magnet. Stock No. NR-4. $3.95 each 3 for	$10.50
12" Television speaker. Field coil type with 90 to 100 ohm field. Stock No. NR-5	$1.49
6 x 9", 1000 ohm field speaker. Stock No. NR-6	99c
8", 750 ohm field speaker with 6V6 output transformer. Stock No. NR-7	99c

Kit of 50 assorted TV knobs. Stock No. NR-10	$1.99
Kit of 50 assorted Radio knobs. Stock No. NR-11	79c
Kit of 50 assorted set screw type radio knobs. Stock No. NR-12	$1.49
Kit of 1 pound radio and TV hardware, nuts and bolts. Stock No. NR-13	99c
Kit of 10 assorted TV focus coils. Some magnet types. Stock No. NR-14	$4.95
Kit of 25 Television filter condensers, Aluminum can FP type. Late production. Stock No. NR-15	$4.95
Kit of 25 Micamold tubular electrolytics for television, radio and amplifier use. Stock No. NR-16	$4.95
Kit of 50, 1 watt latest type insulated resistors. Good sizes. Stock No. NR-17	$1.49
Kit of 25 Micamold 150 volt tubular filter banks for AC-DC radios. All multiple section banks. All good sizes. Stock No. NR-18	$4.95
Kit of 100 assorted 400 and 600 volt plastic tubular bypass condensers. .001 to .1 mfd. Stock No. NR-19	$4.95
Kit of 10, ½ to 1 megohm volume controls. All with shafts at least 1½ long and with on-off switch. Stock No. NR-20	$2.99
Kit of 25 TV voltage dividers. 20 to 50 watt. Stock No. NR-21	$1.49
Kit of 10, 456 kc I.F. coils. Regular and midget sizes. No. NR-22	$1.99

Kit of 25 assorted radio and TV small tube sockets. All late production. Stock No. NR-23	49c
Kit of 10 single TV controls. Part wire wound. Stock No. NR-24	$1.99
Kit of 100 assorted ½ watt and 1 watt insulated resistors. All good sizes and all coded. Latest production. Stock No. NR-25	$1.99

Deal of 5 television flybacks (Horizontal output transformers) all for only $7.95. Includes 1 Philco flyback, 2 of our 77J3 G.E. built flybacks, 1 No. 76381 RCA flyback as used on Model 7T118 chassis KSC47GF-2 and 1 No. PC10120 flyback used by RCA, Capehart, Emerson and others. Use only one of these flybacks for TV service and you have your investment back. Ship. wt. 6 lbs. Stock No. McGX-5 deal of 5 flybacks for only $7.95

Deal of 5 popular deflection yokes for TV service, only $7.95. Remember, your cost on yokes is $6.00 or more at regular net. Now you can get these top quality yokes for only $2.00 each and have plenty on hand. You get 4—70 degree cosine yokes and 1—52 degree yoke. A lucky purchase makes this value possible. Stock No. WA-52 deal of 5 deflection yokes for only $7.95

Assortment of 10 width and linearity coils for only $1.49. Here is an assortment that every TV service shop should have. We find that it is not hard to tell by the DC resistance and general appearance the coil that you need. Buy this assortment of 10 width and linearity coils and save time and money. Stock No. BB-10, 10 width and linearity coils for only $1.49

INDIVIDUALLY CARTONED ELECTRONIC RADIO & TV TUBES

McGee offers you a wide selection of good quality TV and Radio tube types. Individually cartoned. Our private brand. These are not set mfg's. culls, but a carefully inspected private line of tubes with a full 6 months' guarantee. Types listed are in stock in good quantity at this time. Thousands sold. Order 50 tubes and take 10% off the listed prices.

1A7GT	.59	6AQ5	.49	6J6	.59	6U8	.79	12BH7	.79
1B3GT	1.09	6AU6	.49	6K6GT	.69	6V6GT	.59	12BY7	.79
1G4GT	.59	6AW8	.59	6K7G	.59	6W4GT	.59	12J7GT	.59
1H5GT	.59	6AT6	.49	6K7GT	.59	6X4	.39	12K8	.49
1L4	.59	6AV6	.49	6L6G	1.09	6Y7G	.99	12Q7GT	.59
1R5	.59	6AX4GT	.69	6L6GA	1.09	6ZY5G	.59	12SF5GT	.69
1S5	.59	6B8G	.59	6P5GT	.59	12A6	.49	12SJ7M	.69
1T4	.59	6BA6	.49	6S4	.59	12AGT	.49	12SJ7GT	.59
1T5GT	.59	6BA7	.69	6S8GT	.89	12AL5	.49	12SL7GT	.79
1U4	.59	6BC5	.59	6SA7GT	.59	12AT6	.69	14A4	.69
1U5	.59	6BD6	.49	6SC7GT	.59	12AT7	.69	19BG6G	1.79
1X2A	1.10	6BE6	.59	6SD7GT	.69	12AU6	.69	19T8	.89
3A4	.59	6BF6	.59	6SF5GT	.49	12AU7	.69	25BQ6GT	.99
3Q4	.59	6BG6G	1.29	6SF7	.59	12AV6	.59	25L6GT	.75
3S4	.59	6BH6	.59	6SG7	.69	12AV7	.89	32L7GT	.79
3V4	.59	6BJ6	.59	6SH7GT	.59	12AX4GT	.59	35B5	.59
5U4G	.69	6BZ7	.99	6SJ7	.49	12AX7	.69	35C5	.59
5Y3GT	.49	6BL7GT	.99	6SK7GT	.39	12BA6	.59	35W4	.59
6AB4	.69	6BQ6GT	.99	6SL7GT	.69	12BA7	.69	35Z5GT	.55
6AF4	.99	6BZ7	.99	6SN7GT	.69	12BE6	.59	50B5	.59
6AJ5	.69	6C4	.39	6SU7GT	.69	12BD6	.59	50C5	.59
6AK5	.59	6CB6	.59	6T8	.79	12BF6	.79	70L7GT	.99
6AL5	.49	6CD6G	1.49	6U7G	.69				

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY

SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

OUR NEW ADDRESS IS

1901 McGEE St., KANSAS CITY, MISSOURI

(Ferguson, N. C., others) *"La Voz de las Americas,"* 6.950A, noted from around 1900 to 0200 sign-off; fair to weak signal, CWQRM is heavy and has QRM. (Saylor, Va.) TGWA, 9.760, is good level around 1900. (Foster, Ill.)

Haiti—4VEH has "Listeners Post" at 0930-1000 *Sat.* on 9.654 (actually *measured* 9.656), and *Mon.* 2030-2100 on 9.666. (Kapp, Calif.; Gates, Conn.; Foster, Ill.; Hicks, Ga., others) 4VRW, *Radio Haiti*, is noted on 6.165A (some list this one as on 6.216A) on *Thur.* 2155-2230 with "Musical Caravan" session in *English*. (Peterson, Texas) *Radio Commerce*, 6.088A, noted closing in French 2230. (Leon Levy, N. Y.)

Holland—*Radio Nederland*, 6.025, Hilversum, heard ending *English* for North America 2210, fair level in N. Y. (Leon Levy)

Hong-Kong—ZBW3, 9.525, noted 0445 with music and news. (Sanderson, Australia)

Honduras—HRQ, *"Voz de Suyapa,"* San Pedro Sula, 6.125, noted closing 2325 with *English* as well as Spanish announcements; good level but with bad heterodyne. (Niblack, Ind.)

Hungary—*Radio Budapest*, 11.910, noted with news 1705 tune-in. (Parsons, Pa.)

Iceland—TFJ, 12.175, noted *Sun. only* 1115-1130 in Icelandic. (Nyquist, Sweden) Burns, Ill., says he heard this one on a *Sun.* at 1505 with music.

India—Madras, 9.590, heard from 1115 *opening to past* 1230 in native; peaks around 1140; Delhi is heard on 11.620 now to Asia 0830-0945, news 0835A. (Morgan, Calif.) Delhi noted on 11.850 with news 1930. (Sanderson, Australia)

Indo-China—*"La Voix du Vietnam,"* Saigon, has Vietnamese 1745-1900 (to 0000 *Sun.*), 2300-0000, 0530-0830; French 1900-1930, 0000-0030, 0800-0900; Chinese 2230-2300, 0430-0530; *English* 0830-0900, on 838 kc., 1090 kc., 6.165, 7.290, 9.620 (has French 0800-0900 on 838 kc., 7.290 *only*). *Radio Dalat*, 1440 kc., 7.265, has Vietnamese 1200-1330, 2331-2345, 2115-2230; French 2231-2330; Moi 1331-1430 (*Sun. only*). *Radio Hue*, 7.205, has Vietnamese 1000-1045, 2100-0000, 1500-1530; French 0001-0100. (Scheiner, N. J.) *Radio France-Asie*, 15.430, Saigon, noted in *English* 0430-0515. (Sutton, Ohio)

Iran—*Radio Teheran*, EPB, 15.100 noted with news and music 1518-1532 sign-off at fair level. (Parsons, Pa.) EQO, 3.785, has been heard well in Britain in parallel. (ISWL, England)

Iraq—*Radio Baghdad*, 3.295A, noted with *English* 1415-1500 closedown; the 11.705A channel is parallel, announced for "Overseas Listeners," while 3.295 is intended "for local listeners." (Pearce, England) Heard on 11.705A at 0000 with Arabic news and music. (Sanderson, Australia)

Israel—Tel Aviv, 9.008, still noted with news 1515. (Cox, Dela.; Ferguson, N. C.) "Voice of Zion" session in *English* noted 1615-1700 (or later some days). (Crago, Md.; George, Ont., others)

Italy—Rome, 9.575A, is good signal 2130-2150 closedown in *English*. (McGraw, Ohio, others) Rome has news in French 0455-0510 closedown on 21.560. (NNRC) Heard with news in Italian on 9.630 at 1810-1815. (Backus, Va.) Milan, 6.240, noted 1745 with dance music, very high level in England. (Catch)

Japan—JOA3, 9.695, Tokyo, noted with news 0430, followed by native music. JKD21, 6.005, Tokyo, noted at fair level 0530 in Japanese. (Saylor, Va.) JOZ, 3.925, Tokyo, commercial outlet, heard 0430 with Western music and news in Japanese. (Sanderson, Australia) The Home Service outlets noted 0455 with (*English*) news over JKH, 7.2575, JKJ, 7.285. (Morgan, Calif.) Also over 4.910. (Cushen, N. Z.)

Kashmir—Broadcasting stations at Srinagar and Jammu have been handed over to India for administration. (*Radio Times of India*)

Kenya Colony—Nairobi, 4.885, noted 1300 with newscast. (Catch, England) Heard on 3.315 at 1330-1500; verified for this channel *via* airmail in three weeks. (Collett, N. Z.)

Kuwait—Al Kuwait, 5.000, is heard in Sweden 1500-1600 closedown. (Etersvep, Sweden)

Liberia—ELBC, 6.022A, Monrovia, is fair in N. Z. 1500-1530 in Arabic. (*N. Z. DX Times*)

Madagascar—*Radio Tananarive*, 9.515, noted breaking through some days from 2230 opening. (Cox, Dela.)

Malaya—*Radio Malaya*, 6.025, Kuala Lumpur, has news 0630. (Balbi, Himber, Calif.) Heard parallel on 7.200, Singapore. (Sanderson, Australia) BFEBS, 9.690, Singapore, heard with news 0530. (Saylor, Va.) Noted closing on this channel 0745; good level on

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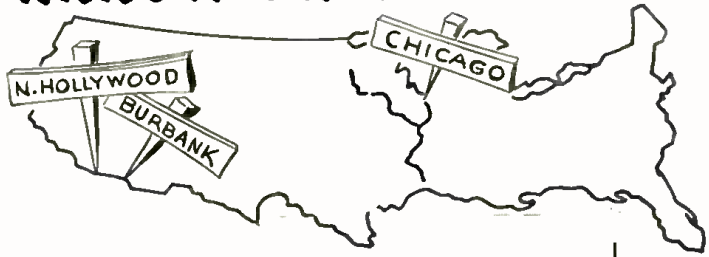

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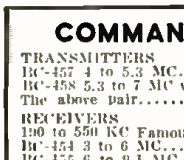

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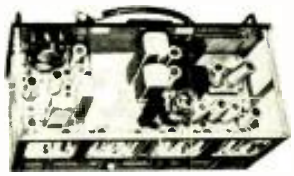

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11.820 parallel 11.955 with BBC news relay 0800. (Boord, W. Va.) Heard on 7.120 at 1100-1115 with BBC news relay; CWQRM. (Sutton, Ohio)

Mexico—XESC, 15.205, noted 1700 at good level; XEQQ, 9.680, heard closing on a *Sun*. 2130 (Hathaway, Ill.) XEOI, *Radio Mil*, 6.010, noted 2300-2400 at fair level, all-Spanish. (Duering, Alta.)

Monaco—*Radio Monte Carlo*, 7.349, noted at good level 1345, some QRM.

New Caledonia—*Radio Noumea* is scheduled 1400-1500, 1900-2100, 0200-0530 (news in French 1430, 1500, 2000, 0300); lists 3.355, 6.035, 1 kw. each; heard in Maryland 0300. (Zahner)

Nicaragua—YNWW, *Radio Sport*, Granada, has *moved* from 7.850 to 5.943A, heard *opening* 0700A and going *past* 2030. (Stark, Texas; Niblack, Ind.)

Nigeria—Lagos, 4.800, noted 1430 with drum interval signal; another day at 1325 ending news, then with native music 1330. (Cateh, England)

Norway—*Radio Norway* is good some days on 9.610 and 7.210 in transmission to North America (East Coast) 2000-2100. (Saylor, Va.) And to West Coast on 7.210 at 2300-2400; *wants reception reports*. (Gay, Calif.)

Pakistan—*Radio Pakistan*, 15.335, noted with news 0300; with news on 9.484 at 0945-1000. (Pearce, England) Heard on 11.726 at 2110 with music; *English* announcement at 2129 followed by news 2130. (Sutton, Ohio) Now uses 9.545 parallel 7.010 for *English* to Turkey 1415-1500 and to United Kingdom 1500-1545. (Radio Australia)

Panama — Niblack, Ind., notes HORT, 6.060, *Radio Balboa*, at good level 1930.

Paraguay — *Radio Encarnacion*, 11.950, is heard in Sweden around 1500. (DX-Club Tellus, Sweden)

Peru—Lima, 6.082, good level with *English* 2330-2345A. (Parker, N. H.) Note *English* is now *Mon.-Fri.* at 2330 (instead of 2300 as formerly). (Gay, Calif.; Rowell, Minn.; Sutton, Ohio, others)

Philippines—DZH7, 9.730, Manila, noted at fair level 0500. (Saylor, Va.) Tested directional antennas for first time over this one recently. (Radio Australia)

Poland—Warsaw schedule for *English* to North America this *winter* reads 0600-0630, 9.570; 0715-0745, 0745-0815, 11.740; 1715-1745, 1945-2015, 2315-2345, 0030-0100, 6.025. Pearce, England, notes Warsaw with *English* 0130-0200 on 9.615, 6.195, and at 1430-1500 over 5.995. Rowell, Minn., hears Warsaw in Polish on 9.525 at 1400-1500, weak level.

Portuguese Guinea—CQM4, Bissau, is using 7.937A now, noted closing 1800 with "A Portuguesa." (Fairs, England, via URDXC)

Roumania—Bucharest still noted in *English* for North America on 9.570 at 2200-2230, 2330-2400. (Sutton, Ohio) And parallel over 6.142A. (Crago, Md.) Good level on latter channel 1745 in *English*. (Cox, Dela.) Noted in Norway around 1700-1800. (Kristiansand S. DX Club, Norway) Has *English* for

Europe 1730-1800 on both 6.142A and 9.570. (Pearce, England)

Sarawak—*Radio Sarawak*, 4.870, noted with news 0800; closes now 0830 with "God Save the Queen."

South Africa—SABC, 4.895, Johannesburg, is noted in Japan 1400-1600 in Afrikaans. (JSWC)

South Korea — HLKA, 2.510, Seoul, noted 0830-0900 in Korean language; *"Radio Vagabond,"* 6.890; heard 0854 with talk in *English*, call at 0855, then music; bad QRM. (Morgan, Calif.)

Spain—*Radio Cuerto de Santa Maria* has *moved* from 7.210 to 7.085A. noted 1600-1700 when left air suddenly: fair level, some CWQRM. (Saylor, Va.) Leon noted on 6.834 in Spanish 1630-1745. (Sutton, Ohio) Madrid's *listed* 9.363 channel has been "wandering" a great deal lately—reported as *low* as 9.330A, as *high* as 9.370A. *Radio Sweden* says Madrid is heard in Ireland on 5.990 at 0730-1200.

Sweden—Stockholm, 9.620, noted with *English* 1930-2000. (Parsons, Pa.) *Winter* schedule for *English* to Western North America is 1600-1615, 0000-0015, 9.535; to Eastern North America 0700-0715, 11.705; 1930-2000, 2100-2145, 9.620. (Hicks, Ga., others)

Switzerland—Winter schedule of Berne to North America (East Coast) is 2030-2215, HER3, 6.165, HER2, 6.055, HER4, 9.535, while uses same channels to Western North America at a *new* time of 2315-2400. (Morgan, Calif., others) Leon Levy, N. Y., notes a good signal on 15.305 in Berne's beam to India-Pakistan 0945-1130 in *English*.

Syria—Damascus, 9.555, is good level 1700 in *English*. (Lilley, Md.) Noted with French to 1630, *English* news 1645 and commentary 1715; closes 1730. (Leon Levy, N. Y.)

Tahiti—FZP8, 6.135 Papeete, noted 2331 with man in Tahitian language, popular music, good level but much QRM; heard on 7.120 at 0018 with man in French, music good level. (Morgan, Calif.) (*Continued on page* 130)

Taiwan (Formosa)—BED36, 7.300, Taipeh, noted at good level 0600 with news in Chinese; faded out around 0700. (Saylor, Va.) "Voice of Free China," Taipeh, has *English* for Western North America 2200-2230 and 2330-2400 and to Europe at 0230-0330 over BED3, 11.920, BED6. 11.736. (Pearce, England, others) BED7, 7.130, closes usually around 0815 to 0830, but sometimes is heard as *late* as 0915; opens again with VOA relay at 1000 running to 1030 when closes with no anthem nor any native announcement. The 11.736 channel should parallel. (Morgan, Calif.) BED32, 9.778A, noted 0500 with Western music, *English*-Chinese lesson. (Sanderson, Australia)

Tanganyika—Radio Dar-es-Salaam, 5.050, is heard in Sweden around 1000. Has CWQRM. (Etersvep, Sweden)

Tangier—WTAN, *"The Voice of Tangier,"* now uses 6.025 at 0800-0830 (*Sun.* 0800-0900) instead of 7.305; has German each Tue. at 1530-1600 on 7.305, and other days uses this channel for other languages around that time; has *tested* recently on 7.175; wants reception reports. (*WRH;* Pearce, England)

Thailand—HSK9, 11.670A, is noted in New Zealand at good level in special transmission to Thai Forces in Korea (parallel 6.001) at 0430-0520; is fair in Australia with *English* on the 11.670A channel from 0525. (Radio Australia)

Trinidad—Radio Trinidad, 6.085A, noted at good level 0500; started to fade around 0520. (Neal, Md.) Heard 1900 on 3.275, weak level in Dela. (Cox)

Turkey—TAT, 9,515, *Radio Ankara*, noted with news, music 1815-1830 in North American beam. (Backus, Va.) *Radio Ankara* has *resumed* Mailbag session *Sun.* 1615-1700 over TAP, 9.465, TAS 7.285. (ISWC. London) The weekday *English* session at 1600 for Western Europe should now be on these channels.

Uganda—Kumpala, 5.026, is heard in Sweden 1045-1215 closedown; CWQRM. (Etersvep, Sweden)

USI (Indonesia)—YDF6, 9.710, Djakarta, noted with *English* 0930-1030. (Beggs, Ariz.) Has improved signals in Eastern USA 0615 when has news. (Boord, W. Va.) Djakarta noted opening 1115 over YDF2, 11.785, with Indian-type program, fair level. (Balbi, Calif.) YDB4, 3.377, Djakarta, heard opening in Indonesian language 0430, fair level in N. Z. (Hardwick) *Radio Sweden* lists *new* Djakarta outlets as YDF4, 17.810, YDF8, 9.865, 100 kw.

Vatican—HVJ, 11.865, noted 1330 ending *English* and leaving air. (Ferguson, N. C.) And on 9.646. (Sutton, Ohio)

Venezuela—Maracaibo. 4.805A, good level 1845 and yet at 2230 closedown. (McGraw, Ohio)

Yugoslavia—Radio Belgrade, 6.100, noted with news 1715. (McGraw, Ohio) Heard opening with *English* for Europe at 1330 on 6.100 parallel 7.200. Pearce, England)

* * *

Press Time Flashes

Jim Moore, Calif., advises that Charles Gustave Gallagher, veteran SWL, passed away recently. During World War II, "Gus," as he was affectionately known, and Fred Wolfe, now also deceased, copied messages from prisoners-of-war and relayed them to loved ones. Literally thousands of these messages were relayed, and in the possessions "Gus" left behind are cards and letters from thousands of grateful families, Jim writes.

Detailed information on the new set-up of World Friendship Society of Radio Amateurs is available direct from the secretary, Bob Kenny, c/o Mrs. S. Cain, R. R. 1, Kleinburg, Ontario, Canada. Headquarters of this club was moved from Britain to America this year.

Clandestine *Yugoslav Emigrant Station*, 6.885A, noted at fair level from 1600 tune-in to 1730 sign-off; *no Eng-*

lish noted. (Saylor, Va.) AFN, 3.188, Frankfurt, Germany, heard 1515 with weather report. (Pearce, England) *Radio Abidjan*, Ivory Coast, lists present schedule on 4.945 with 5 kw. as 0145-0230, 0715-0830, 1330-1630; sent letter verification *via* airmail. (Pearce) Heard in N. Z. at 1530 in French, closing 1600. (Hardwick) *DX-Radio*, Sweden, reports Kathmanduran, Nepal, *testing* on 9.856 at 0900; *not confirmed.*

A station announcing as "Voice of Vietnam," probably in Indo-China, has been heard in Australia at 0500-0600 on *measured* 11.904 and 15.018. (Radio Australia) Was first reported by Balbi, Calif., heard on 11.910A. At press time, Balbi, Calif., noted *Radio France-Asie*, Saigon, Indo-China, using 11.790 with news for Europe 1100, while the 9.755 outlet had news in French (formerly, this was reversed).

Present schedule of the *Far East Network*, AFRS, Tokyo, over a 10 kw. transmitter, is 0530-1000 and 1600-1800 on 6.160 and 1815-0515 on 11.750. (Cushen, N. Z.) JOZ2, 6.055, and JOZ, 3.925, Tokyo, commercial stations, have an "economic" report in *English* daily (*except Sat., Sun.* and market holidays) 0310-0320 which includes financial and market reports. (Balbi, Calif.) Noted with news in Japanese 0900 and closing around 0910. (Morgan, Calif.) A Dutch speaker heard by Cushen, N. Z., on 3.390 around 0500 is believed to be Hollandia, Dutch New Guinea, on a *new* channel.

Budapest, Hungary, has *English* for North America 1930-2000, 2300-2330 on 11.910, 9.833, 7.220; *English* for Europe 1500-1530, 1700-1730 on 11.910, 7220; has special *English* session for Britain on *Sun. only* 0600-0630, repeated 1100-1130 on 9.833. (Pearce, England) Winter schedule of *Radio Norway* to North America is to East Coast 2000-2100, to West Coast 2300-2400 over 6.130, 7.210, 9.610; on *Sun.* extends program by 20 minutes for "Norway This Week" (*English*). (*WRH*)

Radio Pakistan, 11.723A, noted 2100 with BBC news relay. YDJ2, Indonesia, is *closer* 7.096 now than *listed* 7.100; heard 1017 with man in Indonesian language. DZH8, 15.300, Manila, noted 2250 at fair level with Asian program and music. *New* NHK, Tokyo, point-to-point relay noted on 6.190 with QRM to TGWB (Guatemala) at 2345; in clear after TGWB closes around 2400; excellent when returned 0120. BCOF, 6.105, Kure, Japan, noted fading in 0215 at poor level with talk in *English.* (Morgan, Calif.) The 6.190 NHK outlet closes down 0300. (Balbi, Calif.)

* * *

Acknowledgment

Thanks for the FB cooperation during 1954, fellows! Here's wishing all of you the best of holiday seasons—and may DX galore come your way during 1955! Keep your reports coming to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, U.S.A. . . . . .K. R. B.

Broadcast Recorder

(*Continued from page 43*)

the lever farther to the left opens the head-closing mechanism wide to give full access to the heads and tape for marking or cutting and simultaneously brakes the motors to hold the reels. Actuation of the head-closing and pressure-roller mechanism is controlled by a die and cams solidly positioned on the control lever shaft by a D-shaped hole. The cams actuate the mechanism by means of grooved cam-follower rollers. The mechanism is simple, positive, and not subject to abnormal wear.

The tape spooling control lever of the coaxial system is interlocked to the tape drive control lever by a positive pivot action so that neither lever can be operated unless the other is in the "Stop" position. Moving the lever releases the brakes and varies the balance of torque in the spooling motors by means of a rheostat to give control of the rewind speed in either direction. This permits the user to rapidly shuttle the tape to locate any desired point on the reel preparatory to utilizing the "Cue" position of the tape drive control level.

The "Record" function is controlled by a rectangular push-button located in the lower head cover. This button is positively interlocked to prevent accidental erasure of the tape. It will not function in the "Run" position. The tape drive control lever must be in the "Stop" position and the "Record" button held down while the lever is moved to "Run." Returning the lever to the "Stop" position automatically releases the "Record" button and, since this must be done in order to place the recorder in "Cue" or "Rewind" condition, this operation is virtually foolproof.

The design of the magnetic transducers used in this broadcast recorder was a direct outgrowth of the specialized requirements of the motion picture industry's rigorous requirements for "CinemaScope" sound, a four-channel stereophonic system using magnetic sound tracks on both sides of the sprocket holes.

All of the electronic components of the broadcast recorder are mounted on a 5¼-inch by 19-inch relay rack panel, connected to the drive mechanism by multiple contact connectors. This amplifier panel contains the power supply, erase and bias supply amplifiers, the record amplifier, playback preamplifiers, and output amplifier. All low-level circuit filaments are filtered d.c.

The microphone input is a three-contact jack, feeding a high-gain triode stage through an octal plug that is adapted for a highly shielded microphone input transformer with input windings for 50 and 250 ohm inputs, balanced and unbalanced. The output of this stage is bridged by a bridging input for high-level unbalanced signals. The record amplifier is a straightforward triode cascade system with equalization to conform to the NARTB

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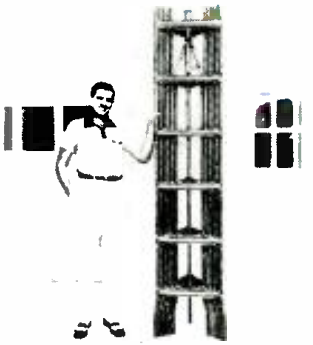
no. 6 tower

"All-Purpose" tower.

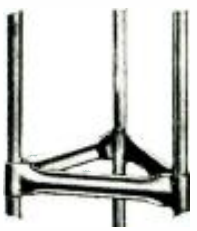
Fulfills 75% of your general tower needs—is structurally as sturdy—yet *costs less* than the well-known Rohn No. 10 Tower. Ideal for home and industrial installations, communication requirements . . . eliminates stocking many different tower models. *Self-supporting to 50 ft. or guyed to 120 ft.* Easy 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!

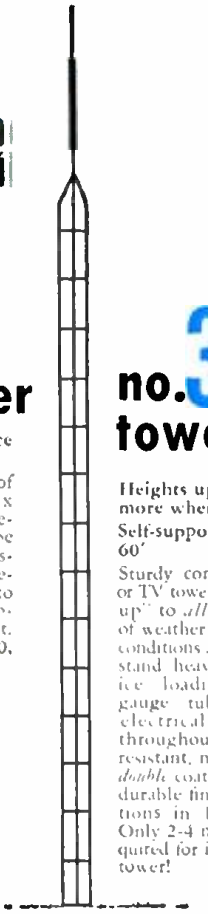
Popular PT-48 has almost 50' of sturdy tower within a compact 8' x 20" package! "Magic Triangle" design is adapted to a pyramid shape using a wide 19" base with progressively decreasing size upward. **Decreases your overhead** . . . easy to transport and assemble — cuts shipping costs. Galvanized throughout.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



Both Towers Feature

THE ROHN MAGIC TRIANGLE

For structural superiority, famed wrap-around "magic triangle" design is featured in these all-steel towers. Towers have full 2½" wide corrugated cross-bracing welded to tubular steel legs. The exclusive design assures dependable strength and permanence.



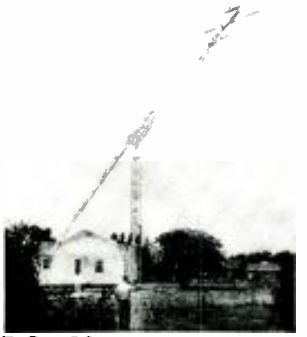
no. 30 tower

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.

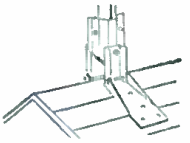
and a complete line of ROHN accessories —*all galvanized*

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*

116 Limestone, Bellevue Peoria, Illinois

curve effected by a selective feedback circuit over the last two stages.

The erase and bias amplifier is a balanced push-pull Colpitts circuit, feeding the bias to the record head from a separate winding on the oscillator coil through a bias level control.

The playback preamplifier is of all-triode cascade design and conforms strictly to the NARTB playback curve.

The metering circuit is of the v.t.v.m. type, with a selective switch to measure bias current, record current, and output level. The bias reading has an adjustment by which the meter reading is set to 100 after the proper bias has been determined for any given type of tape. This makes it possible to check the bias supply easily without reference to an arbitrary value.

The output amplifier is fed through a fader control, taking its signal from either the input or tape playback preamplifier. This permits making A-B checks during a recording with no click to indicate switching surges. The output stage is a cathode follower, with a plug-in transformer provision for zero-level, 600-ohm balanced line operation.

From the foregoing details, it becomes obvious that this new broadcast recorder offers many advantages to the recording engineer and the serious audiophile. —30—

SHIELDED ADAPTER

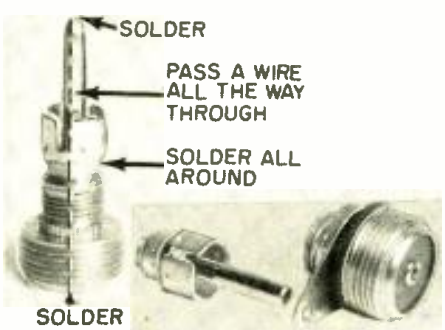
By ARTHUR TRAUFFER

WE occasionally run across amplifiers, preamplifiers, and other pieces of audio or test equipment, which use phono pin-jacks for the mike input connection. Since the conventional female mike connectors do not fit phono pin-jacks, some sort of adapter is needed to make a quick connection. The writer made a simple shielded adapter as follows:

As shown in photo at bottom, all you need is an Amphenol 75-PC1M (or equivalent) chassis unit, and a common phono pin-plug. Total cost about 25c.

The assembly is shown in the photo at the left. Remove the nut, washers, and lug, from the chassis unit. Insert the pin-plug in the hole in the chassis unit, as shown, and solder all around at the joint to make a secure assembly. The two parts can be held in a vise or C-clamp while doing this soldering. Now pass a short length of bare copper wire (about 22 gauge) through the unit and solder at both ends, as usual. You now have a shielded adapter that will fit any female mike connector to any phono pin-jack. —30—

(Left) Method for assembling the shielded adapter. (Bottom) Components required.



Spot Radio News

(*Continued from page* 16)

The televised picture can be photographed with an open-lens camera to obtain well-defined pictures for a permanent record.

THERE ARE STILL A NUMBER of technical problems, affecting the national defense, to be solved, according to the Department of Commerce's National Inventor's Council.

Specifically, it has been revealed, there are about 200 problems, and many of them obtain in the field of electronics. The government reports that some divisions of the military need a coaxial r.f. switch, miniature hermetically-sealed transistor cartridges, and a precision method for the growth of large single silicon crystals.

Because of the diminishing supply of natural quartz, the military has asked that synthetic quartz and all piezoelectric materials which offer a possibility as substitutes should be investigated. Materials now under study by the Signal Corps and a number of university and college labs include aluminum phosphate crystals, nepheline, tourmaline, and various types of water-soluble crystals.

Improved electronic telegraph printers are also urgently needed, Washington says. Existing approaches have been on the basis of producing an electronic printer having high speed, or up to 300 words-per-minute. However, it has been found that at these high keying speeds, the pulse lengths of the standard teletype code are so short that they have an inherent deleterious effect on high-frequency long-range radio operation. Some work has been done on schemes which seek to overcome this problem by using other types of transmission code. One type investigated employs multi-tone transmission of five audio frequencies. As with the standard teletype code, these five frequencies would afford thirty-two possible "on" and "off," or "mark" and "space" combinations. However, they would be transmitted simultaneously, as a single tone, thereby permitting transmission at five times the speed of standard teletype signaling, using the same code pulse length. It is felt, though, that there would be a great disadvantage in going to another type of code, because inter-operation with existing equipment would not be possible. It would be more desirable to provide an electronic printer that would operate from standard teletype code. Definite consideration should be given, the council declares, to the provision of an electronic printer to replace the existing mechanical printer that will operate at a speed of 100 words-per-minute. It is believed that the design and development of such a device would result in a lightweight and simple printer.

Solutions to these problems or ideas that might lead to solutions can be

sent on to the council where they will be examined and evaluated.

OFFICIAL PERMISSION to start "pay-as-you-see" broadcasting has been requested by the proxy of *Skiatron TV*, which holds a franchise to operate the "Subscriber-Vision" coding and decoding system. In a petition filed with the Commission, it was said that subscription TV offered the best and most immediate method of solving the ultra-high problem.

Pointing out that the FCC needs no further evidence of the economic plight of u.h.f. stations, the code-picture operator said that none of the recommendations made for assisting ailing u.h.f. stations has the inherent potentialities for the u.h.f. broadcasters that subscription television service can afford.

"We believe," the brief continued, "that a u.h.f. station will be able to derive sufficient additional revenue from 35 hours of subscription television service per week to enable it to build an audience, and thereby compete effectively with the established v.h.f. stations."

The three-year head-start in subscription TV proposed, it was said, would furnish to each u.h.f. operator an opportunity to improve substantially his economic situation. Instead of trying unsuccessfully to compete with the v.h.f.'s for the advertising dollar, Washington was told, the u.h.f. stations with subscription television will then be able to transmit selected programs of a type and quality not now available. And the sale of u.h.f. converters and adapters, now the bottleneck, the petition added, will thus receive a direct stimulus by the Commission's adoption of the modification proposed; for a large segment of the public will then be willing to add converters to their receivers, so as to obtain a supplementary service that does not now exist.

THE ARMY SIGNAL CORPS will procure approximately two-million tubes during the fiscal year of '55 for its own use, and about two and a quarter-million tubes for the Air Force. About 200 different types will be purchased for the Signal Corps and 130 types for the Air Force.

Some of the more popular types that the Signal Corps will use include 1AD4, 1N70, 1S5, 6AQ5, 1LH4, 1N21B, 2D21W, 6V6GTY, 6X4W, and 1R5. The latter is particularly important to the military; for the Signal Corps will need 297,000 and the Air Force over 400,000. Also high on the Air Force list is the 3Q4; they'll be using over 267,000 of this type. Another key tube on the Air Force spec list is the 6SL7WGT; over 75,000 will be bought.

THERE WERE 409 TV stations in operation, as this column was being prepared, according to official Commission records. Three stations, two in Louisiana and one in Sioux City, Iowa, all v.h.f. units, have gone on the air

CRYSTALS

Guaranteed to oscillate!

Your choice of frequencies!

Largest selection in the world!

NUMBERS LISTED ARE FUNDAMENTAL FREQUENCIES IN KILOCYCLES

ALL CRYSTALS TESTED FOR ACTIVITY! 1-DAY SERVICE FOR EVERYTHING IN STOCK!

FT-243

Lots of 10 or more. Ea. . . . . .
Lots of 5 or more. Ea. . . . 79c
Individually. Ea. 99c

69c

1015	2490	2855	3150	4395	5820	6473 3	7350	7625	7860	8083 3	8310	8550
1110	2495	2860	3155	4445	5825	6475	7358 3	7630	7866 7	8090	8316 7	8558 3
1129	2505	2865	3160	4450	5850	6500	7366 7	7633 3	7870	8091 7	8320	8560
1150	2510	2870	3165	4495	5860	6506 6	7373 3	7640	7873.3	8100	8325	8566.7
1195	2515	2875	3170	4535	5892 5	6525	7375	7641.7	7875	8106 6	8330	8570
1525	2520	2880	3175	4540	5900	6540	7383.3	7650	7880	8108 3	8333 3	8573 3
1900	2525	2885	3200	4580	5907 5	6550	7391.7	7658.3	7883 3	8110	8340	8575
1915	2530	2890	3202	4610	5925	6573 3	7400	7660	7890	8116 7	8341 7	8580
1930	2535	2895	3205	4620	5955	6575	7406	7666.7	7891.7	8120	8350	8583.3
1940	2545	2900	3210	4635	5975	6600	7406 6	7670	7900	8125	8358 3	8590
1950	2550	2905	3220	4680	5995	6606 6	7408.3	7673.3	7906 6	8130	8360	8591 7
1965	2557	2910	3225	4695	6000	6625	7416.7	7675	7908 3	8133 3	8366 7	8600
2015	2560	2915	3230	4710	6006 6	6640	7425	7680	7910	8140	8370	8606.6
2017	2565	2920	3235	4735	6025	6650	7433.3	7683.3	7916 7	8141 7	8375	8608 3
2020	2570	2925	3240	4780	6040	6740	7440	7690	7920	8150	8380	8610
2025	2575	2930	3290	4785	6042	6773 3	7441.7	7691.7	7925	8158 3	8383 3	8616.7
2035	2580	2935	3300	4815	6050	6815	7450	7700	7930	8160	8390	8620
2040	2585	2940	3310	4820	6073 3	6840	7458.3	7706 6	7933 3	8163 4	8391 7	8625
2055	2590	2945	3320	4840	6075	6873 3	7466 7	7708.3	7940	8166 7	8400	8630
2360	2595	2950	3340	4845	6100	6906 6	7473.3	7710	7941.7	8170	8406 6	8633.3
2065	2650	2955	3410	4852 5	6106 6	6940	7475	7716.7	7950	8173 3	8408 3	8640
2090	2655	2960	3420	4880	6125	6973 3	7483.3	7720	7958 3	8175	8410	8641.7
2105	2660	2965	3455	4900	6140	7000	7491.7	7725	7960	8180	8416 7	8650
2125	2665	2970	3465	4930	6142	7006 6	7500	7730	7966 7	8183 3	8420	8658 3
2130	2670	2975	3500	4950	6150	7025	7506 6	7733.3	7970	8190	8425	8660
2135	2675	2980	3510	4995	6173 3	7040	7508 3	7740	7973 3	8191 7	8430	8666 7
2140	2680	2985	3525	5035	6175	7050	7510	7741 7	7975	8200	8433 3	8670
2195	2685	2990	3640	5090	6185	7073 3	7516 7	7750	7980	8206 6	8440	8673.3
2300	2690	2995	3655	5127 5	6200	7075	7520	7758.3	7983 3	8208 3	8441 7	8675
2305	2695	3005	3680	5165	6206 6	7100	7525	7760	7990	8210	8450	8680
2320	2705	3010	3700	5180	6225	7106 6	7530	7766 7	7991.7	8216 7	8458 3	8683 3
2350	2710	3015	3760	5235	6235	7125	7533 3	7770	8000	8220	8460	8690
2355	2715	3020	3800	5245	6240	7140	7540	7773 3	8006	8225	8466 7	8691 7
2360	2720	3025	3885	5285	6250	7150	7541 7	7775	8006 6	8230	8470	8700
2365	2750	3030	3940	5295	6273 3	7160	7550	7780	8008 3	8233 3	8473 3	8706 6
2370	2755	3035	3955	5305	6275	7173 3	7558 3	7783.3	8010	8240	8475	8708 3
2375	2760	3040	3980	5327 5	6300	7175	7560	7790	8016 7	8241 7	8480	8710
2390	2765	3045	3990	5335	6306 6	7200	7566 7	7791.7	8020	8250	8483 3	8716 7
2415	2770	3050	3995	5385	6315	7206.6	7570	7800	8025	8258 3	8490	8720
2430	2775	3055	4045	5397 5	6325	7225	7573.3	7806 6	8030	8260	8491 7	8725
2435	2780	3060	4095	5435	6335	7240	7575	7808 3	8033 3	8266 7	8500	8730
2440	2785	3065	4110	5545	6340	7273.3	7580	7810	8040	8270	8506 6	8733 3
2442	2790	3070	4135	5582 5	6350	7275	7583 3	7816.7	8041 7	8273 3	8508 3	8740
2450	2795	3075	4175	5587 5	6362	7300	7590	7820	8050	8275	8510	8741 7
2455	2815	3095	4215	5645	6373 3	7306.6	7591.7	7825	8058 3	8280	8516 7	8750
2460	2825	3100	4220	5687 5	6375	7308.3	7600	7830	8060	8283 3	8520	
2465	2830	3110	4255	5730	6405	7316.7	7606 6	7833.3	8066 7	8290	8525	
2470	2835	3130	4295	5760	6406 6	7325	7608.3	7840	8070	8291 7	8530	
2475	2840	3135	4300	5775	6425	7333 3	7610	7841 7	8073 3	8300	8533 3	
2480	2845	3140	4330	5782 5	6440	7340	7616.7	7850	8075	8306 6	8540	
2485	2850	3145	4340	5800	6450	7341.7	7620	7858 3	8080	8308 3	8541.7	

FT-243

Lots of 10 or more. Ea. . . . . .
Lots of 5 or more. Ea. 39c
Individually. Ea. 49c

34c

4035	4980	5660	5773 3	5880	6273 5	6400	6725	6875	7475	7673 3	7825
4080	5030	5675	5780	5906 7	6275	6406 6	6750	6900	7506 6	7675	7873.3
4165	5205	5700	5806 7	5940	6300	6425	6775	6925	7525	7706 6	7875
4190	5300	5706 7	5840	5950	6325	6673 3	6800	6950	7573 3	7725	7906 6
4280	5437 5	5725	5852 5	5973 3	6350	6675	6806 6	6975	7575	7773 3	7925
4397 5	5485	5740	5873 5	6240	6373 3	6700	6825	7450	7606 6	7775	7973 3
4490	5500	5750	5875	6250	6375	6706 6	6850	7473 3	7625	7806 6	7975

CR-1A

Lots of 10 or more. Ea. . . .
Lots of 5 or more. Ea. . . 74c
Individually. Ea. 79c

69c

6350	6510	6740	7010	7180	7670	8013	8250	8290	8374
6380	6530	6750	7020	7230	7790	8155 7	8272	8308	8392
6450	6550	6890	7160	7550	8007	8200	8284	8340	8400

FT-171

Lots of 10 or more. Ea. . . . . .
Lots of 5 or more. Ea. . . . 89c
Individually. Ea. 99c

79c

			2123	2280	2415	2630	3010.5	3500	3667.5	3825	3995	4255	5492.5
			2125	2282.5	2435	2665	3175	3510	3682.5	3870	4012 5	4280	6000
			2131	2290	2442.5	2725	3202.5	3520	3695	3880	4037 5	4310	6210
			2145	2300	2467	2780	3205.5	3550	3700	3945	4050	4345	7165
			2150	2305	2470	2835	3215	3562	3712.5	3950	4080	4350	7950
			2155	2320	2532.5	2911	3237.5	3569	3760	3955	4097 5	4360	8000
1151 8	1940	2045	2191	2340	2545	2940	3250	3570	3790	3966.5	4110	4400	9200
1562.5	2010	2065	2220	2360	2550	2967	3322.5	3580	3807.5	3970	4112	4735	9590
1738	2030	2082	2258	2390	2557	2990	3400	3637.5	3810	3975	4171.5	5200	
1746	2040	2105	2260	2405	2582	3010	3422.5	3660	3812 5	3980	4245	5225	

TERMS All items subject to prior sale and change of price without notice. MINIMUM ORDER: $2.50. All CRYSTAL orders MUST be accompanied by check, cash or M.O. WITH PAYMENT IN FULL. No C.O.D. CALIFORNIA BUYERS add sales tax. INCLUDE APPROXIMATELY 5c PER CRYSTAL FOR POSTAGE. ALL CRYSTAL ORDERS—INDICATE SECOND CHOICE FREQUENCIES WHEREVER SUBSTITUTION MAY BE MADE.

NOVICE BAND

FT-243 FUNDAMENTAL FREQUENCIES

Lots of 10 or more. Ea. **99c**

Individually. Ea. $1.25

YOUR CHOICE OF FREQUENCIES!

80 METERS 3701, 3702, 3703 through 3748 in steps of 1 KC.

40 METERS 7176, 7177, 7178 through 7198 in steps of 1 KC.

DOUBLING TO 40 METERS: 3588, 3589, 3590 through 3599 in steps of 1 KC.

SINGLE SIDE BAND—FT-241-A

Low Frequency Crystals **79c**

Lots of 10 or more. Each. 89c
Lots of 5 or more. Each. 99c
Individually. Each. 99c

400	442	446	450	453	456	459	463	466	470	474	477
440	444	447	451	454	457	461	464	468	472	475	479
441	445	448	452	455	458	462	465	469	473	476	480

MISCELLANEOUS & SHIP BAND FREQUENCIES

81.95 KC. Octal tube type (Used in SCR-584 & SPM-1)	$3.99
200 KC. FT-241 CR2 U	1.99
200 KC. Type DC-15 in octal tube base type holder	1.99
327.8 KC. No. D-168312. (Used in TS-102 AP)	9.95
500 KC. FT-241	1.99
1000 KC. Type DC-9, in octal tube base type holder	3.45
2000 KC. FT-243	1.99
2009 KC. DC-34	2.99
2110 KC. DC-34	2.99
2126 KC. DC-34	2.99
2142 KC. DC-34	2.99
2166 KC. DC-34	2.99
2171 KC. DC-34	2.99
2182 KC. DC-34	2.99
2182 KC. FT-243	2.99
2206 KC. DC-34	2.99
2500 KC. FT-241	1.99
2559 KC. DC-34	2.99
2567 KC. DC-34	2.99
2629 KC. DC-34	2.99
2632 KC. FT-241	2.99
2637 KC. DC-34	2.99
2637 KC. FT-243	2.99
2638 KC. DC-34	2.99
2638 KC. FT-243	2.99
2670 KC. FT-241	2.99
2647 KC. FT-243	2.99
2670 KC. DC-34	2.99
2738 KC. Type 1-C	2.99
2738 KC. FT-243	2.99
2738 KC. MC-7	2.99
2801 KC. DC-34	2.99
2917 KC. DC-34	2.99
2951 KC. DC-34	2.99
2973 KC. DC-34	2.99
2977 KC. DC-34	2.99
2983 KC. DC-34	2.99
3000 KC. FT-243	1.99
3021 KC. DC-34	2.99
3023 KC. DC-34	2.99
3043 KC. DC-34	2.99
3053 KC. DC-34	2.99
3055 KC. DC-34	2.99
3088 KC. FT-243	2.99
3093 KC. DC-34	2.99
3093 KC. FT-243	2.99
3098 KC. FT-241	2.99
3108 KC. FT-243	2.99
3123 KC. DC-34	2.99
3125 KC. DC-34	2.99
3188 KC. FT-243	2.99
3193 KC. DC-34	2.99
3193 KC. FT-243	2.99
3198 KC. FT-243	2.99
3203 KC. FT-243	2.99
3000 KC. FT-243	1.99
10.000 KC. Type SIC-5 Bliley. In CR-1 holder	1.99

COMPLETE SETS!

SCR-508 Set of 80 FT-241 crystals $25.00
SCR-509 Set of 80 FT-243 crystals $32.00
SCR-510 Set of 80 FT-243 crystals $32.00
SCR-536 Set of 2 FT-243 crystals P.U.R.
SCR-609 Set of 120 FT-243 Xtals. $48.00
SCR-610 Set of 120 FT-243 Xtals. $48.00
TRC-1, TRC-3, TRC-4 . . . . . P.U.R.
SCR-608 Set of 120 FT-241 Xtals. $48.00

DC-34 & DC-35 CRYSTALS

Your Choice. Ea. only 99c

Pin Spacing ¾". Pin Diameter .1875".

			2240	2415	2643	2894	3161	3480	3750	3905	4055	4215	4435
			2255	2422	2665	2895	3190	3485	3760	3920	4065	4235	4440
			2258	2435	2685	2899	3201	3500	3765	3925	4080	4240	
			2275	2446	2710	2925	3270	3520	3770	3935	4085	4255	
			2280	2466	2711	2926	3279	3540	3775	3940	4090	4275	
1690	1890	2090	2295	2467	2725	2960	3280	3550	3790	3950	4095	4280	
1705	1910	2105	2300	2478	2732	2971	3297	3575	3792.5	3960	4097.5	4305	
1720	1930	2106	2315	2491	2745	2980	3311	3580	3807 5	3965	4115	4310	
1738	1950	2131	2326	2500	2764	3000	3317	3610	3825	3985	4130	4325	
1746	1970	2155	2335	2510	2775	3010	3365	3630	3830	3995	4135	4335	
1770	1990	2175	2340	2527	2776	3027 5	3385	3650	3850	4012.5	4150	4345	
1790	2010	2195	2355	2540	2807	3077.5	3390	3655	3855	4015	4155	4350	
1810	2030	2202	2360	2586	2816	3095	3395	3665	3870	4020	4175	4370	
1830	2050	2215	2375	2587	2831	3117	3412.5	3680	3885	4030	4177.5	4380	
1850	2075	2220	2380	2605	2851	3149	3422.5	3695	3890	4035	4192.5	4397.5	
1870	2082	2235	2395	2625	2853	3155	3462	3700	3895	4050	4210	4415	

U. S. CRYSTALS, INC.,

805 S. UNION AVE.,
LOS ANGELES 17, CALIF.

and boosted the number of commercial TV broadcasters.

ANOTHER MOVE to spark u.h.f. was made by the Commission, when they issued a ruling stating that telecasters could now own five v.h.f. and two u.h.f. stations. The proposal to increase ownership was made a year ago and the network owners agreed that the plan would serve to stimulate interest in the high channels.

Madame Commissioner Frieda Hennock dissented, asserting that additional ownership by multiple owners would not serve to solve the u.h.f. problem. In her opinion the revised rule sanctioned monopoly. She also felt that the numerical limitation did not take into account locations and markets of singly-owned operations.

Pending a firm decision on the high channels by the Senate investigating committee, a ruling on satellite or slave-station operation, and other complex hearing-room actions, few authorizations were being issued to new telecasters. At this writing, only the grants shown on this page were approved.

THE COMMUNICATIONS ENGINEER has played a stirring role in American industry and he will continue to blaze new trails that will benefit everyone. So viewed Merle E. Floegel of the Commission, during an address in Houston, Texas, before the IRE professional group on vehicular communications.

Describing the progress made in traffic control through mobile radio, the FCC spokesman said that one of the more recent developments has been in the regulation of auto traffic along the turnpikes; the high speed toll roads now springing up all over the land. He felt that the successful operation of these new wide-lane roads would not be possible without adequate communication.

Doctors and veterinarians, whose practices are in remote areas, the IRE audience was told, have also found

NEW TV GRANTS SINCE FREEZE LIFT

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

STATE	CITY	CALL	CHANNEL	FREQUENCY (mc.)	POWER* (Video)
California	Sacramento	.....	10	192-198	316
"	Visalia	.....	43	644-650	22.73
Florida	Tampa	.....	13	210-216	316
Indiana	Fort Wayne	.....	69	800-806	99.1
Michigan	Grand Rapids	.....	23	524-530	216
New York	Binghamton	.....	40	626-632	190
Texas	Ft. Worth	.....	11	192-198	222
Virginia	Petersburg	.....	8	180-186	316
West Virginia	Huntington	.....	13	210-216	238

NEW CALL LETTER ASSIGNMENTS

Florida	Tampa	WFLA-TV	8	180-186
Michigan	Grand Rapids	KCRG-TV	9	186-192

*ERP=(effective radiated power, kw.) . . =Call letters to be announced

NEW TV STATIONS ON THE AIR

(As of November 25, 1954)

The following new stations bring the lists published in previous issues up to date.

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER (IN KW.)
Alabama					
Montgomery	WSFA-TV	12	204-210	4.79	316
Indiana					
Waterloo-Ft. Wayne	WINT	15	476-482	2.06	20.5
Kansas					
Wichita	KAKE-TV	10	192-198	5.08	316
North Carolina					
Chapel Hill	WUNC-TV†	4	66-72	14.61	100
Tennessee					
Jackson	WDXI-TV	7	174-180	5.61	56.2
Wisconsin					
Milwaukee	WTVW	12	204-210	4.79	251
Wausau	WSAU-TV	7	174-180	5.61	89.8
Canada					
Calgary, Alberta	CHCT-TV	2	54-60	17.8	100
Saskatoon, Sask.	CFQC-TV	8	180-186	5.43	100

WTOV-TV, channel 27, Norfolk, Virginia, has gone off the air. KOPR-TV, channel 4, Butte, Montana, has been temporarily suspended.

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 410 (122 of which are u. h. f.) †Educational.

that radio-communication systems are extremely beneficial not only in serving humans, but livestock on the farms throughout the country.

Motion picture companies have also found radio communication almost indispensable to their operations, the FCC expert continued. When shooting out-of-door scenes, radio contact has been found to play an important part in coordinating action of widely separated groups, serving to time appearance before the camera with split-second precision.

The FCC report also disclosed that radio equipment is now installed on vehicles used in conjunction with the maintenance of buildings and grounds of large universities, in orchards and cemeteries, on ranches, golf courses, and hunting clubs; and it will also be found installed on lift trucks used for material handling in warehouses, factories, and refineries. Even some of the drive-in restaurants have begun to use two-way for relaying orders from the car hops to the kitchen.

One of the most novel applications has been in the advertising field for skywriting, it was revealed. It's no longer necessary for a skywriter in a single plane to trace his message slowly in the sky. Instead, seven planes, flying at uniform speed, in straight-line formation, one alongside the other, can release puffs of dense white smoke at proper intervals and form a stream of block letters, or a single letter. This is done by controlling the valves in the smoke chambers by coded signals, which are transmitted by radio from a command plane, usually the center one of the seven. A separate signal automatically controls the valve in each plane.

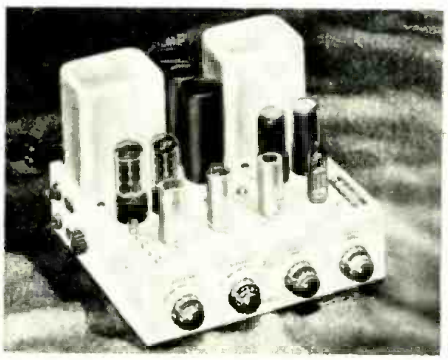
In his opinion, the FCC expert said the most important role of the communications engineer is that of designing a system that will assist in coordinating the activities of an organization and thereby reducing non-productive time to a minimum. Certainly it is evident, he stressed, the book shows that American engineers have met his challenge and rung up an enviable record of achievement in radio-communications industrial history. . . . . L.W.

NEW AUDIO EQUIPMENT

E-V AMPLIFIER

Electro-Voice, Inc., Buchanan, Michigan is currently marketing the Model A20C, a 20-watt amplifier which combines the company's "Circlotron" circuit with a new critical damping control.

All d.c. is removed from the output transformer permitting cool, optimum



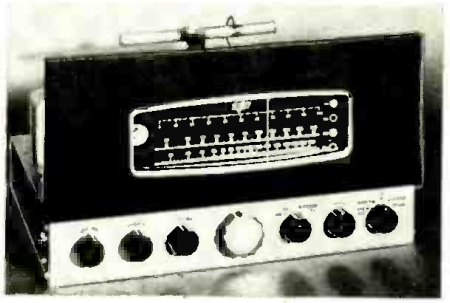
utilization of the output tubes. The damping factor control permits perfect match of the amplifier output impedance to the critical damping resistance of the speaker as well as to the type of enclosure.

Power output is 20 watts rated, 40 watts on peak. Frequency response is 20 to 20,000 cps ± .1 db at full 20 watts. Inputs include "ultra-linear" phono, magnetic phono, tape or TV, tuner or TV, hi-Z microphone while the controls consist of a function selector, record compensation, level, loudness, bass, treble, damping factor, and two hum adjustments on the chassis.

SCOTT FM-AM TUNER

Scott Radio Laboratories, Inc., 1020 N. Rush Street, Chicago 11, Ill. is now offering the Model 5001X FM-AM tuner to the audio trade.

The tuner features a separate power amplifier chassis and includes automatic frequency control, new selector switch for automatic level, and fre-



quency compensation to NARTB, LP, "Ortho," AES, and RIAA recording standards.

The chassis is chrome plated and has a hand-formed, genuine leather dial board. The tuner has seven controls, fourteen tubes, including the tuning-eye and rectifiers.

The separate high-fidelity power amplifier is on a separate chrome chassis. It provides response flat from 30 to 15,000 cps with power output of 20 watts. A bulletin on this new unit is available on request.

LOW-PRICED SPEAKERS

A new low-priced line of 4" and 5" speakers is now available from *Heppner Manufacturing Company* of Round Lake, Illinois.

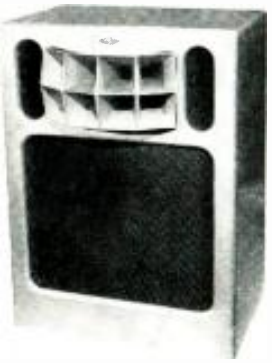
The company advises that new manufacturing techniques permit the low price without impairing quality. Either a break or a cast magnet can be used in the construction with plugs, transformers, and/or brackets being supplied according to the customer's specifications.

Write the company direct for details on this new line.

NEW STEPHENS CABINET

An improved and redesigned version of the company's "Tru-Sonic" Model 617 cabinet with enclosed two-way loudspeaker system is now being marketed by *Stephens Manufacturing Corp.*, Culver City, California, as the "Crusader."

The cabinet houses a complete two-way system consisting of the new 103LX low-frequency loudspeaker and 800-cycle crossover network. In addition, the audio system includes a Model 216 high-frequency speaker associated with a 2 x 4 multicellular



horn affording 40 degrees vertical and 80 degrees horizontal dispersion of high-frequency energy.

Constructed of birch hardwood in either silver hammertone or natural finish, the cabinet measures 20½" deep, 26" wide, and 36" high. It employs a modified bass reflex using rear horn loading to lower the fundamental resonance of the low-frequency diaphragm.

"MARK 30A" POWER AMPLIFIER

Brociner Electronics Laboratory, 344 E. 32nd St., New York 16, N. Y. is in production on a new 30-watt power amplifier and companion audio control center, both using the company's printed circuit production technique.

The "Mark 30A" is rated at 30 watts at 1 per-cent intermodulation distortion. At 20 watts the IM distortion drops below .2 per-cent and below this level is reduced to a virtually unmeasurable level. The entire amplifier

measures 3½" x 12" x 9". Adequate ventilation is provided by the use of perforated metal for most of the chassis.

The companion 30C audio control center is a self-powered preamplifier that provides complete facilities for

selection of radio, TV, tape or phono inputs, separate turnover and roll-off controls for record compensation, continuously adjustable bass and treble controls, and a loudness control. The audio control measures 3½" x 10¾" x 6". Three tubes are used.

AMPLIFIER KIT

Tech-Master Corp., 75 Front Street, Brooklyn 1, New York is now offering a deluxe amplifier kit, based on the *Williamson* circuit with modifications, the TM-15A.

This 20-watt unit has distortion less than .25 per-cent at normal listening levels. For ease of assembly and wiring, all tube sockets and terminal strips come riveted in place on the chassis. Complete step-by-step pictorial diagrams and schematics permit the builder to complete the construction in record time.

A companion preamplifier-equalizer kit, the TM-15P, which has four input channels and a selector switch for FM, AM, or TV, crystal or reluctance pickups, tape recorder or other signal source, is also available from the company.

SPEAKER SYSTEM

Gramercy Sound Associates of 175 Fifth Ave., New York 10, New York is

now offering an 8" speaker system which incorporates the *Goodmans* "Axiette 101" speaker.

The speaker, an English hi-fi unit, employs a hyperbolic cone with a stepped, plastic-impregnated linen suspension. Frequency response is 40 to 15,000 cps, flux density is 13,500 gauss.

The cabinet which houses this speaker is made of ¾" wood and is available in hand-rubbed mahogany or

blonde finishes on birch veneers. Total weight is 35 pounds. It measures 24" high, 10½" deep, and 17" wide.

Literature on the Model 101 is available on request.

WEATHERPROOF COAXIAL

University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y. is marketing a full-range weatherproof coaxial loudspeaker, the Model BLC, which offers good reproduction for p.a. applications.

The Model BLC measures 22½" in diameter and 9" deep. The unit comprises a low-frequency woofer that is coupled to a balanced compression-type exponential horn. The horn starts with a large 8" throat which extends to the 22½" diameter mouth, giving highly efficient low-frequency response. Coaxially mounted, to conserve space, is a separate high-frequency tweeter with its own driver unit, coupled to a wide-angle horn incorporating the company's patented "reciprocating flares" principle. A built-in frequency dividing network provides for crossover at 2000 cps.

SHURE STUDIO MICROPHONE

Shure Brothers, Inc., 225 W. Huron Street, Chicago 10, Illinois has just introduced a new studio microphone, the Model 333.

The unit is a uni-directional microphone which features extended frequency response (30-15,000 cps ± 2½ db), the company's patented "Uniphase" system, small size, and slim design.

The new microphone, while designed specifically for TV studios, motion picture studios, radio stations, and professional recording studios, is suitable for professionals and hi-fi enthusiasts who want quality recording in the home.

A copy of catalogue 33 describing this microphone is available from the sales division of the manufacturer.

PREAMP-EQUALIZER

Fairchild Recording Equipment Co., 154th Street and Powells Cove Blvd., Whitestone 57, N. Y. is now marketing its Model 240 preamplifier-equalizer.

This completely redesigned and restyled unit incorporates several new circuit advances, including one-knob control for both program selection and record equalization. An exclusive "Balanced Bar" control system allows tailoring the tonal content to best suit

the acoustics of the room. In addition, a carefully-engineered listening level control has been included to set

the range within which listening is to be done.

The unit features a low-noise cascode-input stage and a special self-contained power supply which contributes to its high gain and low noise.

CONVERSION KIT

Dynamu Magnetronics Corporation, 21 N. Third St., Minneapolis 1, Minn. has developed a "conversion kit" which contains heads and all of the necessary components to convert home type and professional tape recorders to "studio quality" units.

Complete, illustrated step-by-step instructions are included covering the installation and electrical changes that are required. Currently, two kits are available, one for recorders using two heads and the other for three-head units.

Pentron, Airline, Revere, RCA, Wilcox-Gay, Knight, Masco, Concertone, Magnecorder, Magnecordette, and *Webcor* recorders can be converted with the kits. For details on the model number conversion kit to use with a specific recorder, write the company direct.

PORTABLE AUDIO UNIT

Ampex Corporation of 934 Charter Street, Redwood City, California has come up with a 25-pound portable amplifier-loudspeaker unit, the Model 620.

The new portable incorporates a specially-designed loudspeaker with a

complementary 10-watt audio amplifier in an acoustically correct enclosure. Response of the 620, measured in air by accepted acoustical standards, is essentially flat from 60 to 10,000 cycles. The unit is encased in a *Samsonite* luggage-type carrying case.

"UNIVERSAL ADAPTER"

Audak Company, 500 Fifth Ave., New York 36, N. Y. is introducing a universal adapter which permits the

company's tone arms to be used with practically any cartridge of any make.

The special compass-pivoted construction, which requires no springs and uses only three parts, maintains uniform point pressure irrespective of climatic changes, offers practically no restraint upon the stylus travel, has virtually no frontal oscillation, and keeps the cartridge in full view, thus permitting accurate stylus-to-record alignment.

FOLDED HORN CABINET

G & H Wood Products Co., 75 North 11th Street, Brooklyn 11, N. Y. has recently added the "Klipsch-Cabinart KR-5" to its line of speaker cabinets.

This corner folded horn, designed to accommodate either 8- or 12-inch speakers, is available in finished, unfinished, or leatherette-covered models. The cabinet performs exceptionally well using the *University* 6201, *Electro-Voice* triaxial 12", or the *Altec-Lansing* 601A.

The KR-5 weighs 25 pounds and measures 21" high, 16⅝" wide, and 14" deep. It can be wall-mounted, corner-hung, placed on a table, a bench, or a shelf.

A.F. CURVE TRACER

Maico Company, Minneapolis, Minn. recently introduced a new and improved version of its audio frequency curve tracer.

The new unit features a 12" cathode-ray tube to make it especially suited for research, quality control, and production line testing of receivers, microphones, speakers, filters, transformers, and other partial or complete audio assemblies. —30—

FM-Only Tuner

(*Continued from page 73*)

with a single flick of the finger. A fine tuning knob is provided for exact tuning of weak stations in the presence of severe interference.

The over-all dimensions of the tuner are but 4½" x 13" x 10¼". The instrument is housed in a metal case which provides protection from dust, and is styled so that the tuner can be used "as is" on a shelf or table. If cabinet mounting is desired, this can be accomplished readily with a simple escutcheon without removing front panel or adding shaft extensions.

Designed to surpass the quality requirements of the best FM transmitters and to operate without noise and interference under the most adverse conditions, this new tuner combines all significant technical features and refinements known at this stage of the art. The over-all circuitry is shown in Fig. 2. Unique operating convenience, attractive styling, and moderate cost make it applicable to serious home music systems as well as to professional broadcast monitoring. —30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

AS THE year draws to a close it is both interesting and educational to look back and review what happened in the electronics industry during 1954 and appraise the immediate and possible future effects of the year's developments on the fortunes of independent electronic service as a business.

Color Television

The Federal Communications Commission's Christmas gift to the public last year was the acceptance of industry-developed standards for a system of compatible color television. The industry-wide National Television System Committee (NTSC) accomplished a truly remarkable achievement in developing and proving out the basic standards for this color television system in the comparatively short period of time it required to accomplish its objectives.

At the outset, there were many optimistic reports about the number of color television receivers that could be produced during the first year of the life of compatible color TV. Some early estimates freely predicted the production of more than a quarter of a million color television sets by the end of 1954.

A number of manufacturers produced fifteen-inch sets to test consumer reaction to quality of color and to price. While there was a tremendous interest in the new medium and an enthusiastic response to the quality of color reproduction, the small screen sets failed to attract many purchasers. About mid-year, the nineteen-inch color television receiver became a practical reality with a twenty-one inch set in the offing. Now, at year's end, it looks as if 1955 will see the industry's aggressively competitive manufacturers well on their way to making the general public color TV conscious and hungry for sets.

During the developmental stages of an entirely new product it is difficult to forecast the pattern that will eventually be created to handle the work of its installation, maintenance, and service. However, just as monochrome television created entirely new servicing facilities and techniques over that required for radio, so will color television change the service picture to adequately take care of its more complex needs.

The first requirement for color television servicing is the need for a vast army of trained technicians. Electronic and production engineers have proven time and time again that once the basic technology for a commercial product has been determined from practical experience all production barriers are quickly surmounted. Because of this factor, it would be quite possible for the production of color television receivers to outstrip the available, trained technical manpower to handle the installation and servicing.

This situation points up the tremendous educational job that faces the entire television industry and one that is of particular importance to the independent service industry.

Fortunately, the industry as a whole and individual manufacturers and technical book publishers have been making a wealth of technical training material available to the independent service industry.

Every operator of an independent service business should assume some personal responsibility in the programs to train color television technicians in his own area or locality. Service businessmen should take an active part in the formation of all-industry committees in their communities to work with educational authorities to make the RETMA-sponsored technician upgrading programs available in their local trade schools.

For some time to come set manufacturers will have to stay in close touch with their receivers in the hands of purchasers. The best qualified estimates about the amount of service that will be required on the average color set is ten calls per year. It is also estimated that the average time required on each service call will be two hours. The warranty contracts now in force seem to be priced on the basis of these estimates.

It would be unwise for any service business operator to accept contract service on color television receivers at current contract rates without some positive assurance from the set manu-

NNY PROFIT POLICY MEANS GREATER BARGAINS

RECORDER

DUAL SPEED 3¾" and 7½" PER SECOND 1954 MODEL 4A10

Stock No. AMP-19

$99.99

Reg. $149.95

It's ready to play—complete with latest Prest-O-Matic Push Button Keyboard. Features 2 Record Level Indicators. Radio-Phono-TV Input Jack. Record Lock Button. Fast Forward and Reverse. External Speaker Jack. Foot Control Outlet. Line Cord, and Crystal Microphone.

Thousands of satisfied users including schools, musicians, doctors, lawyers, industry, music lovers, etc., have purchased this identical Recordio for $149.95—Now Olson gives you the chance to get yours for only $99.99—A savings of nearly $50.00.

Takes 3", 5" or 7" reels—records for 2 full hours at 3¾" per second on a 7" reel using both sides of tape or for 1 hour at 7½" per second on a 5" reel. Storage space in rear of case for tape, mike, cord, etc. Portable two-tone case measures 14" x 14" x 9". Operates on 115 Volts AC 60 cycles. 100% Manufacturers and Olson Guaranteed—U.L. Approved—Original Factory-Sealed Carton. Shpg. wt. 32 lbs.

FIRST QUALITY PLASTIC BASE RECORDING TAPE

1200 Ft. Tape on 7" Dia. Reel

STOCK NO. X-249
LOTS OF 12, EACH. **$1.59**
Single, ea. . . $2.19
Lots of 6, ea. 1.79

This famous brand tape regularly sells for $3.50—but Olson gives you a 71% discount. Perfect in every respect, this quality tape is famous for its low noise level and uniform output. Freq. response 50-15,000 cps—red oxide base—¼" wide. Reg. $1.25 seven inch plastic reel included—fits all recorders. Stock up now during this Giant Sale and get the Tape Buy of Your Life. Shpg. wt. (one dozen) 10 lbs.

Espey HI-FI AM-FM RADIO CHASSIS

Complete with 10 Matched Tubes, Knobs, Escutcheon, Antennas and Hardware, Only **$49.95**

STOCK NO. RA-166

Espey Chassis with 12" Magnavox Speaker—STOCK NO. AS-117—ONLY $52.50

Espey Chassis complete with 12" Co-axial Speaker—STOCK NO. AS-118 ONLY $59.95

Olson scoops the nation with this tremendous HI-FI Buy. Regularly sells for $147.50, but Olson put cash on the line so you could save money on the one chassis designed for Quality Installations. Every chassis packed in original factory-sealed carton. 100% Double-Guaranteed by Olson and the Manufacturer. Five of the ten matched tubes are dual-purpose—giving you the equivalent of 15 tube performance. This brilliant AM-FM radio is equipped with built-in Pre-amplifier for GE or any low variable reluctance or any standard crystal phono pick-ups. Features special drift compensator, universal phono input, 3-position equalizer for finest record playback, beam power amplifiers for powerful audio and RCA-Razzetine licensed circuits. Chassis finished in high-lustre and measures 13½" wide, 7¾" high and 10" deep. Front panel neutral grey to match any decor. Dual edge lit slide-rule dial. 115 V. AC 60 cy. Full instructions and mounting diagrams included. Shpg. wt. without speaker 25 lbs., with speaker 32 lbs.

With Crystal Turn-over Cartridge and 2 Precious Tip Needles. STOCK NO. RA-157 **$28.95**

With GE V.R. Turn-about Cartridge and 2 Precious Tip Needles. STOCK NO. RA-158. . . . **$32.95**

NEW WEBSTER-CHICAGO (Webcor) ALL-SPEED AUTOMATIC DISKCHANGERS

Now you can save $20.00 on the latest model Webcor record changers. Your choice of either model. Ideal for use with Espey Chassis or any radio, amplifier or TV set installation.

Plays a 1" stack of 7", 10" or 12" records at 33⅓, 45 or 78 RPM. Features include automatic adjustment for any dia. record stack, improved spindle and automatic shut-off after last record. For 115 V. AC cy. Base size 13⅜" x 12" x 8¼". Shpg. wt. 13 lbs. Webcor Mounting Base—STOCK NO. X-363, ea. $4.95. Shpg. wt. 3 lbs.

Golden Classic Custom Hi-Fidelity Amplifier

Stock No. RA-165 with Matched Tubes **$34.95**

Guaranteed to bring unexcelled listening pleasure and technical perfection at the most reasonable price. Delivers 10 full watts constantly, with much higher peaks. Wide range flat response from 20 to 30,000 cycles at less than 1% to 1% distortion. Features include phono cartridge selector switch, treble and bass boosts, fine hi-lites: 1 mike, 1 radio, 1 crystal phono and 1 magnetic phono. Push-pull output—4, 8, and 16 ohms. Built-in Pre-amp. Can be used with any PM speaker, tuner, phono pickup or any crystal, ribbon or dynamic mike. Size 7" high x 11" wide x 7" deep overall. 115 V. 60 cycles AC. Shpg. wt. 13 lbs.

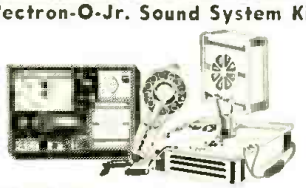
Nationally Advertised Tester—SUPER METER

Combination Volt-Ohm-Milliameter PLUS Capacity, Reactance, Inductance & Decibels Complete with Instructions and Test Leads

STOCK NO. TE-47 **$16.95**

Measures capacity and leakage of paper and electrolytic condensers. Look at all these Ranges—DC VOLTS: 0 to 7.5/75/150/750/1500. AC VOLTS: 0 to 15/150/300/1500/3000. DC CURRENT: 0 to 7.5/75 MA/0-7.5 AMPS. RESISTANCE: 0 to 10,000/100,000 ohms/0 to 10 megs. CAPACITY: .001 to .2 MFD/.1 to 20 MFD. REACTANCE: 150 to 25,000 ohms/15,000 ohms to 2.5 megs. INDUCTANCE: 15 to 7/3 Henries/5 to 700 Henries. ELECT. LEAKAGE: 0-100,000 ohms/100,000 to 10 megs. DECIBELS: −10 to +18 db, −10 to +38 db, +30 to +58 db. Round cornered molded case measures 3 x 6 x 2¼". Operates on 115 Volts AC. Shpg. wt. 4 lbs.

Electron-O-Jr. Sound System Kit



Stock No. RA-179 **$6.95** Reg. $19.95

CAN BE ASSEMBLED IN TWO HOURS

Ideal Christmas Gift. That way you know can now build and operate a complete 1-tube plus rectifier-amplifier P.A. Sound system and easily learn principles of electronics. Includes 5" PM Speaker, Dual Electrolytic Condenser, 75 ma Selenium Rectifier, 3 Resistors, 2 Switches, Volume Cont'l and knob, Input and Output Transformers, Carbon Granule Microphone, 12A6 Tube, 50 ft. 2-conductor Cable, Hook-up wire, Solder and all necessary clips, sockets, hardware, panels and punched forms to make amplifier cabinet and speaker baffle. Simple Instruction book included. Operates on 115 Volts AC or DC. Comes in 4-color gift carton. Shpg. wt. 10 lbs.

12" CO-AXIAL SPEAKER

Stock No. S-168 **$12.95**

Newly designed 1955 Model—guaranteed to give wider range and better all around performance than any Co-Axial we've ever featured. 12 watts output. 35 to 15,000 cps response ± 6 db — 8 ohm impedance. Crossover—2000 cps. 6.9 oz. Alnico 5 Magnet in woofer. 5" tweeter reproduces the highest of notes with utmost clarity. Aluminum moisture-proof voice coils for better heat dissipation. Shpg. wt. 6 lbs.

▲▲▲ COMBINATION DEAL! ▲▲▲

Golden Classic Amplifier & 12" Co-Axial Speaker

Save plenty when you order this special Olson combination. You get the Golden Classic HI-FI Amplifier PLUS the 12" Co-Axial Speaker both as described above for this drastically reduced price. Shpg. wt. 19 lbs.

Stock No. AS-112 **$41.95**

ALLIANCE TV TENNA-ROTORS

Prices reduced on Latest Models. Compact, precision built for eye appeal as well as durability. "Beams" TV antenna in the best direction for strongest signal within range. Life-time lubricated rotor encased in water-tight case. Takes antenna masts up to 1⅜" dia. 115 Volts AC—30 watts. Rotates 360° at 2 RPM

Standard Model F-4 **$18.75**

STOCK NO. AU-15
Panel lamp indicates end of 360° rotation. Control box & rotor—shpg. wt. 12 lbs.

Deluxe Model T-10 **$22.50**

STOCK NO. AU-12
Control bar on top—with direction pointer. Control box & rotor—shpg. wt. 12 lbs.

Deluxe Automatic

STOCK NO. AU-21 **$26.25**
Fully automatic—set it and forget it. Control box and rotor—shpg. wt. 13 lbs.

4-Conductor Cable Stock No. W-62 100 ft. only . . **$2.95**
For all Tenna Rotors—Shpg. wt. 3 lbs.

Thrust Bearing for Heavy Antennas. Shpg. wt. 3 lbs.
STOCK NO. AU-13 $2.91

GIANT TV ANTENNA KIT

Complete kit—nothing more to buy. For best reception on all VHF channels. Rustproof Aircraft Aluminum. Contains: 2 six-element conical bays, 1 pair Q bars, 2 five ft. 1¼" mast sections, 60 ft. 300 ohm lead-in, 3 standoff insulators, 2 screw-eye standoffs, 1 mounting base, 1 guy ring, 4 clamp ass'y, 1 pipe strap, 4 lug bolts and full instructions. Save—order 12 sets—only $119.50. Shpg. wt. each 13 lbs. Express only.

Stock No. AU-24 REG. $31.95 **$12.99**

FREE — WHOLESALE CATALOG!

Get Olson's LOWER than wholesale prices on famous brands—brand new and Double Guaranteed by Olson and Manufacturer. Send for your FREE copy now—it's mailed bi-monthly with new low bargains each mailing.

Mail orders for merchandise on this page to:

OLSON RADIO WAREHOUSE
275 E. MARKET ST., AKRON 8, OHIO

232 RESISTORS KIT

STOCK NO. AS-84 **$3.95**

Value Packed with 200 ½-watt, 20—1 and 2 watt; and 12—5 to 25 watt wirewound resistors worth over $23.50. 5—10—20% tolerances. Includes IRC, Clarostat, Centralab, etc. 100% Olson Guaranteed. Shpg. wt. 2 lbs.

HOOK-UP WIRE

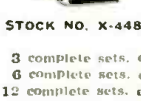
STOCK NO. AS-135
KIT OF 5—100 FT. ASSORTED COILS **$1.97** KIT

3 KITS (15—100 Ft. Coils)—$5.00

Every foot absolutely perfect. Includes solid and stranded types—cotton, rubber or plastic insulated. 300 Volt, 75° C Hi-test wire. Most fantastic deal ever offered. Kit of 5—shpg. wt. 2 lbs.

"Powerfone" Cradle-Phones

Self-powered with Built-in Buzzers



Complete two phone system
STOCK NO. X-448 **$5.95** SET

3 complete sets, each $4.95
6 complete sets, each $4.50
12 complete sets, each $3.95

Perfect for Christmas Giving. Works up to one mile, durable, dependable. Lifetime electro-magnet earphone. Gold-plated diaphragm carbon mike. Connects in 2 seconds—place on table or mount on wall. Complete—you get 2 telephones with built-in buzzers, 2 cradles, 2 batteries, 50 ft. double cable. Handsome Gift Carton. Money-back Guarantee if not twice as Good as you Expected! Shpg. wt. 4 lbs.

MINIATURE ELECTRIC MOTOR

STOCK NO. X-403 **$1.19** EA.
3 FOR $2.95, SINGLE. .

Ideal for running model cars, boats, remote control devices, etc. Operates on 3 to 6 Volts DC. 5 pole armature, bronze bearings and Alnico 6 Magnet. Shaft dia. 3/32". Size 1½ x ¾ x 4¼". Shpg. wt. 1 lb.

HOW TO ORDER

Send remittance with order (Add for postage 5¢ for each dollar's worth ordered—10¢ for each dollar's worth if you are more than 1000 miles away. OLSON REFUNDS EVERY CENT NOT USED). Or send no money—we'll ship C.O.D. and you pay mail or expressman for merchandise and postage. ALL MERCHANDISE 100% GUARANTEED. PLEASE—MINIMUM ORDER $3.00. RN-1254

QUANTITY	STOCK NO.	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL _____

ADDRESS _____ ADD POSTAGE _____

CITY _____ ZONE _____ STATE _____ TOTAL AM'T. _____

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Pittsburgh, Pa. 5918 Penn Ave. ★ Chicago, Ill. 623 W. Randolph ★ Cleveland, O. 2020 Euclid Ave.

Visit the store nearest you

OLSON RADIO WAREHOUSE 275 EAST MARKET ST., AKRON 8, OHIO

facturer for subsidization if his receivers required a higher average number of service calls or if the service time required exceeded two hours on an average.

Because of the need for extensive operational information on their sets and the many unknowables about the amount of service they will require, set manufacturers will maintain a rigid control over placement of service contracts and in the supervision of service on their receivers. It is quite likely that some set distributors may establish the personnel and facilities to give factory-supervised service under programs that will provide for the gradual shift to independent service firms as service requirements become better known.

Good service association could speed the time when color TV service will be shifted to the independents by working closely with distributors and their color television servicing organizations.

Association Developments

Perhaps the most outstanding development in independent service during the year was the rapidly-widening interest in association activities and the formation of new service associations in practically every section of the country. This interest in cooperation clearly reflects the growing concern among established service businesses over the future of independent service in the fast-growing industry and the desire to stabilize the business of servicing on a higher plane of business ethics and technical proficiency.

Studies of the memberships of new service associations indicate that a stable service industry has been created in the cauldron of competition. The members of this industry have come to realize that the basic problems of service business stability can only be accomplished through the close cooperation of ethical competitors. There is also a recognition that technical competence alone is not sufficient for the successful operation of a service business. The growing interest in management factors reflected everywhere in the development of service selling programs of various types and in the elements of service business management presages a new and potent force at work in the activity of electronic servicing.

Another event of interest during the year was the formation of another regional association to bring together practically all of the individual associations of various types in its area to formulate programs that embrace all of the elements of electronic servicing. The Eastern Television Service Conference, Inc., comprising 37 service associations located in states along the Atlantic seaboard, completed its organizational pattern and held its first full-fledged series of meetings in Philadelphia early in the year.

The associations that banded together to form the ETSC include those organized by service dealers, dealers

with service departments, and employed technicians. The conference was held in connection with a 3-day color television symposium sponsored by the Council of Radio & Television Service Associations of Philadelphia. Officers elected by the delegates included Harold "Dusty" Rhodes of Patterson, N. J., as chairman; Bert Bregenzer of Pittsburgh, Pa., as vice-chairman; John Rader of Reading, Pa., treasurer; and Ferdinand J. Lynn of Buffalo, N. Y., secretary. Trustees of the corporation include Roger K. Haines of Haddonfield, N. J., Albert M. Haas of Philadelphia, Pa., and Max Liebowitz of New York City.

By means of their dynamic house organ, the "TSA News," the Television Service Association of Michigan has succeeded in crystalizing the thinking of legitimate service businessmen in all parts of the state about the dire need for and effectiveness of cooperation through association. The Detroit TSA, nationally known for its successful efforts in combatting unethical service practices with full cooperation of their Better Business Bureau and local law enforcement agencies, continued to set the pace for tangible results from cooperative effort. The Greater Detroit Electronics Parts Show, a cooperative venture sponsored by twelve independent parts jobbers in Detroit and Pontiac, represented the first project of its kind in the area held exclusively for dealers and service technicians.

The annual clinic and fair sponsored by the Texas Electronic Associations brought hundreds of service businessmen to Dallas from all parts of Texas and from adjoining States. The attendance far exceeded that recorded at the first state-wide affair held in Forth Worth in 1953.

Delegates from member associations made tentative plans to expand the activities of the state association to interest service business operators in communities where local associations are impractical.

The annual NATESA convention, held in Chicago late in September, brought delegates from member associations in all parts of the country and interested observers from many non-affiliated associations. Included among the observers was a service operator from Caracas, Venezuela, whose efforts may result in the broadening of NATESA to become an international association.

The primary purpose of the annual NATESA convention is to permit committees to complete the final details of their assignments before presentation to the membership for approval and the election of officers for the ensuing year.

The consensus among observers who attended the convention was that the organization is structurally sound and merits the wholehearted support of all service and dealer organizations. It was noted that there is an homogeneity and enthusiasm among the present member associations of NATESA that

will inspire many presently nonaffiliated associations to join the national organization as its 1954-1955 program unfolds.

Service Association Objectives

A study of the published objectives of service associations released during the year reveals an interesting concordance in what is badly needed to stabilize servicing and to make it a worthwhile venture as a business enterprise. The following list represents a cross-section of the needs of the industry that were specified in all association programs during the year.

Public Relations—The set owning public is still inclined to look upon television receivers as comparatively simple devices that are easy to repair. Also, there is a marked tendency to put up with degraded pictures rather than to spend money on maintenance.

Service operators are universally of the opinion that a strong public relations program in the interests of competent electronic service is a responsibility of the over-all industry. They feel that the set manufacturers have over-simplified television in their advertising and thus are primarily responsible for the general set-owner attitude about service and the qualifications for handling it efficiently. They are of the opinion, too, that component manufacturers and parts distributors have a sufficient stake in the profitable sale of service that they should assume some of the responsibility for the badly needed public relations programs.

It is widely felt that television broadcast stations should, for the protection of their own investments, carry out regular educational programs to set-owners about picture quality. Television set-owners are the broadcast station's customers. The quality of the pictures cannot be any better than the reproduction that appears on the viewer's screen. Surveys have shown that almost half of the owners of television sets are now watching degraded pictures on their screens because they do not realize the sets need adjustment or service.

Since there is no indication that television will replace radio as the major medium for information, the degree of its long-range success will depend upon its ability to attract and hold audiences as the major vehicle for entertainment. For this reason service people feel that continuing programs about picture fidelity should be a *must* with every television broadcasting station.

Elimination of Bait Advertising—Service associations are inclined to assume the responsibility for fighting the use of bait advertising and its associated evils in their communities. Wherever effective associations have been formed and they have gone on record with a code of ethics to which members must adhere, the local Better Business Bureau has been highly cooperative in helping to weed out unethical service companies.

Technician Identification—For many

years associations have been striving to find some plan which would provide for recognition of the competent electronic technician and make it tough for the pseudo-serviceman to mess up the industry through his fumbling activities. This need for some system of technician identification has led many service people to advocate the licensing of electronic technicians on either a local or state-wide basis.

While most service business operators have realized the need for a practical and effective system of identification, the majority have feared that the evils of political control through any form of licensing would far outweigh any advantages that it might gain. The result is that plans are now underway both on local and national levels for the service industry itself to establish an identification plan that through widespread publicity would provide all of the advantages of licensing without the dangers inherent in political control.

Consumer Sales—There probably is not one service association in the country that did not go on record this year against the indiscriminate sale of replacement products to consumers. It is claimed by many service operators that consumer knowledge of dealer costs of replacement tubes and parts poses one of their biggest problems in maintaining good customer relations and one that is tough to handle.

Many parts distributors have recognized the growing need for concentrated selling of replacement products to *bonafide* service technicians and service businesses only. These distributors have instituted systems of customer identification to eliminate over-the-counter sales to consumers. Where such systems have been installed the distributors report an enthusiastic response from their technician-service customers.

Technician Training—Service association members fear that unless some cooperative plan is developed for training technicians in the practical phases of color television circuitry as it is employed in production-line receiver models, a bad state of confusion will develop. They point out that during the early days of monochrome TV, lack of coordination in the scheduling of technical lectures by the various manufacturers brought about a situation where as many as three different meetings were scheduled in the same town on the same night.

Many associations now plan to offer set and equipment manufacturers a lecture coordination service in their areas to minimize the possibility of confusion and lack of attendance due to multiple meetings.

As the year draws to a close it appears as if the service industry will go into the new year in common agreement on all major objectives. There are strong indications that national unity will be achieved in the very near future which will permit the independent service industry to present a solid front in fulfilling its programs.

—30—

What's New in Radio

(Continued from page 100)

The 51SB includes such extras as voice-operated and push-to-talk controls, a speaker de-activating circuit, TVI suppression, and unitized construction for quick and easy removal of any major section. Completely self-contained, the 51SB requires no external accessories with the exception of a microphone.

Complete information on this unit is contained in Bulletin 51SB which is available on request.

TV TUBE-CONTINUITY CHECKER

Visulite Company, 423 Broome Street, New York 13, N. Y. is now offering an inexpensive continuity tester which will check instantly the

filaments of loctal, octal, and all miniature tubes simply by plugging them into the sockets provided.

In addition, the new unit checks filaments of picture tubes, fuses, appliances, motors, electric circuits by means of the test leads provided. It operates on 110 volts a.c. or d.c. Built-in resistors prevent danger of shock or burning out of the items under test.

The instrument comes complete with test leads and an instruction sheet.

ROTARY RELAY

Automatic Electric Sales Corporation. 1033 W. Van Buren St., Chicago 7, Ill. has developed a single can-type rotary relay which is said to be capable of replacing whole banks of relays, or combinations of relays and stepping switches.

The Series OCS is small, light, and resistant to shock, vibration, and temperature changes. It measures 3¼" x 2 7/16" x 1 25/32" in size and weighs from 14 to 20 ounces, depending on design.

Complete information on this unit which combines relay and stepping switch functions is available from the company.

OUTPUT TRANSFORMERS

Microtran Company, 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y. is now offering a push-pull driver and output transformer line that has been designed to be used with high-power alloy junction transistors.

To avoid switching transient volt-

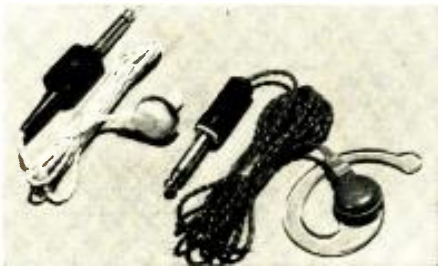
ages in the class B output stages and to maintain good circuit balance, bifilar windings are used. Frequency response is 200 to 4000 cycles. Power level is 2 watts.

The driver transformer provides a suitable match to the 25-ohm input impedances of the output stage. The output audio transformer matches a 4-ohm speaker load.

MINIATURE EARPHONES

The Fenton Company, 15 Moore Street, New York 4, N. Y. is now offering a line of clip-on miniature earphones for every requirement.

Some suggested uses for these hearing-aid quality earphones are dictating machine transcribing, monitoring, phone order desk, simultaneous listening, radio communication, private sampling of recordings in music stores, etc.



These new "Fen-Tone" clip-ons are available in 128, 1000, and 2000 ohm models with flesh colored plastic clasp or earmold.

REPLACEMENT FLYBACKS

Five new correct replacement flyback transformers have been added to the TV replacement line offered by *Triad Transformer Corporation*, 4055 Redwood Ave., Venice, California.

All of the new units are ruggedized versions of original equipment and are electrically and mechanically interchangeable with the manufacturer's original equipment. Three of the new units are designed for use in *Admiral* receivers while the other two are for *Emerson* receivers.

A copy of the company's TV replacement guide, TV-54, contains model numbers and chassis for which the new transformers are suitable and is available on request.

RENEWAL PICTURE TUBES

The Tube Division of *Radio Corporation of America*, Harrison, N. J. is now marketing two 70-degree TV picture tubes, 14" and 21" types, for replacement service applications.

The *RCA*-14HP is a 14" rectangular glass tube with a screen size of 11⅜" by 8½". It has low-voltage electrostatic focus and magnetic deflection. It has a diagonal deflection angle of 70 degrees, a maximum high-voltage rating of 14,000 volts, design-center value. It features a spherical "Filterglass" faceplate.

The *RCA*-21YP4-A is an aluminized 21" rectangular version with a screen size 19⅛" by 14 3/16" and a spherical "Filterglass" faceplate. Its other specifications are the same as the 14" ver-

sion with the exception that the maximum high-voltage rating is 18,000 volts.

INSPECTION MIRROR

General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Ill. is now offering another service tool in its already extensive line.

The new item is an illuminated inspection mirror which is similar in appearance to a dentist's oral inspection mirror. It is 12¼" long and enables the technician to inspect the most inaccessible parts of any TV chassis.

No external cords or connections are required as the unit is powered by two penlight cells. From its anodized aluminum case, the battery illuminates a bulb which transmits its light along a 6" transparent *Lucite* rod to the hinge-mounted mirror on the "business end" of the tool. Shock and shorting are eliminated by the dielectric materials used in the construction.

DUAL-VARIABLE CAPACITOR

McCoy Electronics Company, Mt. Holly Springs, Pa. has developed a new miniature dual variable capacitor for subminiature receivers and transmitters.

Dimensions, exclusive of shaft, are only 13/16" x 11/16" x 1 1/16". Capacitance ranges up to 385 $\mu\mu$fd. per

section with at least 10:1 ratio from maximum to minimum. Both rotors and both stators are isolated for flexibility of circuitry.

Other specifications include: shaft diameter 3/16" or ¼"; standard shaft length, ⅜"; weight ½ ounce. Additional details will be supplied by the company on request.

SHIELD CANS

A line of rectangular cans for use as high-voltage shields, transformer cases, capacitor housings, and similar applications on electronic, electrical, TV, radio, and related equipment has been developed by *George D. Ellis & Sons Inc.*, American and Luzerne Streets, Philadelphia 40, Pa.

Twenty-five different sizes of rectangular and square base cans from 2⅛" x 1¾" to 7½" x 7½" are available and most sizes can be made to any required body height from 2" up to 9". A variety of access openings, with closures, ventilating hole patterns, fastening fixtures, etc. can be provided.

U.H.F. FRINGE ANTENNA

Clear Beam Antenna Corp., 21341 Roscoe Blvd., Canoga Park, California is now offering a new antenna which has been specifically designed for the reception of fringe u.h.f. signals.

The "Duo-Quad UHF Radar" an-

tenna is composed of a four-stack bow-tie cross-polarized dipole fans. For positive ghost rejections a closely spaced all-aluminum reflector screen is utilized.

A double-stacked version is also available for extreme u.h.f. fringe conditions. It is a side-by-side arrangement on a specially designed all-aluminum "H" frame featuring strength and fast assembly. —30—

Printed Wiring TV

(*Continued from page 59*)

certain that such wiring will become popular in TV receivers. From the service technician's viewpoint, printed wiring techniques are not a particular time saver, nor are repairs greatly facilitated. It is necessary to stock special new parts such as tube sockets, potentiometers, capacitors, etc., made expressly for printed wiring. Locating defects in printed assemblies is not much different from conventional methods except that a more uniform layout is usually used. The major drawback in servicing printed wiring lies in the repair or replacement work for any parts which are mounted on the printed wiring strip. Great care and usually a more time consuming procedure is required to make such repairs without incurring new damage. Although some of the manufacturers feature complete printed assemblies as replacement for defective sections, conventional parts replacement and substitution for suspected components are possible and often economical. —30—

Bandswitching Transmitter

(*Continued from page 69*)

tuning capacitor. Another shield surrounds the 6146 wiring to isolate it from the oscillator. This shield also supports the low voltage input filter capacitor. Another shield runs between the speech amplifier and the 807's, and also supports the driver transformer.

The bias supply components are attached to the rear chassis lip, as is the filament transformer for the 5R4GY's.

Some information is in order concerning the filament wiring. The low voltage power transformer, T_4, has a filament winding (X-X) which is used to supply the final and modulator tubes V_9, V_{11}, V_{10}, and V_{12} as well as furnish 6.3 volts to the back-connected filament transformer used in the bias pack. An additional filament transformer, T_3, is used to feed the exciter and speech amplifier tubes. Although not indicated on the schematic in the interests of clarity, each side of the filament wiring is bypassed to ground through .005 μfd. ceramic capacitors, connected at each tube socket. The relay control leads are similarly bypassed by C_{32} and C_{33} where they leave the chassis. Shielded cable is used for the key and a.c. leads. A bottom plate, preferably made of perforated

sheet metal should be used to completely cover the bottom side of the chassis, as a ventilated TVI shield.

The transmitter was housed in a cabinet originally belonging to an SX-42 receiver, which, with its perforated metal access cover, makes a very neat appearance, and an absolute minimum of TVI. Since the photographs were made, decals have been added to conveniently identify the controls, and add somewhat to the professional appearance of the transmitter.

Coaxial cable should be used to feed to the antenna, and a good ground should be made to the chassis of the rig.

Operation

A few initial checks should be made before operating the rig, to make sure that everything is functioning properly. The low voltage power supply should be checked for approximately 300 volts output, and the bias voltages set to the previously specified values. The operating bias on the 6146's will be about 85 volts when the proper six ma. of grid current flows, with 75 volts of this bias being obtained from the bias supply. Without turning on the high voltage, the exciter should be tuned up using crystal and c.w. operating settings. Only 2 or 3 ma. are obtained at the multiplier grid. The oscillator plate current should never be allowed to exceed 50 ma., but in this unit the current normally only rises to about 40 ma. when the excitation is removed. The multiplier, of course, is cut off, and the final will standby at approximately 50 ma. Should the plate currents at any time be found to be excessive, the tube should be checked for traces of gas. A few ohms added in the oscillator cathode will serve to hold the tube down, should it be necessary.

The multiplier plate runs from 10 to 30 ma. under normal operating conditions, depending upon the screen excitation control setting. Once the final grid is set up to draw 6 ma., the screen voltage can be set at the reduced voltage condition by means of the tune-up switch, plate voltage applied to the final and its operation checked, under load. The plate voltage will be about 650 volts, and the screen voltage when at full power will run around 150 volts. Incidentally, a 100 watt bulb makes a good dummy load for testing, and its brilliance will be an indication of the r.f. output. The rig should be checked on all bands, and given a test run to check for any indications of overheating, and may then be put into operation. A final cathode current of about 230 ma. has been found to be a satisfactory operating value.

Operation and adjustment is primarily a matter of becoming familiar with the various controls and their functions. The setup of the pi-network is conventional. A data sheet #710, available from the *E. F. Johnson Company*, covers the proper settings and gives other design information. It should

be pointed out that, in this particular construction, it was found advisable to omit the .6 microhenry coil sometimes added in series with the variable inductor, in order to obtain somewhat better *C/L* ratios, particularly at 28 mc.

The rig should be tuned in the c.w. position, and then switched over to AM making sure that the high voltage is off while switching to avoid arcing. In the phone position, the exciter cathode is open until the high voltage switch is closed, which allows a single switch to control the transmitter for send-receive conditions.

When shifting frequency around a band, such as is common with v.f.o. operation, it will be found that only the rotary inductor need be moved slightly to keep the output network tuned, and the exciter tuning capacitors are broad enough to require only slight readjustment when large frequency shifts are made.

Operation is a pleasure, and considerable comment has been made as to the fine quality of the signal on the air. Anyone interested in duplicating the transmitter will be well pleased with the finished unit, besides enjoying the satisfaction of a commercial appearing rig which has been "home made." —30—

All-Purpose Enclosure

(Continued from page 49)

sound. The self-contained tweeter in the 12TRX is now employed.

Thus, five different combinations of units are available at the turn of a switch. Because the "Fold-a-flex" enclosure may be adjusted for three types of baffling it is possible to hear and to analyze fifteen distinct performance effects.

This may seem unnecessary from a practical sense. It probably is—but such a system has its place in the modest hi-fi showroom for consumer demonstration and does reduce inventory requirements for cabinets of different types. And it permits a convenient means for the study of the behavior of loudspeakers under widely varied conditions. —30—

NATESA ELECTS

AT the meeting following the opening day dinner of the recent 5th national convention and trade show of the National Alliance of Television & Electronic Service Associations (NATESA) held in Chicago, the following officers were elected for 1955:

Frank Moch, national president; Bertram Lewis, treasurer; Ray Neiswonger, secretary general; Ferdinand Lynn, vice-pres. eastern div.; Milton Klarsfeld, sec'y. eastern div.; Fred Colton, vice-pres. east central div.; Charles Burns, sec'y. east central div.; Vincent Lutz, vice-pres. west central div.; William Briza, sec'y. west central div.; Horace Collins, vice-pres. western div.; and Edward Failing, sec'y. western div. —30—

Within the Industry

(*Continued from page 30*)

The new facilities will be used to house the specifications and drafting department, the machine shop, and stock and supply areas . . . **NORTH HILLS ELECTRIC CO., INC.** has moved to 203-18 35th Ave. in Bayside 61, N.Y.

* * *

ALBERT A. PULLEY, manager, general recording, *RCA Victor* Records Division, *Radio Corporation of America*, has been elected president of the Audio Engineering Society, succeeding Jerry B. Minter, president of *Components Corp.* of Denville, N. J.

The new president has been with *RCA* and its predecessor company since 1920 when he joined the test department of *General Electric Company*. He was transferred to the radio department, working first on radio transmitters and then on the *G-E* disc recording system. When *RCA* assumed these interests in 1930, Mr. Pulley shifted to Camden, N. J.

Col. Richard H. Ranger, president of *Rangertone, Inc.*, was elected executive vice-president of the society. William J. Mahoney, Jr. of *Arthur-Sampson Enterprises, Inc.* of Cincinnati was named central vice-president and Richard F. Hastings of *Ealy & Hastings*, North Hollywood, Cal. was chosen western vice-president.

C. J. LeBel, founder and first president of the society was re-elected secretary for his fourth consecutive term. Ralph A. Schlegel was also renamed treasurer.

* * *

OLSON RADIO WAREHOUSE, INC. with headquarters in Akron, Ohio, has opened a new store at 5918 Penn Ave., Pittsburgh, Pa. Leonard D. Berringer has been named manager of the new facility . . . **DELCO RADIO DIVISION** of Kokomo, Indiana has established a Semi-Conductor Division in conjunction with its Radio Engineering Department. Dr. E. George Roka is in charge of the new department . . . The formation of a Vernistat Division has been announced by **THE PERKIN-ELMER CORPORATION** of Norwalk, Conn. The new division will manufacture a new type of precision variable-ratio transformer . . . **VIDAIRE ELECTRONICS MFG. CO.** has been incorporated and will henceforth be known as the **VIDAIRE ELECTRONICS MFG. CORP.** There are no changes in personnel nor management . . . **GENERAL CERAMICS CORPORATION** of Keasbey, N.J. has acquired **ADVANCED VACUUM PRODUCTS, INCORPORATED** of Stamford, Conn. which will be operated as a wholly-owned subsidiary . . . Technical writing service for manufacturers of electronic equipment is being offered by a newly formed firm known as **SANDS ASSOCIATES** with headquarters at 533 E. Micheltorena St., Santa Barbara, California. The new firm is headed by Leo G. Sands who has been associated with such firms as *RCA*, *Philco*, *Bogue*, *Bendix* and *Langevin* . . . **FEDERAL PACIFIC ELECTRIC COMPANY** of Newark, N.J. has acquired the transformer firm of **GARDNER ELECTRIC MANUFACTURING COMPANY** of San Francisco.

* * *

JACK E. WILLSON has been appointed audio products manager for *National Company, Inc.* of Malden, Mass.

A recipient of a Navy Technical Development Award for his development of bomb release equipment, Mr. Willson comes to his new post from the *Collaro Division* of *Rockbar Corporation*. From 1948 to 1952 he served as eastern sales manager for *Electro-Voice, Inc.*

As head of the division, he will create new markets and build sales for the company's new hi-fi line. —30—

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0A2	$ .87	1S5	.40	6AQ7GT	.68	6G6G	.63	6V6	.38	7Y4	.40	12SH7	.70	35Z5GT	.59
0A3/VR75	.97	1SA6	.48	6AS5	.62	6H6	.49	6W4GT	.41	7Z4	.45	12SJ7	.55	36	.35
0A4G	.60	1T4	.46	6AT6	.36	6J5	.38	6W6GT	.41	12A6	.49	12SK7GT	.49	37	.35
0B2	.74	1U4	.46	6AU6	.40	6J6	.50	6X4	.35	12A7	.98	12SL7GT	.49	39-44	.35
0B3/VR90	.90	1U5	.40	6AV5GT	.79	6J7	.49	6X5	.35	12AH7GT	.85	12SN7GT	.50	42	.40
0C3/VR105	.95	1X2	.55	6AV6	.36	6J8G	.90	6X8	.70	12AL5	.40	12SQ7GT	.53	43	.53
0D3/VR150	.85	2A3	.90	6AX4GT	.57	6K6GT	.39	7A4	.45	12AT6	.35	12SR7	.49	45Z3	.40
0Z4	.58	2A5	.49	6B7	.93	6K7G	.38	7AS	.55	12AT7	.62	12Z3	.39	46	.45
1A4P	.35	2A6	.49	6B8G	.29	6K8G	.64	7A6	.65	12AU6	.36	14A4	.65	47	.85
1A5GT	.40	2A7	.60	6BA6	.38	6L6G	.99	7A7	.65	12AU7	.59	14A5	.57	49	.38
1A7GT	.45	2B7	.62	6BA7	.55	6L6GA	.99	7AD7	.90	12AV6	.44	14A7	.53	50L6GT	.61
1AB5	.38	2X2	.39	6BC5	.49	6N7	.95	7AG7	.55	12AV7	.64	14AF7	.59	50X6	.62
1B3GT	.67	2X2A	1.14	6BE6	.37	6Q7	.49	7AH7	.55	12AX4GT	.55	14B6	.45	50Y6GT	.57
1C5GT	.40	3A4	.44	6BF5	.69	6R7	.49	7B4	.44	12AX7	.55	14B8	.63	56	.47
1C7G	.37	3A5	.90	6BG6G	1.15	6S4	.39	7B5	.55	12AY7	.72	14C5	.80	57	.53
1D7GT	.75	3A8GT	.59	6BH6	.45	6S7G	.55	7B6	.55	12BA6	.47	14C7	.65	58	.56
1E7GT	.35	3B7	.39	6BJ6	.41	6SA7	.40	7C4	.55	12BA7	.59	14E6	.65	70L7GT	1.00
1F4	.40	3D6	.38	6BK7	.89	6SC7	.75	7C7	.65	12BD6	.46	14E7	.80	71A	.52
1F5G	.44	3LF4	.71	6BL7GT	.65	6SD7GT	.38	7E5	.59	12BE6	.45	14F7	.65	76	.42
1H4G	.40	3Q4	.48	6BN6	.79	6SF5GT	.45	7E6	.40	12BH7	.60	14F8	.90	77	.53
1H5GT	.38	3Q5GT	.48	6BQ6GT	.75	6SF7	.58	7F7	.64	12C8	.34	14H7	.57	78	.43
1J6G	.59	3S4	.46	6BQ7	.88	6SG7	.40	7F8	.90	12F5GT	.35	14N7	.67	81	1.10
1L4	.45	3V4	.50	6C4	.35	6SH7	.60	7G7	.80	12H6	.45	14Y4	.67	82	.67
1L6	.61	5T4	1.25	6C5	.39	6SH7GT	.50	7H7	.56	12J5GT	.39	19	.45	83	.77
1LA4	.59	5U4G	.49	6C6	.54	6SJ7	.54	7J7	.75	12J7GT	.57	19BG6G	1.15	84	.52
1LA6	.75	5V4G	.76	6C8G	.85	6SK7	.39	7K7	.80	12K7	.53	19T8	.75	85	.57
1LB4	.77	5Y3G	.38	6CB6	.42	6SL7GT	.49	7L7	.77	12K8	.55	22	.40	89Y	.29
1LC5	.59	5Z3	.33	6CD6G	1.05	6SN7GT	.48	7N7	.57	12Q7G	.57	25AV4GT	.80	117L7GT	1.17
1LC6	.75	6A8	.65	6D6	.67	6SQ7	.49	7Q7	.57	12S8GT	.60	25BQ6GT	.75	117Z3	.38
1LD5	.49	6AB4	.42	6D8G	.95	6SR7	.45	7R7	.59	12SA7GT	.62	25L6GT	.40	117Z4GT	.73
1LE3	.75	6AB7	.71	6E5	.76	6ST7	.48	7S7	.83	12SC7	.68	25W4GT	.45	117Z6GT	.70
1LG5	.75	6AC5GT	.95	6F6	.45	6T8	.57	7V7	.87	12SF5	.48	25Z5	.60	2051	.93
1LH4	.75	6AC7	.68	6F7	.90	6U7G	.45	7W7	.85	12SF7GT	.68	25Z6GT	.40	9001	1.47
1LN5	.55	6AF5	.89	6F8G	.69	6U8	.59	7X6	.57	12SG7	.70	26	.42	9002	.98
1N5GT	.61	6AF6G	.75									27	.37	9003	1.30
1P5GT	.56	6AG5	.47									32L7GT	.95	9006	.67
1Q5GT	.55	6AG7	.90									35C5	.37	803	2.95
1R4	.81	6AH6	.98									35L6GT	.45	807	1.25
1R5	.47	6AK5	.59									35W4	.59	814	3.50
1S4	.55	6AL5	.35									35Y4	.44	836	7.95
		6AQ5	.39									35Z3	.40	866A	1.45
		6AQ6	.36												

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Vibration Amplifier

(*Continued from page* 65)

tening to and interpreting vibrational movement in machinery, the transistor vibration amplifier has been found to have another valuable application.

When the point of the probe is moved lightly across a material surface, a sound is produced in which the frequency depends on the number of surface irregularities encountered (and the speed of movement) and in which the amplitude depends on the degrees of surface irregularity.

Used in this fashion, the instrument permits the operator to determine even very small differences in the surface smoothness of various materials.

Best results are obtained when the probe is held at a slight angle, with the apex facing *away* from the direction of movement. The probe tip should make firm, but *light*, contact with the surface of the material being checked.

When comparing the surface smoothness of two different materials or objects, special care must be taken to move the probe across each surface at exactly the same speed. Otherwise, the results are somewhat difficult to interpret.

The user will soon discover additional applications for the transistor vibration amplifier as he works with it.

—30—

HISS REDUCTION

By JAMES A. McROBERTS

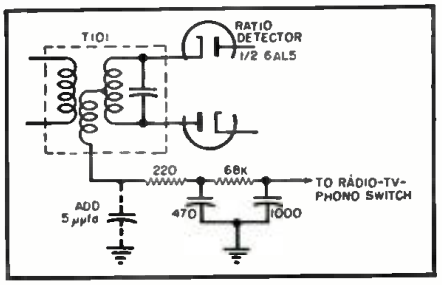
FIG. 1 shows the partial schematic diagram of a Magnavox ratio detector output circuit which has been modified to remove the high frequency hiss sometimes present in FM detector outputs. A 5 μμfd. ceramic condenser has been added as shown by the dotted lines. The addition of this condenser shunts a large proportion of the radio frequency to ground and eliminates r.f. hiss. The condenser serves two other minor purposes:

1. Further de-emphasizes the audio.

2. Removes 4.5 mc. r.f. which might be passed along to the remainder of the audio system and built up in the audio amplifier, only to re-enter the video and cause grain in the picture.

Other makes of sets have been improved by increasing the value of this first condenser from 1 to 5 μμfd. Some sets rely on the lead dress to furnish the capacity and often simply dressing the lead from the ratio transformer tertiary coil to the chassis will suffice. —30—

Fig. 1. Partial schematic of the ratio detector circuit used in a Magnavox TV.



1954 INDEX
VOLUMES 51-52

As a service to our readers we are again presenting a complete listing of all feature articles which appeared in RADIO & TELEVISION NEWS during 1954. We suggest you keep this for reference.

AMATEUR

ANTENNAS

The Ground Plane Grows Up (Harrison, W6ULD) ..... 49 May
The Inverted Ground Plane (Semkow, W7IIP) ..... 155 Nov.
3-Bands, 1-Vertical (Harrison, W6ULD) ..... 66 June

CONVERTERS

Communication Set—The Easy Way (Stanley) ..... 44 Oct.

MISCELLANEOUS

Amateur's 4-Tube Miniature Superhet (Popenoe, Jr., W6IWM) ..... 43 Feb.
A New Slant on TVI (Geiser, W1ZEO) ..... 130 Sept.
A Pioneer Amateur Station (Watson) ..... 32 July
A Subminiature Code Practice Oscillator (Garner, Jr.) ..... 40 Feb.
Bandswitch Your Loading Coils by Remote Control (Wortman, W2LJU) ..... 50 June
Crystal Substitute (Donald) ..... 47 Mar.
Junk Box "Sending Iron" (Robberson) ..... 44 Nov.
Mobile Communications Center Provides Emergency Service (McKay, W5LIM) ..... 39 Oct.
New Communications Receiver ..... 67 Mar.
"Self-completing" Electronic Key (Gallagher, W5HZB) ..... 80 Mar.
The Signal Bouncer (Robberson) ..... 47 Apr.

TRANSMITTERS

A "Basket Chassis" Transmitter (Sodaro, W6ZRT) ..... 42 Jan.
A 146 mc. Civil Defense Station (Pustarfi, W2HDQ & Daly, W2YBZ) ..... 35 Apr.
Compact 100-Watt Bandswitching Transmitter (Johnson, W3TRR) ..... 66 Dec.
Compact 2-Meter Rig (Smith) ..... 63 May
Completing "Three Tubes on 2 Meters" (Wels, K2AVB) ..... 46 Aug.
80-Meter Novice Transmitter (Bulkley, W2QUJ & Kirchhoff, W2FAR) ..... 52 Jan.
QRZ Mobile (Wortman, W2LJU) ..... 46 Feb.
The "Globe Scout" (Meyerson, WØGFQ) ..... 54 Dec.
Two-in-the-Hand (Part 1) (Wagner, W6WGD) ..... 31 Aug.
Two-in-the-Hand (Part 2) (Wagner, W6WGD) ..... 61 Sept.
2 Meters in the Family Car (Rogers, W1DFS) ..... 38 July

AM-FM

MISCELLANEOUS

A Regenerative Short-Wave Receiver (Stoecker) ..... 61 Oct.
Fringe Area FM Antenna (Meredith, Jr.) ..... 100 Oct.
Highly-Sensitive Link-Coupled Loop Antenna (Hannibal) ..... 96 Dec.
High Performance Headphone Ra-

dio (Gottlieb) ..... 42 Feb.
Midget FM Tuner (Larson)..... 40 Dec.
Superregenerative Transistor Receiver (Hughes, W9VHJ) ..... 72 Mar.
The C900 FM Tuner (Hermann)... 82 Sept.
The FM-Only Tuner (von Recklinghausen, Casey & Pomper)..... 71 Dec.
The Model FM-80 Tuner..... 78 Nov.

SERVICING

Auto Radio Service Checkpoints (Ledbetter) ..... 52 Aug.
Latest Trends in AM Receivers (Kay) 50 Mar.
Servicing Midget Receivers (McRoberts) ..... 48 Sept.
Troubleshooting 3-Way Portables (McRoberts) ..... 36 July

AUDIO

AMPLIFIERS

A Heavy-Duty Audio Amplifier (Krauss) ..... 48 Aug.
A Low-Powered Phono Amplifier (French) ..... 42 Oct.
A Simple—Yet Good Quality—Preamp (Finlay) ..... 42 Nov.
A 35-Watt "Infinite Feedback" Audio Amplifier (Boegli) ..... 39 July
A Tone-Compensating Preamp (Daniel) ..... 56 Oct.
Audio Amplifier-Preamp for Home Use (Cheilik) ..... 68 Nov.
Miniature Preamp (Wiener)..... 40 Sept.
Simplified Cross-Coupled Amplifier (Boegli) ..... 62 May
The "Linear Standard" Amplifier (Knapp) ..... 43 May
The "Mark 12" (Brociner)..... 72 Oct.
The RCA Model SV-1 Preamp (Wortman) ..... 39 Aug.
The Scott 99-A Amplifier (Pomper).. 66 Feb.

MISCELLANEOUS

Acoustic Measurements for the Audiophile (Fleming) ..... 38 Sept.
A Four-Channel Audio Mixer (Carroll) ..... 57 Nov.
A New Line of Hi-Fi Speakers (Olson & Preston)..... 69 Feb.
A Transistor Phase Inverter (Caldwell) ..... 71 Sept.
Audio-Custom Built (Mann)..... 51 Aug.
Checking Your Audio System (Konins) ..... 59 May
Choosing Your Hi-Fi Loudspeaker (Cohen) ..... 37 Nov.
"Concert Hall on Wheels" (Cohen). 66 Sept.
Elimination of R.F. Interference in Audio Systems (Part 1) (Coriell).. 56 June
Elimination of R.F. Interference in Audio Systems (Part 2) (Coriell).. 44 July
E-V Model 666 (Souther & Burroughs) ..... 63 Mar.
Horns for the P.A. Technician (Cohen) ..... 43 Apr.
Impedance Matching of Multiple Speakers (Hubelbank) ..... 56 Apr.
New Mixer-Fader ..... 82 Nov.
New Multichannel Mixer..... 71 Oct.
Pages from a Tape Editor's Notebook (Part 3) (Hoefler)..... 40 Jan.
Pages from a Tape Editor's Notebook (Part 4) (Hoefler) ..... 50 Feb.
Power Amplifier Output (Sodaro, W6ZRT) ..... 54 Mar.
Servicing Hi-Fi (Fidelman)..... 56 July
Servicing Hi-Fi Amplifiers (Fidelman) ..... 60 Nov.
The "Compleat Fidelity" (Part 3) (Drenner) ..... 44 Jan.
The Poor Man's "3D" Converter (Chernof) ..... 50 Nov.
"Ultra-Linear" Operation of 6V6 Tubes (Hafler) ..... 43 June
Use Your Receiver for P.A. Work (Taylor, W8NAF) .....152 Oct.

PHONO

How's Your Rumble? (Mitchell).... 78 Mar.
Let's Look at Changers (Sheneman). 56 Mar.
Reducing Turntable Rumble (Lang, Jr.) ..... 72 Sept.
Regulating the Speed of Record Players (Burstein) ..... 74 Sept.
Servicing Record Changers (Sheneman) ..... 70 Nov.

RECORDING

A Dual Channel Recording System (Part 3) (Read) ..... 62 Jan.
Mac's Radio Service Shop (Frye)... 86 Mar.
Servicing Tape Recorders (Rockwell) 74 Mar.
The Broadcast Recorder (Berlant)... 43 Dec.
The New "600" ..... 51 Sept.

SPEAKER HOUSINGS

All-Purpose Enclosure for 12" Systems (Part 1) (Read)..... 52 Nov.
All-Purpose Enclosure for 12" Systems (Part 2) (Read)..... 48 Dec.
Choosing Your Loudspeaker Enclosure (Cohen) ..... 46 Dec.
The "Bass Ultraflex" Enclosure (Plach & Williams)..... 61 Dec.
The "Diffusicone-8" Enclosure (Cohen) ..... 55 Mar.
The DU-201 "Duette" ..... 39 Feb.
The Karlson Speaker Enclosure (Karlson) ..... 58 Jan.

TONE CONTROLS

A Bass-Boost Control (Ferres)..... 52 July
A Feedback Loudness Control (Williams) .....134 Mar.
An Equalizer for FM Pickups (Mitchell) ..... 54 May
An Outboard Bass-Booster (Ferres) 88 Sept.
Simplified Design of Feedback Equalizers (Rose) ..... 54 Sept.
The Audio Cathode Follower (Nelson) ..... 50 Apr.
The Auto-Tone (Miller) ..... 54 Apr.
The Curve that Conforms ..... 49 July

BOOK REVIEWS

An Introduction to Radio and Television (Phillips, Grogan & Ryan) .....102 July
Analyzing and Tracing TV Circuits (Kiver) ..... 84 Dec.
Automatic Record Changer Service Manual (Vol. 5) (Sams Staff).....101 July
Basic Radio Manual (Sams Staff)...138 Apr.
Beginning Television Production (White) .....102 July
Data and Circuits of Television Receiving Valves (Jager) .....124 Mar.
Dial Cord Stringing Guide (Sams Staff) .....138 Apr.
Electronic Organs (Eby) ..... 99 Jan.
Elements of Electrical Engineering (Cook & Carr) .....138 Apr.
Elements of Mathematics for Radio, Television and Electronics (Fischer & Jacobs).....129 June
Elements of Radio (Marcus & Marcus) .....103 Aug.
Fundamentals of Transistors (Krugman) ..... 169 Oct.
Guide to Audio Reproduction (Fidelman) .....124 Mar.
Hi-Fi Manual (Hoefler).....182 Nov.
Hi-Fidelity (Trend Staff)..... 86 Dec.
High Fidelity Techniques (Newitt)..100 Jan.
Highlights of Color Television (Locke, Jr.) .....129 June
How to Install & Service Auto Radios (Darr).....175 Sept.
How to Locate and Eliminate Radio & TV Interference (Rowe).....169 Oct.
How to Service Tape Recorders (Tuthill) .....182 Nov.
How to Troubleshoot a TV Receiver (Johnson) .....192 Feb.
How to Use Meters (Rider)..... 86 May
How to Use Signal & Sweep Generators (Johnson) ..... 99 Jan.

Introduction to Color TV (Kaufman & Thomas) .....130 June
Loudspeakers (Briggs) .....175 Sept.
Most-Often-Needed 1954 Radio Diagrams and Servicing Information (Beitman) .....169 Oct.
Most-Often-Needed 1954 Television Servicing Information (Beitman)..139 Apr.
Most-Often-Needed 1953 Radio Diagrams (Beitman) .....124 Mar.
On The Air (Manvell) ..... 86 May
Practical Television Engineering (Heil) .....100 Jan.
Principles of Electronics (Agger)...192 Feb.
Radio Amateur Question & Answer License Guide (American Electronics Co.) .....125 Mar.
Radio Data Charts (Beatty & Sowerby) .....124 Mar.
Radio Troubleshooting Guidebook (Rider & Johnson)..... 88 May
Receiving Tube Substitution Guidebook (Middleton, H. A.)..... 86 May
Servicing TV Vertical & Horizontal Output Systems (Thomas).....103 Aug.
Specialized Auto Radio Manual (Vol. 1-A) (Rider Staff).....103 Aug.
Specialized Auto Radio Manual (Vol. 3-A) (Rider Staff).....175 Sept.
Specialized Auto Radio Manual (Vol. 5-A) (Rider Staff).....183 Nov.
Specialized Home and Portable Radio Manual (Rider Staff).....131 June
Technician's Guide to TV Picture Tubes (Remer) .....176 Sept.
Techniques of Television Production (Bretz) .....124 Mar.
Television, A World Survey (UNESCO) .....139 Apr.
Television Servicing (Buchsbaum)..130 June
Television Servicing Course (Beitman) .....131 June
Television Simplified (Kiver).....129 June
Television Tube Location Guide (Sams Staff) ..... 99 Jan.
The Electronic Musical Instrument Manual (Douglas) ..... 86 May
The Magic of Electronics (Bukstein) .....101 July
The Oscilloscope (Zwick)..... 86 Dec.
The Oscilloscope at Work (Haas & Hallows) .....182 Nov.
The Radio Amateur's Handbook (ARRL Staff) ..... 86 May
The Wear and Care of Records and Styli (Weiler) .....103 Aug.
Transistors and Their Applications (Garner, Jr.) .....192 Feb.
Transistors, Theory and Practice (Turner) .....103 Aug.
TV Field Service Manual (Vol. 1) (Alsberg, ed.) .....104 Aug.
TV Field Service Manual (Vol. 2) (Alsberg, ed.) .....183 Nov.
TV Manufacturers' Receiver Trouble Cures (Vol. 5) (Snitzer).....101 July
TV Troubleshooting and Repair Guidebook (Middleton, R. G.).... 86 May
UHF Television Antennas and Converters (Lytel) .....125 Mar.
Vade-Mecum (Gijsen, ed.)..... 84 Dec.

BUSINESS MANAGEMENT

How Is Your Training Program? (Hazlehurst) ..... 66 Mar.
Mac's Radio Service Shop (Frye)... 68 June
Mac's Radio Service Shop (Frye)... 76 Sept.
Mac's Radio Service Shop (Frye)... 80 Nov.
Mac's Radio Service Shop (Frye)... 78 Dec.
Radio-TV Service Industry News...124 Jan.
Radio-TV Service Industry News..160 Feb.
Radio-TV Service Industry News..160 Mar.
Radio-TV Service Industry News..156 Apr.
Radio-TV Service Industry News..136 May
Radio-TV Service Industry News.. 80 June
Radio-TV Service Industry News..112 July
Radio-TV Service Industry News..122 Aug.
Radio-TV Service Industry News..158 Sept.
Radio-TV Service Industry News..170 Oct.

Radio-TV Service Industry News..106 Nov.
Radio-TV Service Industry News..146 Dec.

GENERAL

CIRCUITS (THEORY)

Half-Wave Rectifier Circuit (Catal-do) ..... 47 May
Measuring Resistance Between Tube Elements (Austin)..... 96 Jan.

MISCELLANEOUS

A Citizens Band Garage Door Control (Smith, W8VVD)..... 35 Feb.
A Modern Metal Locator (Turner, K6AI) ..... 35 Sept.
A Photoelectric Contrast Control (Vogelgesang) ..... 89 Oct.
A Phototransistorized Photoelectric Counter (Sokal & Seed)..... 52 June
A Simple Geiger Counter (Fechter & Boyd) ..... 35 July
A Sound-Controlled Thyratron for High-Speed Photography (Vogelgesang & Hilmanowski)..... 36 Aug.
A Transistor Metronome (Garner, Jr.) ..... 50 Jan.
A Transistorized Applause Meter (Garner, Jr.) ..... 82 Mar.
A Transistorized Light-Beam Communications System (Kenn & Sokal) ..... 52 May
A Transistor Vibration Amplifier (Garner, Jr.) ..... 64 Dec.
"Bootstrap" Interval Timer (Hillman, W6QHK) ..... 52 Oct.
Certified Record Revue (Whyte).... 64 Jan.
Certified Record Revue (Whyte).... 56 Feb.
Certified Record Revue (Whyte).... 76 Mar.
Certified Record Revue (Whyte).... 68 Apr.
Certified Record Revue (Whyte).... 48 May
Certified Record Revue (Whyte).... 58 June
Certified Record Revue (Whyte).... 58 July
Certified Record Revue (Whyte).... 50 Aug.
Certified Record Revue (Whyte).... 60 Sept.
Certified Record Revue (Whyte).... 60 Oct.
Certified Record Revue (Whyte).... 62 Nov.
Certified Record Revue (Whyte).... 60 Dec.
Electronic Memory (Bukstein)..... 76 Dec.
Headphones for Radio and TV (Renné) .....116 Jan.
I Married a TV Technician (Kessler) .....138 Oct.
Mac's Radio Service Shop (Frye)... 76 Jan.
Mac's Radio Service Shop (Frye)... 74 Apr.
Mac's Radio Service Shop (Frye)... 74 May
Mac's Radio Service Shop (Frye)... 66 July
More Old Time Operators Report (Bowers) ..... 76 June
"Old Timer" Ormsby (Bowers).... 83 Aug.
Outdoor Soldering (Robberson)....118 Oct.
Quartz Crystal Etching (Brizendine, W4ATE) ..... 38 May
Radio Astronomy (Smith)..... 35 June
Remote Controls for Marine Radiotelephones (Robberson)..... 40 June
Save That Rectifier (Fath)..... 70 July
The Design and Construction of Vacuum-Tube Tesla Coils (Kawcyn & Marshall)..... 45 Aug.
The Electronorgan (Part 3) (Dorf)... 68 Jan.
The Electron Tube (Watson)..... 66 Nov.
The Practical Switchless Intercom (Dorf) ..... 47 Nov.
The Theremin (Moog, K2AMH)..... 37 Jan.
The Universal Vibrato (Dorf)..... 52 Apr.
Transistorized Moisture Detector (Garner, Jr.) ..... 52 Sept.
TV-Radio Service Technician Associations ..... 85 Mar.
Waveform Tracing Aid (Garner, Jr.) ..... 64 Feb.
Wireless Operators of Old (Bowers) 90 Mar.
Wireless Ops of Old (Bowers).....186 Feb.

POWER SUPPLIES

A Transistor Power Supply (Garner, Jr.) ..... 74 Nov.
Power Supply for Reforming Electrolytics (Amerose) .....122 Oct.

SHORT-WAVE

Short-Wave (Boord) ..... 73 Jan.
Short-Wave (Boord) ..... 76 Feb.
Short-Wave (Boord) ..... 84 Mar.
Short-Wave (Boord) ..... 73 Apr.
Short-Wave (Boord) ..... 70 May
Short-Wave (Boord) ..... 65 June
Short-Wave (Boord) ..... 64 July
Short-Wave (Boord) ..... 64 Aug.
Short-Wave (Boord) ..... 90 Sept.
Short-Wave (Boord) ..... 70 Oct.
Short-Wave (Boord) ..... 76 Nov.
Short-Wave (Boord) ..... 70 Dec.

INDUSTRY

Aerial "Private Eye" Traces TV Signals ..... 43 July
From Catswhiskers to Color—An Editorial (Read) ..... 31 July
Looking Ahead (Schulman) ..... 43 Mar.
Magnetic Recording 1888 to 1954 (Wortman) ..... 59 July
P.A. Rentals—A Profitable Sideline (Berliner) ..... 50 July
Parts Show Exhibitors ..... 157 May
Radio Servicing in South Africa (Holman) ..... 71 Aug.
Resistor Trial by Test (Entrekin) ... 68 Feb.
Sonic Liquid Level Indicator (Kielich) ..... 46 June
The ARTSNY Story ..... 68 July
The Convair Analogue Computer (Horwitz) ..... 61 Jan.
TV on Mt. Fuji (Kasahara) ..... 120 Feb.
World's Most Powerful Radio Transmitter ..... 112 Feb.

TELEVISION

ANTENNAS

A New Antenna Coupling System (Harris) ..... 117 Sept.
Antenna Antics (Margolis) ..... 90 Oct.
Home-Built U.H.F. Antennas (Hawkins) ..... 58 Mar.
How Good Are Your TV Installations? (Ledbetter) ..... 44 Dec.
New Approach to Conical Antenna Design (Wade) ..... 76 May
New Standards for TV Antennas (Carpenter) ..... 41 Nov.
The Continuous Evolution in TV Antennas (Noll & Mandl) ..... 64 May
The Tri-Pole Antenna (Lo) ..... 104 Feb.
The U.H.F. Corner Reflector (Hurd & Kobler) ..... 63 Apr.

MISCELLANEOUS

A Video-Magnetic Tape Recorder .. 120 June
A U.H.F. Booster (Steidley, W4IYB) 35 Aug.
Build Your Own TV Color Converter (Part 1) (Stanley) ..... 37 Dec.
Community TV (Buchsbaum) ..... 35 May
Fundamentals of Color TV-Color Analysis (Part 1) (Kiver) ..... 68 Mar.
Fundamentals of Color TV—The NTSC System (Part 2) (Kiver) .... 59 Apr.
Fundamentals of Color TV—The Tri-Gun Receiver (Part 3) (Kiver) ... 40 May
Fundamentals of Color TV—Tri-Gun Receiver Circuits (Part 4) (Kiver) ..... 47 June
Fundamentals of Color TV—Chrominance Circuits (Part 5) (Kiver) ... 60 July
Fundamentals of Color TV—The Color Signal (Part 6) (Kiver) ..... 42 Aug.
Fundamentals of Color TV—Color Synchronization (Part 7) (Kiver) ..... 42 Sept.
Fundamentals of Color TV—Deflection and High Voltage (Part 8) (Kiver) ..... 64 Oct.
Fundamentals of Color TV—R-Y & B-Y Demodulation Systems (Part 9) (Kiver) ..... 63 Nov.
Mac's Radio Service Shop (Frye) ... 74 Feb.
Mac's Radio Service Shop (Frye) .. 62 Aug.
Mac's Radio Service Shop (Frye) .. 74 Oct.
My Start in TV Servicing (Stanley). 66 Jan.

New TV Designs for 1954 (Gary)... 44 Mar.
New TV Grants Since Freeze Lift..148 Jan.
New TV Grants Since Freeze Lift...128 Feb.
New TV Grants Since Freeze Lift..166 Mar.
New TV Grants Since Freeze Lift.. 88 Apr.
New TV Grants Since Freeze Lift..100 May
New TV Grants Since Freeze Lift.. 98 June
New TV Grants Since Freeze Lift..100 July
New TV Grants Since Freeze Lift..116 Aug.
New TV Grants Since Freeze Lift..128 Sept.
New TV Grants Since Freeze Lift..112 Oct.
New TV Grants Since Freeze Lift..160 Nov.
New TV Grants Since Freeze Lift..138 Dec.
New TV Stations on the Air..... 94 Feb.
New TV Stations on the Air.....132 Mar.
New TV Stations on the Air.....136 Apr.
New TV Stations on the Air.....110 May
New TV Stations on the Air..... 98 June
New TV Stations on the Air..... 96 July
New TV Stations on the Air.....116 Aug.
New TV Stations on the Air.....128 Sept.
New TV Stations on the Air.....112 Oct.
New TV Stations on the Air.....160 Nov.
New TV Stations on the Air.....138 Dec.
Pictures on Tape ..... 55 Feb.
The CBS Patching Bay..... 72 Aug.
The Chromatic Color Picture Tube (Buchsbaum) ..... 52 Mar.
TV Booster for U.H.F. (Lange)..... 66 Apr.
TV Cinderella (Lucas, Jr.)..... 47 Oct.
TV Stations on the Air..... 57 Jan.
TV Test Equipment—How to Choose, How to Use (Middleton)..... 48 Mar.

SERVICE NOTES

Add Hi-Fi to TV (Buchsbaum)..... 73 Nov.
An Unusual TV Phase Detector (Frieborn) ..... 58 Sept.
A Simple TV Linearity Pattern (Gary) ..... 59 Aug.
Color Receiver Alignment (Buchsbaum) ..... 52 Feb.
Economy Model TV Sets (Buchsbaum) ..... 68 Oct.
Find the Open Filament (Weiss)...156 Oct.
Installing a Color Picture Tube (Buchsbaum) ..... 46 July
Know Your 1954 Admiral TV Receivers (Admiral Corp. Service Dept.) ..... 57 Feb.
Know Your 1954 Motorola TV Receivers ..... 45 Jan.
Know Your 1954 Stewart-Warner TV Receivers (Massie) ..... 59 Mar.
1954 TV Receiver Specifications... 77 Mar.
1954 TV Receiver Specifications... 46 Apr.
1954 TV Receiver Specifications... 58 May
1954 TV Receiver Specifications... 64 June
1954 TV Receiver Specifications... 54 July
1954 TV Receiver Specifications... 58 Aug.
1954 TV Receiver Specifications... 50 Sept.
1954 TV Receiver Specifications... 56 Nov.
1954 TV Receiver Specifications... 56 Dec.
Positive Grid Circuits in TV Receivers (Kiver) ..... 62 Feb.
Receiving Tubes for Color TV (Buchsbaum) ..... 38 Aug.
Service Hints on Admiral TV Sets.188 Feb.
Service Hints on Crosley TV Sets.. 73 June
Service Hints on Motorola TV Sets.103 Jan.
Service Hints on Stewart-Warner TV Sets .....158 Mar.
Servicing Gated-Beam Detector Circuits (Mandl) ..... 52 Dec.
Servicing Printed Wiring TV (Buchsbaum) ..... 57 Dec.
The Crosley "Super-V" (Youger)... 59 June
Television Troubleshooting Methods (Frieborn) ..... 64 Mar.
Tracing the Waveform (Fleishman). 60 Aug.
Troubleshooting the Turret Tuner (Lowe) ..... 54 Jan.
TVI Troubleshooting (Part 1) (Quirk) ..... 66 May
TVI Troubleshooting (Part 2) (Quirk) 38 June
TVI Troubleshooting (Part 3) (Quirk) 55 July
TVI Troubleshooting (Part 4) (Quirk) 56 Aug.
U.H.F. Fringe Installations (Buchsbaum) ..... 40 Apr.

INDEX OF Advertisers

DECEMBER 1954

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

ADVERTISER	PAGE
Aaron Electronic Sales	142
Acro Products Company	168
Airex Radio Corp.	169
All Channel Antenna Corp.	12
Allied Radio Corp.	9
American Television & Radio Co.	14
Amplifier Corp. of America	116
Approved Electronic Instrument Corp.	115
Arkay Radio Kits	157
Arrow Sales Incorporated	127
Ashe Radio Co., Walter	117
Audel Publishers	154
Baltimore Technical Institute	142
Barry Electronics Corp.	170
Bell Telephone Laboratories	26
Belden	13
Blonder Tongue Labs.	134
Boland & Boyce, Inc.	28
Burstein-Applebee Co.	151
CBS-Hytron	7
Cabinart	113
Candler System Co.	150
Capital Radio Engineering Institute	17
Centralab	164
Channel Master Corp.	94, 95
Chicago Standard Transformer Corporation	155
Cincinnati Ventilating Co., Inc., The	106
Cleveland Institute of Radio Electronics	27
Columbia Electronic Sales	128
Commissioned Electronics Co.	152
Component Corporation	162
Concord Radio	155
Corona Radio & TV Co.	145
Coyne School	101
Crescent Industries, Inc.	118
DeVry Technical Institute	5
Delco Radio	21
Dumont Laboratories, Inc., Allen B.	22
Editors & Engineers, Ltd.	144
Electronic Chemical Corp.	153
Electronic Instrument Co., Inc. (EICO)	36, 129, 134
Electron Tube Wholesalers, Inc.	169
Electro-Voice	8
Erie Resistor Corporation	106
Fairchild Recording Equipment	126, 131
Fair Radio Sales	141
Finney Company	11
Fisher Radio Corp.	102, 103, 104, 105
G & G Radio Supply Co.	112
G. L. Electronics	107
General Cement Mfg. Co.	93
General Electric	34, 35
General Electronic Dist. Co.	150
Good, Inc., Don	97
Goodheart, R. E.	167
Granco	156
Grantham School of Electronics	118
Greenlee Tool Co.	136
Hallicrafters	110, 112, 114
Harjo Sales Co.	152
Harvey Radio Co.	140
Heath Company	79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90
Henry Radio Stores	132
Hughes Research and Development Laboratories	143
Indiana Technical College	161
Instructograph Company	167
International Resistance Co.	3rd Cover
International Rectifier Corporation	122
JFD Manufacturing Co., Inc.	33
J. J. Glass Electronics Co.	97
JSH Sales Co.	156
Jones & Laughlin Steel Corporation	135
Kay-Townes Antenna Company	98, 99
Kedman Company	161
Kuehne Mfg. Co.	161
Kuhn Electronics	118
Lafayette Radio	123
Lansing Sound, Inc., James B.	154
Leotone Radio Corp.	132
Liberty Electronics, Inc.	136
L. I. Radio Co.	169
Magnecord, Inc.	30
Mallory & Co., Inc., P. R.	4th Cover
Mannfred Electronics Corporation	167
Marine View Electronics	169
Mattison Television & Radio Corp.	148
McGee Radio Company	124, 125
McGraw-Hill Book Co.	140
Mills Products Co.	160
Milwaukee School of Engineering	120
Mosley Electronics, Inc.	150
Moss Electronics Distributing Co., Inc.	108, 109
Musical Masterpiece Society, Inc., The	93
National Company	163
National Electronics of Cleveland	164
National Radio Institute	3, 19, 20
National Schools	23
Newcomb	16
New Jersey Television Supply Co.	150
Offenbach-Reimus	97
Olson Radio Warehouse	147
Palley Supply Co.	140
Peak Electronics Co.	168
Perma Power	158
Philco Corporation	119
Photocon Sales	166
Pickering & Company, Incorporated	18
Platt Electronics Corp.	156
Popular Electronics	171
Precise Development Corp.	92
Precision Radiation Instruments	145
Premax Products	116
Premier TV Radio Supply	111
Probescope	151
Progressive "Edu-Kits," Inc.	129
RW Electronics	149
RCA Institutes, Inc.	29, 97
RCA Service Company, Inc.	106
Radio-Television Training Association	25
Radiart Corp.	6
Radio City Products Company	145
Radio Receptor Company, Inc.	139
Radio Sound Publications	165
Radio & Television News	148
Rad-Tel Tube Co.	165
Raytheon Manufacturing Co.	2nd Cover
Regency	130
Rek-O-Kut Company	146
Rider Publisher, Inc., John F.	128
Rinehart & Co., Inc.	91, 106, 121, 132, 136, 166
Rockbar Corporation	144
Rohn Manufacturing Company	133
Sams & Co., Inc., Howard W.	142
Sam's Surplus	130
Sangamo Electric Company	96
Sarkes-Tarzian, Inc.	10
Sprague Products Co.	15
Sprayberry Academy of Radio	77
Stackpole Carbon Company	32
Stan Burn Radio & Electronics Co.	154
Steve-El Electronics Corp.	150
Stevens Walden, Inc.	92
Stuart Electronics Distributors	163
Sun Parts Distributors, Ltd.	144
Supreme Publications	139
Sylvania Electric Products, Inc.	24
"TAB"	172
Teltron Electric Company	116
Terminal Radio Corp.	160
Transamerica Electronics Corp.	159
Transvision, Inc.	152, 160
Triad Transformer Corp.	100
Tri-State College	165
Tung-Sol Electric, Inc.	166
U. S. Crystals, Inc.	137
United Radio Co.	157
University Loudspeakers, Inc.	162
Valparaiso Technical Institute	157
Video Electric Company	120
Vue-Rac	168
Walsco Electronics Corporation	31
Weller Electric Corporation	153
Western Television Institute	164
Wholesale Radio Parts Co., Inc.	162
Winston Electronics, Inc.	138
World Radio Laboratories	157
Zingo Products	145

Classified Continued from Page 169

FREE: Get our monthly electronic lists. Dick Rose, Everett, Wash.

TUBES and equipment bought, sold, and exchanged. For action and a fair deal write B. N. Gensler, W2LNI, 136F Liberty, N. Y. 6, N. Y.

AN/APR-4, other "APR-," "ARR-," "TS-," "IE-," ARC-1, ARC-3, ART-13, everything surplus; Tubes, Manuals, Laboratory equipment. Describe, price in first letter. Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio.

FORTY Complete VHF Radio Terminals. These are designed for telephone service in the 72-76 mc. band, and are ideal for setting up a communication system along a pipeline, railroad, or in mountainous or bush country. Each terminal consists of the following: 1—Link Radio Type 1498T Transmitter; 1—Link Radio Type 1498P Power Supply; 1—Link Radio Type 1498R Receiver; 1—Budelman 200 watt Power Amplifier; 1—Type PP13 Power Supply; 1—Federal Type 101B V-F Ringer; 500 ft. —Type RG 8U Coaxial Cable; 2—Welded steel Yagi Antennas—5 element; 1—Lister Diesel-Generator set, 2KW. P. J. Plishner, 550 Fifth Avenue, New York City.

SPEAKER, New Altec-Lansing 602-A. Foran, 3452 Hackett, Milwaukee, Wisconsin.

TELEVISION Receivers, working, $30 up. Repairable, $10. W4API, 1420 South Randolph, Arlington 1, Virginia.

TV-FM antennas. All types including UHF. Mounts, Accessories. Lowest prices. Wholesale Supply Co., Dept. H., Lunenburg, Mass.

RADIO Diagrams $1.00, Television $2.00. Give make, model, Diagram Service, 672-RN, Hartford 1, Conn.

HI FI Bargain Collaro 3-532 Intermix 15 Spindle-dual ceramic cartridge-mounting board—$36.95 Prepaid. Crescent Trionatic-dual cartridge-automatic shut-off—Mounting board $21.95. Prepaid. Low Prices—Cartridges, tuners, etc. Write Today. Fidelity Unlimited, 63-03 39 Ave., Woodside, N. Y.

30-40 MC-AM Crystal Controlled 10 tube receivers 6 volts DC with tubes and one vibrator. Less crystal. Spera 37-10 33 Street, L.I.C., N. Y.

CODE—Practice oscillator kit. Complete with transistor and battery $14.95 postpaid. Caldwell, Box 685X, 1421 Arch St., Phila. 2, Pa.

CATHODE Ray Tubes. Sylvania 5FP14. New Original Carton. $5.00 Postpaid. Shore Sales Co., Kilgore, Texas.

TELEVISION Sets $17.95 up. Jones Radio, 1115 Rambler, Pottstown, Pa.

ALUMINUM Tubing, Angle and Channel Plain and Perforated Sheet. Willard Radcliff, Fostoria, Ohio.

DIAGRAMS for repairing radios $1.00. Record-Changers $1.50. Television $2.00. Give Make, Model. Diagram Service, 672-RN, Hartford 1, Connecticut.

WANTED

WILL buy 8 each ARC-3—R77 Receivers—$125.00. T67 Transmitters $90.00. J68 Power Unit $75.00 state condition. Purchasing Dept.—Trans-Texas Airways, Houston 17, Texas.

TOP Dollar Paid for ART-13's, dynamotors, parts racks and all other component parts. Write: Harjo Sales Co., 4109 Burbank Blvd., Burbank, Calif.

WILL Buy All ART-13/type T-47A $200.00. ART-13/type T-17 $150.00. BC-788C $100.00. R5/ARN-7 $125.00. ARC-3 complete $250.00. BC-348 modified $35.00. BC-348 unmodified $50.00. ARC-1 Radio $150.00. BC-312 Receiver $40.00. BC-342 Receiver $50.00. Ship Via Express C.O.D. Subject to Inspection To: H. Finnegan, 49 Washington Avenue, Little Ferry, N. J.

WANTED: Type R19/TRC-1 Receivers. Box 513, Radio & Television News.

WANT: Surplus electronic equipment such as ART-13, DY-17, APR-4, APN-9, BC-610, BC-939, BC-348, ARC-1, RTA-1B. Cash or trade for Viking, Ranger, National, Hammarlund, Elmac, Gonset, Hallicrafters, etc. Alltronics, Box 19, Boston 1, Mass., Richmond 2-0048.

RECORDS

25-50% DISCOUNT on guaranteed factory fresh LP records, and pre-recorded tape. Send 20¢ for complete LP catalogue. Record Sales, 4710 Caroline, Houston 4, Texas.

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USED correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

USED Correspondence Courses. Books Bought, Sold, Rented. Educational Exchange, Summerville, Ga.

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500 PenniPrints $5. Sell your idea with PenniPrints. Your ink drawings, plans, forms, details, layouts, newspaper clippings, testimonials, electrical diagrams, reproduced 8½ x 11. Your photos 8 x 10 prints 2000 for $20.00. Easily folded for mailing. Free estimates. PenniPrint Co., Dept. 21, P.O. Box 1159, Chicago 90.

HELP WANTED

TELEVISION Jobs—Names and addresses of companies to contact. $1.00. Fitzgerald, Dept. A-14, 3038 West Wellington Avenue, Chicago 18, Illinois.

SITUATIONS WANTED

TELEVISION Parts Man, Young, Thoroughly Experienced Wishes re-locate. Preferably Florida. Box 514, Radio & Television News.

MISCELLANEOUS

BUILD amazing electronic brain which can play game. Details, 25c. Bernard Gott, Apt. 5-D, 213-02 73 Ave., Bayside 61, N. Y.

TEST Equipment repaired and calibrated by Factory staff. All makes. Superior, Simpson, Triplett, Eico. Prompt service. Free estimate. Our nineteenth year. Douglas Instrument Laboratory, 176 Norfolk Avenue, Boston 19, Mass.

TEST Equipment repair—Kit construction. Free Information. Bigelow Electronics, Beulah, Mich.

200 UNMARKED ceramicons. Mixed values $1.00. Schneider, Box 214, Seaford, N. Y.

Mc's Speaker Reconing. Low prices. 506 N. Ward Street, Benton, Illinois.

ALL makes speakers repaired. Amprite Speaker Service, 70 Vesey St., New York City 7.

RADIO-TV Repair, Colorado. Small shop grossing enough to pay out in five months. Free pictures C-4174 Continental, 804 Grand, Kansas City, Mo.

SPEEDWAY ¼" ELECTRIC DRILL JACOBS GEARED CHUCK MODEL 200J

HI-TORQUE (Powerful) UL Appvd. 2400RPM 115 Volt AC DC motor. Geared Chuck & Key. With 9 Drills in case..........$14.25
Model 400J ½" Drill 425 RPM. Powerful 115V AC DC Motor w 9 drills&case.$29.95
Model 1000 Speed Saw ¼HP/Adj45° $22.35
HAND-SAW Finest Swedish Steel, Sandvik Grade. Cross Cut $10.95 Reg......$3.95

CUMMINS DRILLS

¼-inch Geared Chuck Drill, Hi-Torque 1800 RPM/115VAC Motor, w Perm-Align Bearings. Model 44..................$23.98
Power Saw Industrial Workhorse. Cuts 2" Lumber & Steel. 6⅜" Blade. Adj Cut. 115VAC/DC, #700. Maxsaw........$52.25

CHROME VANADIUM DRILLS

29Pcs Set 1/16" to ½" by 64ths...$7.98
60Pcs Set #1 to 60 C.V.............$5.95
13Pcs Set 1/16" to ¼" with Index.$1.98
12Pcs Set 1/16" to ½"............$2.98
Drill Index HUOT For 29Pcs Set....$1.98
Drill Index HUOT For 60Pcs Set....$1.49

NEW "LENK" 180 Watt Perfect Balance SOLDERING GUN

No other soldering gun offers all these features at any price. 115VAC 180 Watt, light weight 28 ozs., swivel 180 deg. Korodless Tip, Heavy Duty Transformer, Positive Trigger-easy action.....................$7.45

NEW FAMOUS MAKE GUNS GTD
TAS-4 soldering gun 135W..........$7.89
TAS-5 soldering gun 250W.......... 8.77
TAD-4 dual heat 100-150W.......... 9.65
TAD-5 dual heat 200-275W..........10.53

FILAMENT TRANS.

2.5VCT/10A 12.5KVINS..$5.50; 3 for $14
2.5VCT/10A 5KVINS $3.59
7.5VCT 12A 15 KVINS 10.95; 2 for $17.50
24V 1.25A CSD......$1.98; 2 for $3.49
42.5V/2A Sel Rect Xfmr.....$4.98; 2/$8
PRI 110 & 220V Sec 16.6V/1.25A, 12.6 VCT/3.5A ....$4.98; 2/$8.00

TRANSFORMERS

ALL 115V 60CYC INPUTS
2500V/20MA, 6.3V/.6A, 2.5V 1.75A, 4 BC412 Scope..$7.98
1600VCT/5MA, 6.3VCT/3A, 6.3 VCT 10A, 2.5VCT/5A...$7.95
900V/35MA, 2x2.5V/2A Xclent 1800V Dbler. $1.98
778VCT 200MA, 5V 3A, 6.3VCT/5A THORDARSON..$4.98; 2 for $9; 6 for $24
770V 2.5MA, 2.5V/3A, HMSLD FILTER PARTS 4/scope..........$3.69; 2 for $6.00
700VCT 70MA, 5VCT 3A, 6.3VCT/2.5A $3.95
600VCT 50MA, 6V 3A, 6V/1.5A, 5V/1A HALF SHELL..$2.49; 2 for $4.50; 10 for $20
550VCT 250MA, 5V/2A, 6.3VCT/2.5A, 12.6 V 3.5A, RCA CSD..........$4.50; 2/$8
420VCT 90MA, 6.3V/1.9A, W/INPUTS 6, 12, 24, 115VDC & 115 & 230 VAC @...$1.49

FILTER CHOKES

Check These Reduced Prices
50Hy/125ma/Csd H'sld $2.89
20Hy 300ma or 15 Hy/400ma 8.95
13.5 Hy 1 Amp./17KVins...35.00
Dual 2Hy 300ma. USN....95c; 2 for 1.49
10Hy 100 MA Freed................. 1.39
3Hy 40ma UTC HI "Q"....69c; 2 for 98c
6Hy 175MA...............$1.49; 2 $2.49
2.5 Hy 300 MA 60 Ohm......$1.69; 2/$3

"TAB" SPECIALS

RF CHOKE 20MH/500MA.......69c; 10/$4
RF CHOKE 20MH 200MA.......39c; 10 $2
VEEDER ROOT Counter 3 Digit.79c; 10 $5
VEEDER ROOT 4 Digit.....89c; 10 for $6
BLOWER 40CFM 24VDC.....$5.00; 2 $8
CLOCK MOTOR Haydon Synchronous 6-10 VAC 24 RPM w switch......98c; 3 for $2
RELAY DPDT 12VDC Telephone..98c; 6 $5

5BPI $1.85

C'RAY TUBE....EA. Lots of 3
Sold Singly $2.25

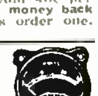
NEWLY IMPORTED AC-DC VOM MODEL TS-52 MULTITESTER

$6.49 Ea.

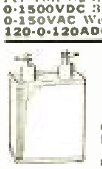
Lots of 3
Sold Singly $6.89
(+40c Ea. Shipping U.S.A. Only)

Finest, Hi-accuracy pocket VOM. Deposited. Precision resistors. Jeweled microamp meter movement. Extra long meter scales for easy accurate readings, vivid Red & Black calibrations. This is an exceptional buy for the TV serviceman, Ham, Beginner or engineer. Slips in your suit breast pocket, measures only 1⅛" D, 4" L, 3⅛" W. 1000 ohms per volt. Ranges read as follows: AC & DC volts: 0-10-250 & 500V. DC MA: 0-1 & 250 MA. ohms: 0-100K. Built ready to work (No Kit) **Model 12C** precision mfgrd pocket size multitester, engineered for accuracy & durability as above VOM, except for extended scales & case style. Reads as follows: AC & DC volts: 0-5-25-250 & 100V. DCMA: 0-1-10-100 MA ohms: 0-10K and 100K. Case measures 1¼" D, 4⅝" L, 3⅛" W, with test leads. Each **$9.89**; 3 at **$9.35** Ea. Add 40c per meter shipping U.S.A. **Sold on money back guarantee.** Schools & Colleges order one, then write for qty price.

METER SALE



5MA Tuning Meter 2"..$1.29
0-1MADC 3½" RND/MR35-W001DCMA $8.33 Reg..$3.95
0-5MADC 3½" RND MR35-W005DCMA/$8.33 Reg.$3.95
0-100MADC/3½" RND MR35W....$3.95
0-800VDC Weston 301/3½" SQ 1000R-Per-Volt $25.00 List $8.95
0-1500VDC 3½" RND/$12.95 Reg..$5.95
0-150VAC Westinghouse 3" SQ.....$4.95
120-0-120ADC/with-Shunt; "AN"...$4.98



GTD. OIL CONDENSER SPECIAL

10 MFD $1.75 ea.
600 VDC lots of 3
Case dimensions, not including insulators 4¼H x 3¾W x 1¼"D. Smaller Quantities, special $1.98

"TAB" THAT'S A BUY

CIRCUIT BREAKERS

Heinmann Magn Bkrs, Amps: .220, 3, 7, 9, 12, 30, 35, 40 80, 180....$1.98; 12 $20
Klixon Thermal Push Button Brkr. Amps: 5, 10, 15, 20, 30..89c; 10 $7.98; 50/$34

CIRCUIT BREAKER FUSES
Amps: 3, 5, 7, 10, 15, 20
Ea. 27c; 5 $1; 25 $5; 100 Asstd. $15
Crkt Bkr Fuse & Mtg Clips...3/$1; 20 $6

SENSATIONAL Slim-Jim Hi-Gain DYNAMIC MIKE & TILT STAND

Hand, chest or table use. Compact width 1⅜ lgth 6" weight only 7 ozs. W.E. Head UTC-Xmfr 4/HAM, Mobile, Pa. & Recording —50DB/80—7500 CPS GTD to satisfy. Postpaid U. S. A. Only......Lots of 3 **$3.49**
Sold Singly, Ea. $3.98
Mobile Clamp....25c

SELSYNS—SYNCHROS

AY1/Autosyn 26V/400Cy/E.P. $3.98
AY5 Autosyn/26V/400Cy E.P. $3.98
CK-2 Low-In-Servo Motor E.P. $20.00
AY20 Autosyn/26V/400Cy E.P. $4.98
C44968 Sync Rptr 115V/60Cy $16.00
C56701 Syn Rptr 115V 60Cy $21.00
C56776 Syn Rptr/115V/60Cy $15.00
C69406-1 Syn Rptr/115V 60Cy $21.00
C76166 Voltage Rcvr/115V/60Cy...$16.50
C78248 Syn Trans/115V/60Cy $16; 2 $28
C78249/Syn Diff/115V 60Cy....$7; 2 $12
C78386 Sync Transf 115V 60Cy ...$29.50
C78670/Sync Special 50V 50Cy...$21.00
2J1F1 Syn Gn/115/57.5V/400Cy.$9; 2 $16
2J1F3 Sync Gen 115 57.5V/400Cy ..$9.00
2J1G1/Syn Tr 57.5 57.5V/400Cy.$6; 2 $11
2J5HA1 Gen/115/105V 60Cy $57.00
2JD5HA1 Syn Mtr 115/105V/60Cy.$57.00
1CT/Sync Trnsf 90/55V 60Cy......$59.00
5CT MK111 MOD2, 90 55V 60Cy ..$43.00
5F MK4 MOD IV 115V 60Cy $43.00
5G MK1 MOD6 115 90V-60Cy $45.00
5GSpecial KS5950/115V 90V-400Cy...$27
6G Syn Gen/MK2/MOD 1V/115V/60Cy.$49

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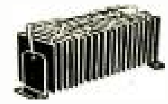
A must for Radio-TV Service. Throws light where you want & **FREES** both hands for work. Worn with or without glasses. Powerful focused 25 ft. beam. Adjustable angle up & down. With batteries. Postpaid (This item only) U.S.A. **SPECIAL..........$1.98; 6 for $11.00; 12 for $20.00.**

NEW "TABTRON" SELENIUM RECTIFIERS ENGINEERED FOR INDUSTRIAL USE



We manufacture power rectifiers to your specifications. Contact "TAB" for fast delivery on any rating, from one amp up to and above 1000 amps, convection or fan cooled. Single or 3-phase to your spec's. **NEW LOWER PRICES.**
Full Wave Bridge.*

Max Amps	18VAC* 14VDC	36VAC* 28VDC	72VAC* 56VDC	130VAC* 100VDC	144VAC* 118VDC	266VAC* 217VDC	C. T. 30VAC 12VDC	3 PHASE BRG. 120VAC 150VDC	240VAC 300VDC
1	$ 1.35	$ 2.35	$ 4.60	$ 7.50	$12.75	$22.25	$ 2.10	$14.90	$28.95
2	2.00	2.75	6.00	9.25	15.75	28.85	Q	15.90	30.95
4	3.50	6.50	14.50	22.00	26.75	38.85	2.95	18.90	36.95
6	4.10	8.00	17.50	29.95	34.75	54.85	3.25	20.90	39.95
10	5.95	11.50	25.00	41.50	44.75	84.85	4.75	36.90	71.95
12	7.50	14.50	30.00	44.50	54.75	99.85	5.95	41.90	81.95
20	12.00	23.00	49.00	72.00	82.75	160.85	7.95	50.90	97.95
24	14.50	29.00	58.00	81.50	94.75	190.85	9.95	89.90	159.95
30	18.00	34.50	72.00	110.00	128.75	235.85	Q	117.90	225.95
36	22.50	42.50	88.00	135.00	165.75	295.85	14.95	134.90	269.95
50	29.75	54.50	Q	175.00	195.75	405.85	23.95	179.90	359.95
100	56.00	99.50	Q	324.00	390.75	795.85	39.95	359.90	719.95

NEW RECTIFIER & TRANSFORMER

115V 60 cy input
up to 14VDC at 12 amps........$19.98
up to 28VDC at 4 amps........ 14.98
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

NEW HIGH CURRENT PWR SUPPLIES GTD*

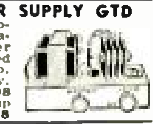
Variable 0-28VDC, Completely Built. Ready to Go. Full Wave Selenium Rectifier, Transformer, Variac, Volt & Amp Meters, Switch, Terminals & Fuse. In Hvy Dty. Steel Cabinet. Standard 115V 60 cy input. 220V to order. * One Year

Stock Number	Continuous Rating	With Meters
T28V6A	0-28VDC at 6 Amp	$49.95
T28V12A	0-28VDC at 12 Amp	89.00
T28V24A	0-28VDC at 24 Amp	129.50
T28V50A	0-28VDC at 50 Amp	239.50
T28V100A	0-28VDC at 100 Amp	469.00

NEW RECTIFIER XFMRS

Primary 115V 60 Cyc
Sec 18-15-9-0-9-15-18V
(36-30-18VCT Common Ct)
4 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 only 2 Amps..............$1.98
***DUAL PRIMARY 115 & 230 VOLT.**

NEW DC POWER SUPPLY GTD

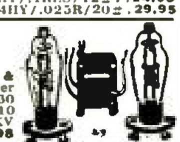


Variable DC Power Supply. Full Wave Rectification, 6000Mfd filter Condenser, fused. Rated 6.3V or 12.6V at 2 amp. operates 115V/60 cy. Model 2DCF ...$12.98
As above except 6 Amp Model 6DCF ...$29.98

NEW RECTIFIER CHOKES

CH07/4 Amp/.07HY/.6RES/10#...$7.95
CH01/12 Amp/.01HY/.1RES/12#..14.95
CH004/24 Amp/.004HY/.025R/20#.29.95

866A KIT and XFORMER

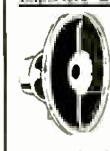


(2) 866A Tubes & Sockets, Transformer Rated: Pri 115V 60 cyc Sec. 2.5VCT/10 Amp Hi-Volt 7.5KV Insulation $4.98

NEW BATTERY CHARGER RECTIFIER

13-0-13V (CT) 100Amp Fan Cooled or 34 Amp Air Cooled. Replacement 6 Volt Booster Chgr. Sel. #CR16........$10.98; 3/$31
16-0-16V (CT) Fan Cooled 12V 60Amp and 6V/100Amp Booster Chgr Replacement. Model CR30.............$11.98; 3/$33
Exporters & Mfgrs. Write for Qty Price.

HI-FI SPEAKERS



All 8 ohm, V.C., Alnico V Magnets, Inbuilt Network, 2 wires needed for HF & LF Response. Famous Hi-Fi Speaker Mfrs.
15" Coaxial PM & 5" Tweeter. 25 watt/20-17500 cy. Model P25CO......$23.75
12" Coaxial PM & 3½" Tweeter. 12 watt/45-15KC Spec....$12.75; 3 for $35
8" Coaxial PM & 2½" Tweeter, 8 watt/70-15000 cy. Model P8CO....$7.98; 2/$15
12" HI-FI PM 10W 35-14KC...$10; 2/$18
8" HI-FI PM 7W 45-14KC...$7.25; 2/$13
TWEETER 5"/12W/12-15KC 16-ohm.$4.45
TWEETER 3½"/5W/2-15KC/8-ohm.$3.25

AUDIO COMPONENTS

GE RPX050 Orig. GE Box.$6.69
GE RPX040/78 Goldtone $5.25
GE RPX041/MG Goldtone $5.25
GE RPX052/Dual (D&S) $17.75
GE RPX053/.001 & .003 diamonds, Reg $34.05; "TAB" Gtd.$25.98

"TAB" GTD Phono Needle Replacements
RPJ010 Dual .001 & .003 sapphire. $1.69
RPJ012 Dual .001 & .003 diamonds.$20.89
RPJ001/78 or RPJ005 .001 sapphire.$1.35
RPJ003/78 or RPJ004 LP diamond..$10.89
RPJ013 Dual diamond & sapphire..$12.89
All other makes & types (exc. G.E.) all GTD exact replacements. Specify Model&#
MGor78 single osmium..59c; 12 for $5.98
MGor78 single sapphire styli.......$1.15
MGor78 single diamond..........$10.89
MG&78 dual diamond.............$20.89

HIGH FIDELITY AUDIO

You are there! Hear Carnegie Hall in your living room through the NEW TAB HI-FI Linear Amplifier. Check these outstanding features. Response: ±, 5DB/20-50KC. OUPT 12 watt. HUM: 80DB down. Input: 4 channels. Selector and equalizer switch. Calib bass & treble controls 4, 8, & 16 ohms output. Handsome front panel for custom mounting. Model TAB45..........$49.98
LJ-3 GROMMES 10 watt HI-FI ampl 20-20KC, 4 Inpts. bass & treble cntr..$41.90
50-CM FISHER Master control, preamp equalizer, 4 inputs, frequency and tone compensation controls $97.50
70RT FISHER FM-AM tuner. Engineered to perfection for the Hi-Fi enthusiast.$184.50
70-A FISHER Basic amplifier 25 watt for use with 70RT or 50CM..........$99.50
RC-80 GARRARD 3-speed changer..$49.50
RC-90 GARRARD 3-speed changer..$69.50
TAB45 amplifier 12" coax speaker, RC80 changer, RPX050 dual cartridge. Regular $127.50. Special.............$114.00
LJ ampl, 12" coax speaker RC80 changer & RPX050 cartridge $110.84 Reg. Spec.$99.00
LJ ampl & 12" coax spkr..........$45.00
50CM Preamp, 70RT tuner, 70A ampl, RC90 changer, RPX053 cart dual diamonds $476.98 Reg. Spec. $442.93
Write for Hi-Fi Gram.

"TAB" TESTED & GUARANTEED

PRICES SUBJECT TO CHANGE
WRITE FOR COMPLETE LISTING

TUBES

Type	Price
OA2	$0.88
OA3/VR75	1.04
OB2	1.37
OB3 VR90	.96
OC3/VR105	.92
OD3 VR150	.92
1B3 8016	.80
1B22	1.82
1B23	8.87
1B24	8.98
1B26	2.24
1B27	11.98
1B32/532A	2.48
1B35	9.15
1B37	14.87
1B38	29.45
1B41	49.95
1B42	17.48
1B46	1.98
1B63	45.00
1D21 SN4	3.89
1L4	.48
1L6	1.35
1LD5	.98
1LN5	.78
1R4	1.29
1R5	.59
1U4	.52
1U5	.54
1X2A	.98
2C36	27.00
2C39A	26.98
2C40	4.98
2C43	17.48
2C44	1.15
2C51	3.88
2D21	1.18
2E31	1.49
2E43	1.49
2J26	24.75
2J27	22.95
2J31	27.00
2J32	29.48
2J33	27.00
2J34	24.98
2J37	12.70
2J38	69.98
2J39	6.98
2J42	148.98
2J48	24.45
2J49	84.00
2J50	99.98
2J51	238.98
2J55	84.98
2J56	149.00
2J62	49.45
2K22	23.48
2K23	11.48
2K25	28.49
2K25/723AB	23.88
2K28	27.48
2K29	22.88
2K33	219.48
2K39	134.99
2K41	126.00
2K45	72.50
2K48	99.48
2X2	.42
3B22	2.48
3B23 RK22	4.95
3B24	4.70
3B26	3.70
3B28	7.90
3C22	85.00
3C23	8.67
3C33	9.51
3C45	9.98
3D21A	8.15

Type	Price
3D22	13.97
3D23	4.90
3E29	14.49
3K23	349.00
3K27	149.00
4C35	21.49
4D21	18.99
4E27	22.49
4J22	129.51
4J31	99.51
4J52	199.99
4PR60A	42.50
EL5BHD	15.99
5C21/C6J	9.89
5C22	38.95
5D21	14.98
5R4GY	1.20
5R4GYW	1.75
5U4	.55
5Z3	.99
6AG5	.71
6AG7	1.14
6AH6	1.21
6AJ5	1.40
6AK5	.87
6AK6	.92
6AL5	.48
6AL7GT	.98
6AN5	3.27
6AQ5	.52
6AQ6	.81
6AQ7GT	1.29
6AR6	3.27
6AS7G	3.48
6AT6	.54
6AU5GT	1.10
6AU6	.56
6AV5GT	.98
6AV6	.49
6AW6	1.09
6B4G	1.18
6BA6	.54
6BA7	1.09
6BC5	.63
6BC7	1.23
6BD6	.83
6BE6	.54
6BF5	.98
6BG6G	1.58
6BH6	.63
6BJ6	.69
6BK7	1.58
6BL6	58.00
6BL7GT	1.19
6BN7	2.69
6BQ6GT	1.20
6BQ7	1.65
6C21	24.50
6C4	.52
6C5	.68
6CB6	.59
6CD6G	1.69
C6J/5C21	9.89
6J4	6.66
6J5	.54
6J6	.58
6L6	1.48
6L6G	1.08
6L6GA	1.08
6L6GAY	1.98
6SA7GT	.66
6SC7	.90
6SF5	.78
6SG7	.64
6SH7	.61
6SJ7	.58
6SK7GT	.56
6SL7GT	.64
6SN7GT	.68

Type	Price
6SQ7GT	.62
6SR7	.62
6SS7	.88
6SU7GTY	2.69
6T8	.96
6U4	.74
6U8	.99
6V6	1.39
6V6GT	.59
6W4GT	.52
6X5GT	.54
6Y6G	.88
7A8	.68
7C7	.76
7F7	.82
7F8	1.24
7H7	.72
7N7	.92
7V7	1.06
7Y4	.68
8D21	298.00
12A6	.48
12AH7GT	1.45
12AL5	.54
12AT6	.54
12AT7	.89
12AU6	.72
12AU7	.69
12AV6	.52
12AV7	.98
12AW6	1.18
12AX7	.98
12AY7	1.69
12BA6	.59
12BA7	.94
12BD6	.59
12BE6	.59
12BF6	.85
12BH7	1.29
12SA7GT	.68
12SC7	1.08
12SF7GT	.84
12SG7	.80
12SH7	.63
12SJ7	.54
12SK7	.66
12SL7GT	.62
12SN7GT	.68
12SQ7GT	.54
12SR7	.66
FG17	3.90
24G 3C24	1.32
25BQ6GT	.98
25L6GT	.67
25Z5	.78
25Z6GT	.58
FG27A	8.24
28D7	1.94
35B5	.52
35L6	.67
35T	4.88
35Y4	.68
35Z5	.54
41	.72
42	.68
45Z3	.88
48	1.98
50A5	.76
50B5	.54
50C5	.54
50L6GT	.62
RK61/XFG1	2.65
FG67	14.68
HY69	4.98
71A	.74
75	.64
78	.78
80	.58

Type	Price
81	1.38
83	1.12
83V	1.22
84 6Z4	.62
100TH	9.88
FG105	19.48
117L/M7GT	1.98
117Z6GT	.96
CV148	9.98
FG166	48.49
FG172	29.00
250TH	18.97
250TL	17.75
304TH	12.49
304TL	12.49
388A	1.48
WL417A	8.48
417A/5842	18.50
GL434A	12.69
446B	3.48
450TH	49.97
450TL	52.00
460/HF200	15.95
CK502AX	1.49
CK503AX	1.49
CK505AX	1.79
CK512AX	1.45
CK531DX	1.89
531	5.72
CK532DX	1.89
WL532A	3.68
CK533AX	1.29
CK536AX	.99
CK538DX	.98
CK539DX	2.19
CK541DX	1.99
CK543DX	.99
CK544DX	.99
CK546DX	1.99
CK571AX/5886	2.49
CK573AX/6029	3.49
WL676	34.98
703A	4.72
705A	1.88
707A	7.90
707B	14.88
715A	4.96
715B	7.94
715C	17.98
717A	.88
719A	24.48
721A	3.92
722A 287	1.94
723A B	16.98
724A	3.95
724B	2.74
725A	9.98
726A	14.48
726B	31.00
726C	44.00
801A	.42
803	3.48
805	3.22
807	1.54
808	2.62
809	3.58
810	10.88
811	3.00
812	2.70
813	11.48
814	4.98
815	5.98
826	.95
828	9.25

Type	Price
829	7.94
829B	12.48
832	7.72
832A	9.92
833A	39.45
834	5.95
836	5.95
837	1.42
849	29.45
860	4.48
861	22.48
865	1.26
866A	1.50
872A	3.29
CK1005	.68
1613	.82
1614	1.95
1619	.36
1625	.32
1632	.68
1633	.98
1634	1.18
1635	1.69
1636	3.08
1642	.62
1644	.92
2050	1.48
2050W	2.48
5654	1.72
5670	3.44
CK5672	1.20
CK5678	1.28
5687	3.74
CK5702	2.90
CK5703	1.29
5713	120.00
5812	2.99
5814	2.08
5840	7.98
8012	2.58
8013A	3.92
8025A	4.68
9001	1.12
9002	.82
9003	1.12

XTAL DIODES

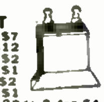
Type	Price
1N21	.30
1N21A	1.55
1N21B	2.10
1N22	1.22
1N23	1.35
1N23A	1.89
1N23B	2.00
1N25	4.98
1N26	8.75
1N27	1.55
1N34	.63
1N35	1.65
1N38A	1.29
1N41	8.95
1N42	16.95
1N45	1.45
1N46	.69
1N47	4.00
1N48	.47
1N51	.45
1N54	.78
1N54A	1.00
1N58A	1.15
1N60	.60
1N63/K63	2.49
1N64	.69
1N69	.98

Other Types in Stock. Write.

PRECISION LABORATORY POTENTIOMETER

Wire wound 20,000 ohm 2¾" Diameter/4" shaft. Special......$1.98; 2/$3.50
HELIPOT 100-ohm/0.5%/10 Turn..$7.98
HELIPOT 2000-ohm/0.5%/10 Turn.$7.98
MICROPOT 20,000-ohm/0.1%/10T..$7.98
HELIPOT 30,000-ohm/0.5%/10T...$7.98
HELIPOT 50,000-ohm/0.5%/10T...$7.98

OIL CONDENSERS NEW WAREHOUSE LIST



.00025MFD 25KV $4; 2 $7
.0016MFD/15K $7; 2 $12
2X.1MFD 2000V $1.39; 2 for $2
.5MFD 600V .....25c; 6 for $1
.5MFD/1500V ...85c; 3 for $2
1MFD/500V .....33c; 4 for $1
1MFD/600V ....39c; 3 for $1
2MFD 600V ....59c; 5 for $2
4MFD/3000V ....$7.98; 2 for $14
4MFD/5000V ....$19.95; 2 for $35
5MFD/600V ....$1.50; 3 for $4
16MFD/600VAC/1800VDC $5.95; 2 for $10
10MFD/600V 2x2.5&5MFD $1.98; 12/$18
Write for Quantity Price

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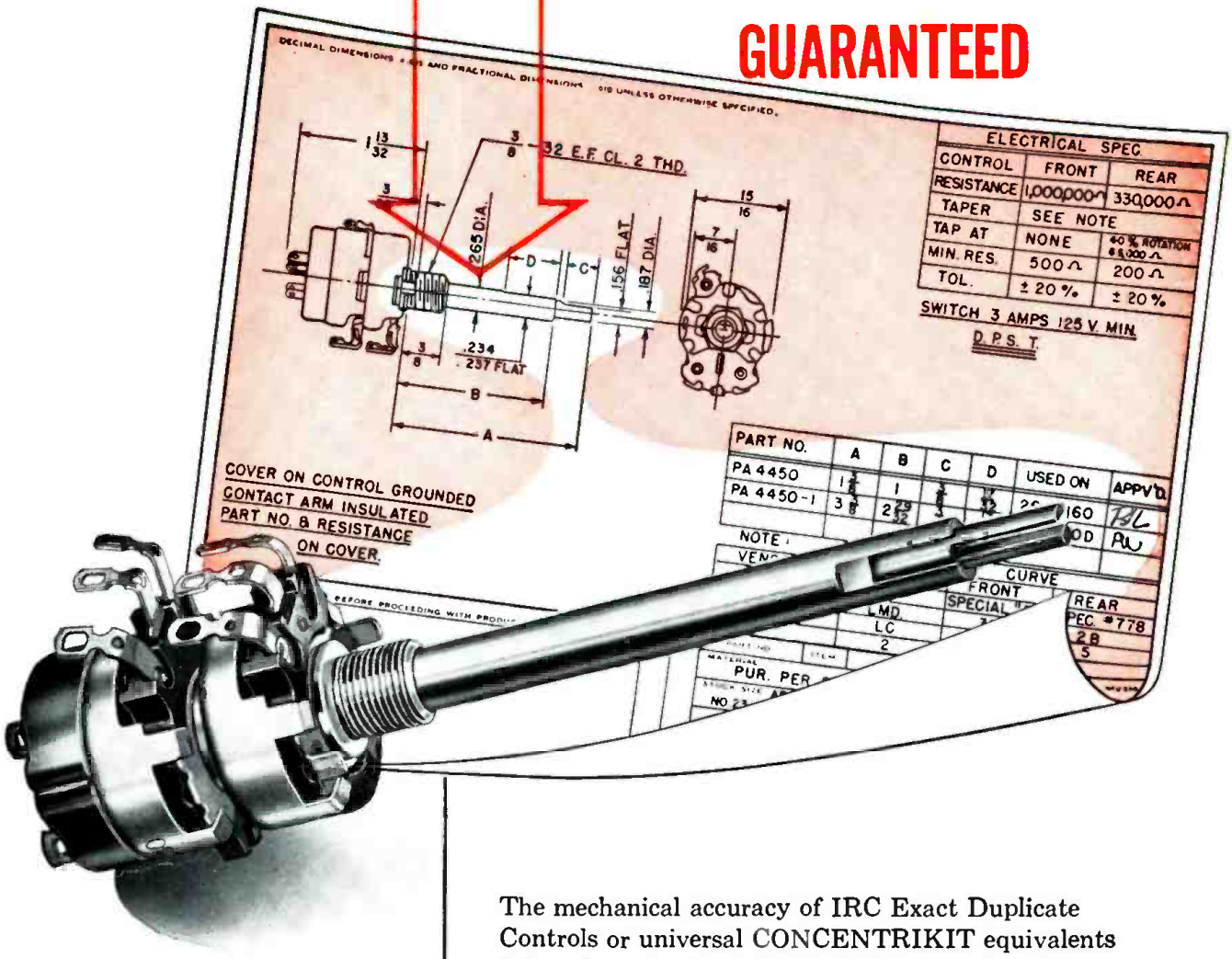
Money Back Guarantee (Cost of Mdse. Only) $5 Min. Order F.O.B. N.Y.C. Add Shpg. Charges or 25% Dep. Tubes Gtd. via R-Exp. only. Prices subject to Change Without Notice.
Rector 2-6245

HERE'S WHY IRC EXACT DUPLICATES ARE DOUBLE-MONEY-BACK GUARANTEED



ONLY IRC GUARANTEES SATISFACTORY MECHANICAL FIT AND ELECTRICAL OPERATION OR DOUBLE-YOUR-MONEY-BACK

The typical manufacturer's specifications shown here are *exactly* duplicated by IRC QJ-180 control. CONCENTRIKIT assembly includes P1-229 and R1-312 shafts with B11-137 and B18-132X Base Elements, and 76-2 Switch.

The mechanical accuracy of IRC Exact Duplicate Controls or universal CONCENTRIKIT equivalents is based on set manufacturers' procurement prints. Specifications on those prints are closely followed.

Shaft lengths are *never less* than the set manufacturer's nominal length—*never more* than 3/32" longer.

Shaft ends are precisely tooled for solid fit.

Inner shaft protrusion is accurately duplicated for perfect knob fit.

Alterations are never needed.

For Exact Duplicate Controls, specify IRC. Most Service Technicians do.

IRC

Wherever the Circuit Says ~~~

INTERNATIONAL RESISTANCE CO.

415 N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licensee

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P.R. MALLORY & CO. Inc.
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Because Only Mallory Makes FP Capacitors

They were introduced by Mallory. For over 15 years they have set the standard of quality and performance in the industry. And they are available *only* from Mallory.

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- 85°C construction
- Ability to handle high ripple currents
- Well suited for voltage doubler circuits
- Ideal for use with selenium rectifiers
- Genuine fabricated plate anode
- Corrosive impurities held to less than 7 parts in 10 million
- Long shelf life
- Long service life
- Fast, twist prong mounting
- Standardized can size

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