RADIO & TELEVISION NEWS

AUGUST
1948
35¢

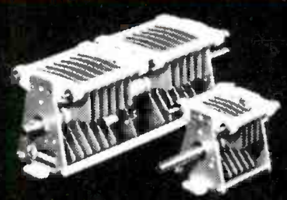
RADIO-FACSIMILE MAY PRINT
"NEWSPAPERS OF TOMORROW"

PAGE 39

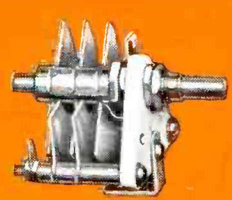
JOHNSON OFFERS

A Condenser To Fit Every Need!

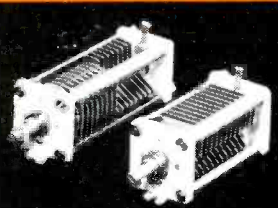
TYPE C & D — Sturdily constructed to give trouble-free operation under the most severe service, JOHNSON Type C and D Condensers cost less than any other quality condensers. Features include sturdy construction, heavy aluminum plates .051" thick, Steatite insulation and center rotor contacts on all dual models. Both front and rear shaft extensions permit ganging.
Available in 52 different models, single or dual sections, with spacing varying from .175" to .500" and maximum capacities from 50 to 1,000 mmfd.



TYPE E & F — Rugged and compact, JOHNSON Type E and F Condensers for medium and low power transmitters have more capacity per cubic inch and occupy less panel space for their rating than any other condenser on the market. Features include Steatite insulation, stator mounted above to reduce capacity to ground, front and rear shaft extensions that permit ganging.
Available in 45 different models, single or dual sections, spacing .045" to .125", and maximum capacities from 35 to 500 mmfd.



TYPE G — The JOHNSON Type G Condenser is widely used as a neutralizing condenser for medium and low power stages. It's equally famous for its outstanding performance in grid and plate tuning at high and ultra high frequencies. Features include front and rear shaft extensions and universal mounting bracket and locking nut.
Available only in single sections with single end plate. Seven models from which to choose. Capacities from 3.5 to 52 mmfd. Plate spacing from .045" to .225".



TYPE H — Combining minimum weight with small size, JOHNSON Type H Condensers are designed especially to withstand heavy vibration. Steatite end plates prevent any possibility of "short circuit loops" and permit panel mounting with both rotor and stator insulated from ground. Aluminum plates are .020" thick. End plates are 1½" square.
Available in 17 different models, single or dual sections, spacing .030" or .080", and maximum capacities from 25 to 100 mmfd.

TYPE J — A midget condenser with big condenser characteristics, Type J has wider spacing than most small types, yet occupies little more space. It is ideal for oscillator and low power stages. Universal type mounting brackets make possible a variety of mountings including chassis, panel or inside tube socket type inductors. Steatite end plate.
Available only in single sections with single end plate. Six different models with maximum capacities from 7 to 102 mmfd. Plate spacing is .025".

MIDGET AIR VARIABLES — Here are three of the smallest air variables ever produced.
SINGLE TYPE — Available in four models: 1.55 to 5.14 mmf, 1.73 to 8.69 mmf, 2.15 to 14.58 mmf. and 2.6 to 19.7 mmf.
DIFFERENTIAL TYPE — Available in four models: 1.84 to 5.58 mmf, 1.98 to 9.30 mmf, 2.32 to 14.82 mmf and 2.67 to 19.30 mmf.
BUTTERFLY TYPE — Available in four models: 1.72 to 3.30 mmf, 2.10 to 5.27 mmf, 2.72 to 8.50 mmf, and 3.20 to 11.02 mmf.

Write For New Complete JOHNSON Condenser Catalog

TYPE N — When space is limited, yet you need extremely high voltage rating, fine adjustment with uniform voltage breakdown rating throughout the full capacity range, the JOHNSON Type N Neutralizing Condenser is the perfect answer.
Available in three different models. Capacity range in each type is approx. 1.5 mmfd. to 10.5 mmfd., peak RF breakdown ratings at 2 MC ranges from 8,500 with the N125 to 14,500 for the N375.

JOHNSON ... *a famous name in Radio*

E. F. JOHNSON CO., WASECA, MINNESOTA

COVER PHOTO: WQXR-FM's facsimile installation in the New York Times Building. Engineer A. A. Cosmas adjusts scanner while Frances Clark of Radio Inventions, Inc. (Makers of Fax) sets scanning spot control. (Photo by The New York Times Studio)

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RADIO & TELEVISION NEWS

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Average Paid Circulation over 175,000

CONTENTS

AUGUST, 1948

DEPARTMENTS

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VOLUME 40 • NUMBER 2

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Audit Bureau of Circulations

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EVERYTHING YOU WANT.......in a high quality low cost receiver

- Coverage: 540 kc to 54.5 Mc
- Five bands
- Accurately calibrated slide rule dials
- Full electrical bandspread
- Series noise limiter
- Universal antenna input
- Built-in PM speaker
- Beat oscillator
- 2.5 watt audio output

Model hallicrafters NEW S-53

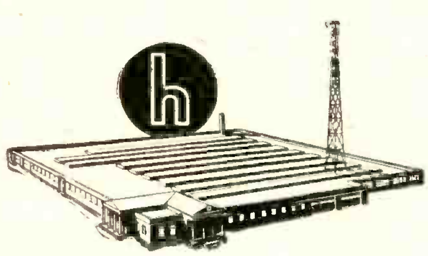
Hallicrafters Model S-53 takes an important position in the Hallicrafters line of high quality communications receivers. Completely modern. Superbly engineered for top flight performance at remarkably low price. All the Hallicrafters built-in quality features amateurs expect and demand in a good receiver. Extended frequency range from 540 kc to 54.5 Mc in five bands. Uses two Mc IF which positively eliminates all amateur station images or repeat points within the ham bands. The strikingly designed, edge lighted dial is precisely calibrated. A separate bandspread control provides full electrical bandspread on all frequency bands. Latest series type noise limiter circuit; voltage stabilized oscillator; iron core IF's; built-in PM dynamic speaker. Rich satin-black steel cabinet with satin chrome trim. Complete with seven tubes and rectifier. 105-125 volts, 50-60 cycles AC **$79.50**

Overall tuning range: 540 kc to 54.5 Mc. Band 1: 540-1630 Kc; Band 2: 2.5-6.3 Mc; Band 3: 6.3-1.6 Mc; Band 4: 14-31 Mc; Band 5: 48-54.5 Mc.

Controls: main tuning, bandspread, bandswitch, RF gain, audio volume, tone control, noise limiter, standby-receive, phone-code switch, speaker-headphone switch and phone jack on rear panel. Input jack for record player pickup connection.

New superhet circuit uses: 1—6C4 oscillator; 1—6BA6 mixer; 2—6BA6 IF's; 6H6 detector-AVC-noise limiter; 6SC7 BFO-1st audio; 6K6GT audio output and 5Y3 rectifier.

Size: 12⅞" x 6⅞" x 7⅞".



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PRACTICE WITH YOUR OWN HANDS!
Mind training through hand practice, that's the only way to LEARN and REMEMBER Radio. It's the most successful of Home Training methods.

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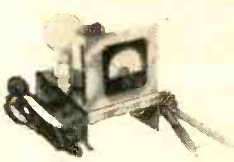
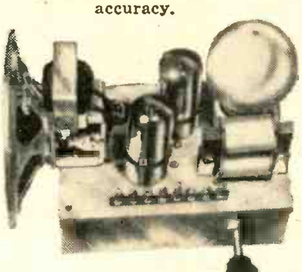


I give you a fine, moving-coil type Meter Instrument on Jewel Bearings — with parts for a complete Analyzer Circuit Continuity Tester. You learn how to check and correct Receiver defects with professional speed and accuracy.

Practice *Does It!*
Soldering, wiring, connecting Radio Parts . . . building circuits with your own hands — you can't beat this method of learning. When you construct this Rectifier and Filter Resistor and Condenser Tester, etc., you get a really practical slant on Radio that leads to a money-making future.



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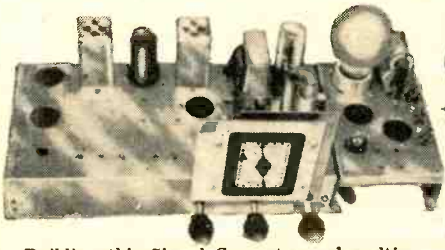

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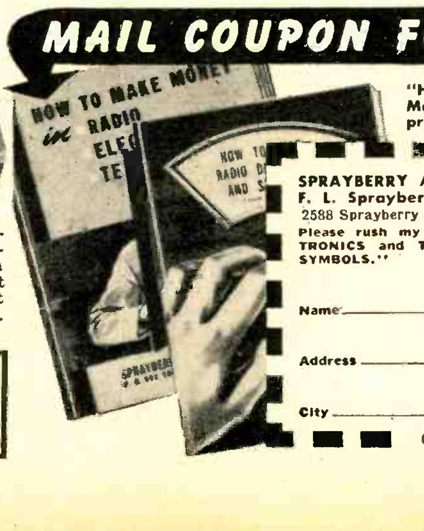

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For the RECORD

BY THE EDITOR

RADIO NEWS ADOPTS NEW TITLE

To Be Known as RADIO & TELEVISION NEWS

Now that Television has definitely established itself as one of the most potent forces in our American Way of Life, it is axiomatic that we accept video and radio as being of equal importance to all radiomen, regardless of whether they are servicemen, dealers, engineers, students, or manufacturers.

RADIO NEWS has long opposed the hush hush tactics of many television set manufacturers in their attempt to control video service for their very own, and so we look with favor upon the recent unanimous recommendation on the part of the RMA Service Committee to abolish the practice of a one year factory guarantee on TV sets and that television set installation and maintenance (with standard RMA 90 day guarantee) be turned over to regular, established radio servicemen. It has taken a long, long time for certain manufacturers to realize the many imperfections in their original operation. We expect, then, an even greater need for more and more technical information which will enable the serviceman to better understand the new techniques now required in his daily work and to give him training to meet the many new problems that Television presents.

At this writing it is believed that television will supplement rather than replace regular broadcasting. Production of television receivers now exceeds a total of 400,000 units since the war. That's an excellent showing, considering the fact that 175,000 units were produced for the entire year of 1947. By the end of this year, it is predicted that between 600,000 and 750,000 sets will have come off the production lines and that next year the total 1949 production may double this figure. A 10% drop in AM receiver production is expected this year, although production of FM sets, auto radios, and portables continues to exceed 1947 production figures. The end of this year should reveal that between one-fourth and one-third of over-all sales (dollar-wise) will be in TV. Service technicians can look forward with optimism to their stake in television.

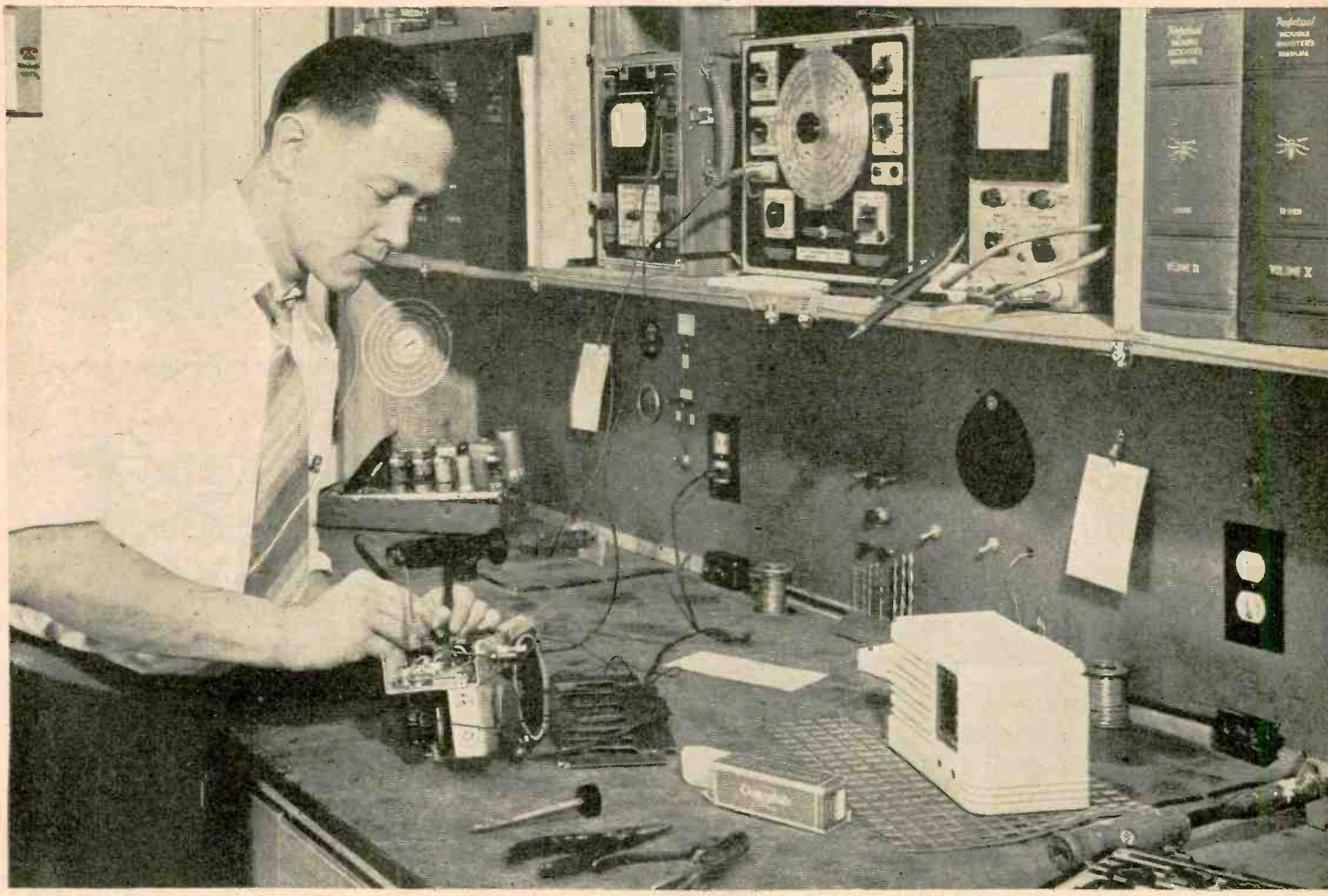
In recognition of our responsibility to satisfy the ever increasing demand for more and more technical material on television, we have, beginning with this issue, changed our title to more accurately describe our contents and format.

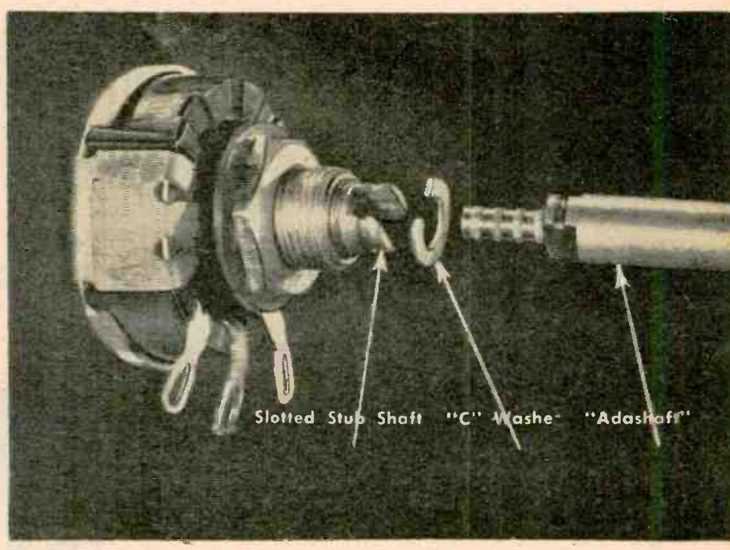
We are sure that our more than 200,000 readers will give their enthusiastic approval to this important change.

And so after 29 years under one title, RADIO NEWS will henceforth be known as RADIO & TELEVISION NEWS.

Oliver Read

"Centralab parts





Capacitors: CRL line of ceramic By-pass and Coupling Capacitors gives you ceramic dependability and permanence at a new low price! Packaged in a convenient envelope, *Hi-Kaps* are clean, easy to stock and handle. Wide range from .000050 to .010000 mfd. Rating — 600 WVDC, 1000 V. flash tested. Just out! New ceramic *Hi-Vo-Kaps* for television and high voltage use!

Controls: With CRL's improved *Adashaft* Radiohms you can carry a small stock of controls, yet be ready to handle almost any kind of control replacement problem. No wiggle, no wobble, no slip. Just insert shaft pilot in hole provided in control stub shaft, and slip "C" washer into place. Available in all sizes for all Model "M" volume control applications. Six types of shafts.

Spot Radio News

★ Presenting latest information on the Radio Industry.

By RADIO NEWS'
WASHINGTON EDITOR

A NEW HIGH in receiver production has been achieved during the past year according to Paul V. Galvin, chairman of the RMA set division. Reporting before the 24th annual convention of RMA in Chicago, Mr. Galvin disclosed that the radio industry turned out 19,500,000 sets with a total manufacturers' dollar volume of $700,000,000.

During 1947, industry produced 1,200,000 FM sets, about 175,000 TV models, 3,000,000 auto receivers, and more than 2,500,000 portables.

Discussing production for the '48-'49 period, Mr. Galvin said: "Probably the peak of unit production is past and will not be up as high this year, but the increased dollar volume of FM and TV receivers should largely fill the gap of the industry's lower unit volume."

Max F. Balcom, RMA prexy, predicted that television receiver production in 1948 will reach between 600,000 and 750,000 units, as compared with the 175,000 production of '47. Mr. Balcom also reported that 200,000,000 receiving tubes and $212,000,000 worth of transmitting equipment were produced in 1947.

Detailing the parts picture for '47-'48 and '48-'49 at the Chicago meeting, J. J. Kahn, chairman of the RMA parts division said that TV set manufacture has been and will continue to be quite a stimulus to component production. He pointed out that this condition should hold for several years, since the industry estimates that there'll be over two million TV sets in the field by 1949, over five million in 1950, nine million in 1951 and nearly fourteen million in 1952.

Good news indeed!

AN OUTSTANDING TRIBUTE was paid to the engineering personnel of industry by Dr. W. R. G. Baker at the Chicago conference in his recording of the achievements of the RMA standards committees which met over 200 times during the year to set up standards which expedited the adaption of technical developments to commercial uses with resulting benefits to the public.

Standards prepared by the committees covered disc home recording, color coding, intermediate frequencies, antenna-to-set transmission line for TV receivers, tube type designations, ceramic dielectric condensers, transmission lines for FM sets, drive pulleys, amplifiers, vibrating interrupters and rectifiers for auto frequency of 115 cycles.

According to Dr. Baker who is director of the RMA engineering division there were 59 committees involved in receiver standard work, 11 in sound activities, and 32 in a joint electronic tube engineering council.

THE CONTROVERSIAL BROADCASTERS CODE of Ethics, presented a year ago at the Atlantic City NAB meeting and debated widely for many months, prompting a few omissions, a few additions and a bit of rephrasing, has been accepted by the NAB membership and become a standard of practice.

Adopted were standards for news, political, public affairs, religious, crime and mystery, and children's programs.

The code is extremely frank. In the crime and mystery program section, for instance, broadcasters are told that programs should avoid presentation of brutal killings, torture or physical agony, the use of supernatural or climactic incidents which are likely to terrify or excite unduly. The code also forbids the presentation of episodes involving the kidnapping of children, sound effects calculated to mislead, shock or alarm the listener, and suicide as a satisfactory solution to any problem.

In a section on contests the code states that contests should offer the opportunity to all contestants to win on the basis of ability and skill, rather than chance. And broadcasters are told to avoid programs designed to "buy" the audience by requiring it to listen in hope of reward rather than for the quality of entertainment.

Advertising and time standards for advertising copy also appear in the code. Rigid rules are provided, covering length of time of announcements in multiple sponsored programs, spot announcements for products, or weather or time.

Bravo to NAB for this forceful code which will be of much mutual benefit to broadcaster and listener.

MR. AND MRS. J. Q. PUBLIC have invested in their sets more than four times as much as the broadcasters have invested in their equipment. So stated FCC chairman Wayne Coy at the recent NAB meeting in Los Angeles. He pointed out that listeners spent 50 per-cent more per year for new sets, tubes and repairs than . . . "the whopping sum of

$400,000,000 spent by advertisers on the sponsorship of their programs."

Commenting on the much debated subject of FM broadcasting, Mr. Coy said: "In my opinion it will be a red letter day in the history of American broadcasting when broadcasters make up their minds that they can provide a superior aural broadcast service through the use of frequency modulation, and direct their efforts to planning for that conversion . . . We can have more FM stations than we can ever have in the standard broadcast band. This means that more communities can be served and that there will be more free competition . . . The FM allocation plan provides for uniformity of power within given areas of the country. This is not an unimportant fact . . . It paves the way for competition between stations on the basis of quality of programming, initiative, enterprise and imagination in serving the public interest."

Well said, Mr. Chairman!

FACSIMILE HAS AT LONG LAST won its spurs and become a commercial service. FCC approval, granted during the latter part of June, provides for the transmission of 8.2-inch wide copy at 105 lines per inch.

Eleven stations have begun to schedule faxcasts; WBNS, Columbus, Ohio; WHAS, Louisville, Ky.; WGHF, New York City; WCAU and WFIL, Philadelphia, Pa.; WQAM, Miami, Fla.; KPRO, Riverside, Calif.; WBBB, Burlington, N. C.; WCOB, New Bedford, Mass.; WAKR, Akron, Ohio and KRSC, Seattle, Wash.

The use of either simplex or multiplex systems was authorized by FCC. Commenting on the application of either of these methods, FCC stated that while the simplex system offered no technical problem, the fact that no FM programs can be broadcast while fax is on the air might distract listeners and reduce the listening or viewing audience. The multiplex system, providing simultaneous FM broadcast and fax transmissions, is the ideal system, but there are many technical problems to solve. For instance, methods must be devised to prevent mutual interference. Under the present FCC rules, fax transmissions should not cause any degradation in the aural programs below 15,000 cycles, an objective which has not yet been attained. FCC engineers believe though that the problem will be solved and very quickly.

Several unusually interesting technical definitions were included in a set of new fax rules and standards. The term "index of cooperation" was defined as the product of number of lines per inch, "available line length" in inches and the reciprocal of the "line-use ratio;" 105 x 8.2 x 8/7 = 984. The "line-use ratio" is the ratio of the available line to the total length of the scanning line, while the "available line" refers to the portion of the total length of scanning line that can be used specifically for picture signals.

Simplex faxcasts will be allowed for one hour between 7 a.m. and midnight, while multiplexing systems can operate

(Continued on page 110)

FOR THE NEWEST IN TV AERIALS

Watch WARD

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All major parts pre-assembled.
Saves costly installation time.

Here's another "first" by Ward in the rapidly expanding field of television reception. Advanced Ward design and engineering makes receivers work to their highest degree of efficiency.

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As a result of months of exhaustive scientific research and field testing, Ward now makes available a high band TV array which can be stacked above the standard television elements, and independently oriented! Also new is a kit for stacking two of Wards finest television assemblies into a two-bay array for a greater gain than ever before.

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Send in coupon today for free copy of new Ward catalog.

ORIENTING AND GAIN. Each bay tilts in any plane, can be oriented in any direction to give sharpest focus possible. Eliminates awkward or tricky installations. Permits hairline adjustments for utmost gain on both the high and low band stations.

ADAPTABILITY. Ease of combination of assemblies in basic kits makes "Magic Wand" Aerials more adaptable than ever to the varying requirements of each installation. This superior flexibility means a highly specialized Ward TV aerial for each purpose, with fewer models in stock, no obsolescence, and greater profits! Write today for free catalog!

Please send me free copy of your new catalog showing latest developments in television aerials.
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NEW SERIES 16 SUPER DE LUXE AM-FM CHASSIS

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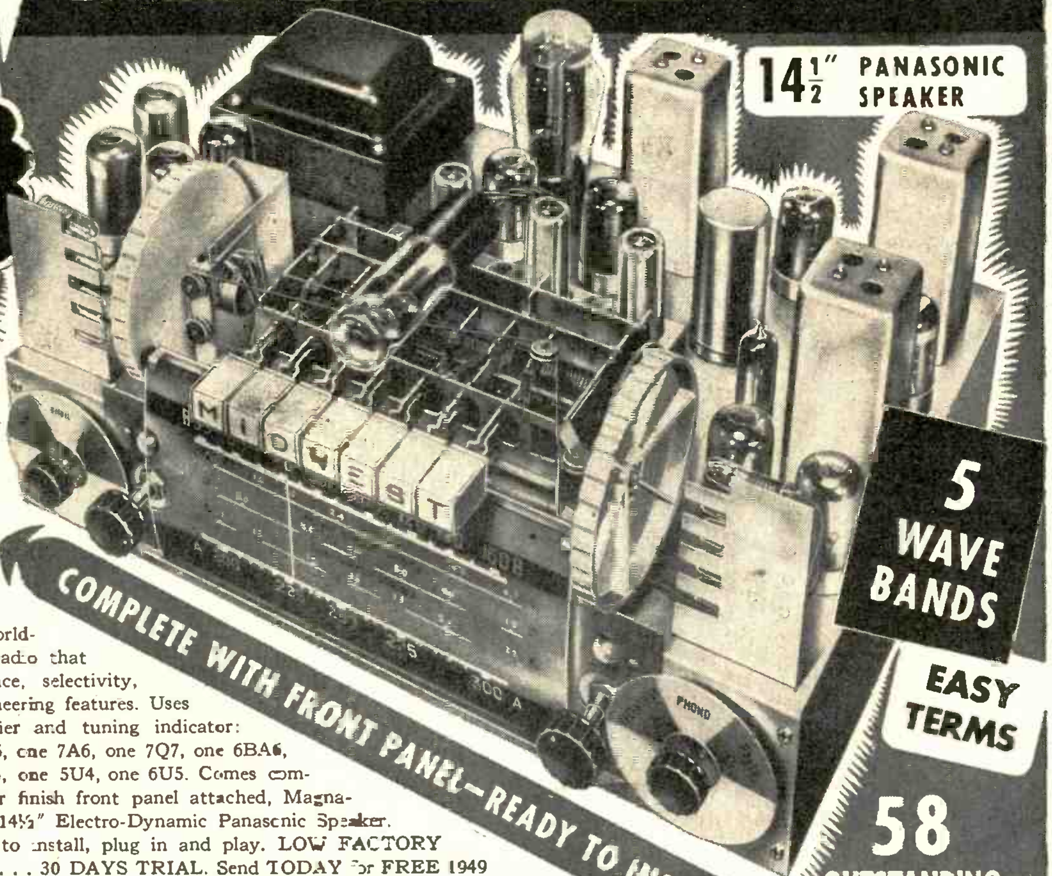

14½" PANASONIC SPEAKER

5 WAVE BANDS

EASY TERMS

COMPLETE WITH FRONT PANEL—READY TO INSTALL!

Here is the last word in radio engineering . . . a powerful world-ranging, magnificently-toned radio that is unsurpassed for performance, selectivity, sensitivity, and advanced engineering features. Uses these latest-type tubes, rectifier and tuning indicator: three 7A7, three 7A4, two 7C5, one 7A6, one 7Q7, one 6BA6, one 6BE6, one 6C4, one 6AL5, one 5U4, one 6U5. Comes complete with satin stripe copper finish front panel attached, Magna-Tenna Loop Aerial and giant 14½" Electro-Dynamic Panasonic Speaker. Requires only a few minutes to install, plug in and play. LOW FACTORY PRICES . . . EASY TERMS . . . 30 DAYS TRIAL. Send TODAY for FREE 1949 Midwest Radio Catalog of separate Chassis and beautiful Console and Table models.

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...Plus NO-DRIFT FM and many other features

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VOL. XVII (17)

Should be over your bench NOW!

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Rider-Exclusive "clarified-schematics", break-down every multiband job into individual diagrams of circuits as they exist with each turn of wave band or equipment switch.

The separate "How It Works" book and the Index comes with the Manual at no extra cost. Explains the theory of new radio circuits and elaborates on the mechanical innovations of the sets covered by the Manual.

1648 PAGES, PLUS "HOW IT WORKS" BOOK AND INDEX $15.00

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208 page "How It Works" book covers underlying theory of television. Transmission and reception, frequency standards, antennas, various portions of television receivers.

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"HOW IT WORKS"
Available Separately

If television is not yet in your area, it will be soon. Here is theory you want. **$2.70**

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The first industry-wide service manual covering products of all leading manufacturers of PA amplifying systems, manufactured since 1938 to date. Schematics, voltage data, resistance values, capacity values, parts lists, etc. "HOW IT WORKS" explains theory of various designs employed in different types of amplifier systems, the servicing of PA systems, using sine wave and square wave means of checking, methods of rapidly locating faults. Everything you need. **Approx. 2000 Pages. . . $18.00**

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Says **N. W. SCOTT, JR.**
Manager of the Service Dept.
BRITTS RADIO SERVICE, Orlando, Fla.

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Let NATIONAL SCHOOLS, of Los Angeles, a practical Technical Resident Trade School for almost 50 years, train you for today's unlimited opportunities in Radio

these two **FREE** *books will tell you how*

Good Jobs Await the Trained Radio Technician

You are needed in the great, modern Radio, Television and Electronics industry! Trained Radio technicians are in constant and growing demand at excellent pay—in Broadcasting, Communications, Television, Radar, Research Laboratories, Home Radio Service, etc. National Schools Master Shop Method Home Study Course, with newly added lessons and equipment, can train you in your spare time, right in your own home, for these exciting opportunities. Our method has been proved by the remarkable success of National Schools-trained men all over the world.

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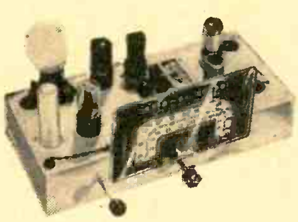

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NOW! New Professional Multitester Included!

This versatile testing instrument is portable and complete with test leads and batteries. Simple to operate, accurate and dependable. You will be able to quickly locate trouble and adjust the most delicate circuits. You can use the Multitester at home or on service calls. It is designed to measure AC and DC volts, current, resistance and decibels. You will be proud to own and use this valuable professional instrument.

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AFCA NEWS

Brig. Gen. S. H. Sherrill

Stephen H. Sherrill was graduated from West Point in 1917 and served as a Cavalry Commander during World War I. He took post-graduate work in communications at Yale and then served 4 years as an instructor in ROTC at Carnegie Tech. From 1930 to 1932 he attended Command and General Staff School later serving 4 years as Officer in Charge of Procurement Planning District in northeastern United States. For six years he was on Staff and Command duties at Fort Monmouth and in 1939 graduated from the Army War College. After 3 years' service on the War Department General Staff he was appointed a Brigadier General and commanded the training center at Camp Kohler, Drew Field, and Fort Monmouth, retiring on January 1, 1946. Since that date he has organized the Army Signal Association, now the Armed Forces Communications Association.

OCCURRING in a period of a strengthening of the nation's defenses, with a plain need for unity of action in the strengthening process, and with communications and electronics of greater importance than ever before to the military, the Armed Forces Communications Association's convention at Dayton, Ohio, May 10-11 held much serious business.

It was fitting to the point of coincidence that the Association's second convention—its first under its new name, and its first since unification of the services—should have been held at an Air Force installation and nearby city. For this year begins the rebuilding of the Air Force, with its communications and electronics developments taking a large part in the rebuilding. Appropriations for research, development, and procurement on these phases have been sharply boosted.

One of the youngest chapters in the AFCA, the Dayton-Wright unit as host to the convention had done a bang-up job in setting the stage for the meeting. The chapter president, E. H. Bobzean, Assistant District Manager of the *Ohio Bell Telephone Co.*, solicited the aid of individuals and businesses in Dayton and wound up with practically the entire community giving him solid backing on the arrangements.

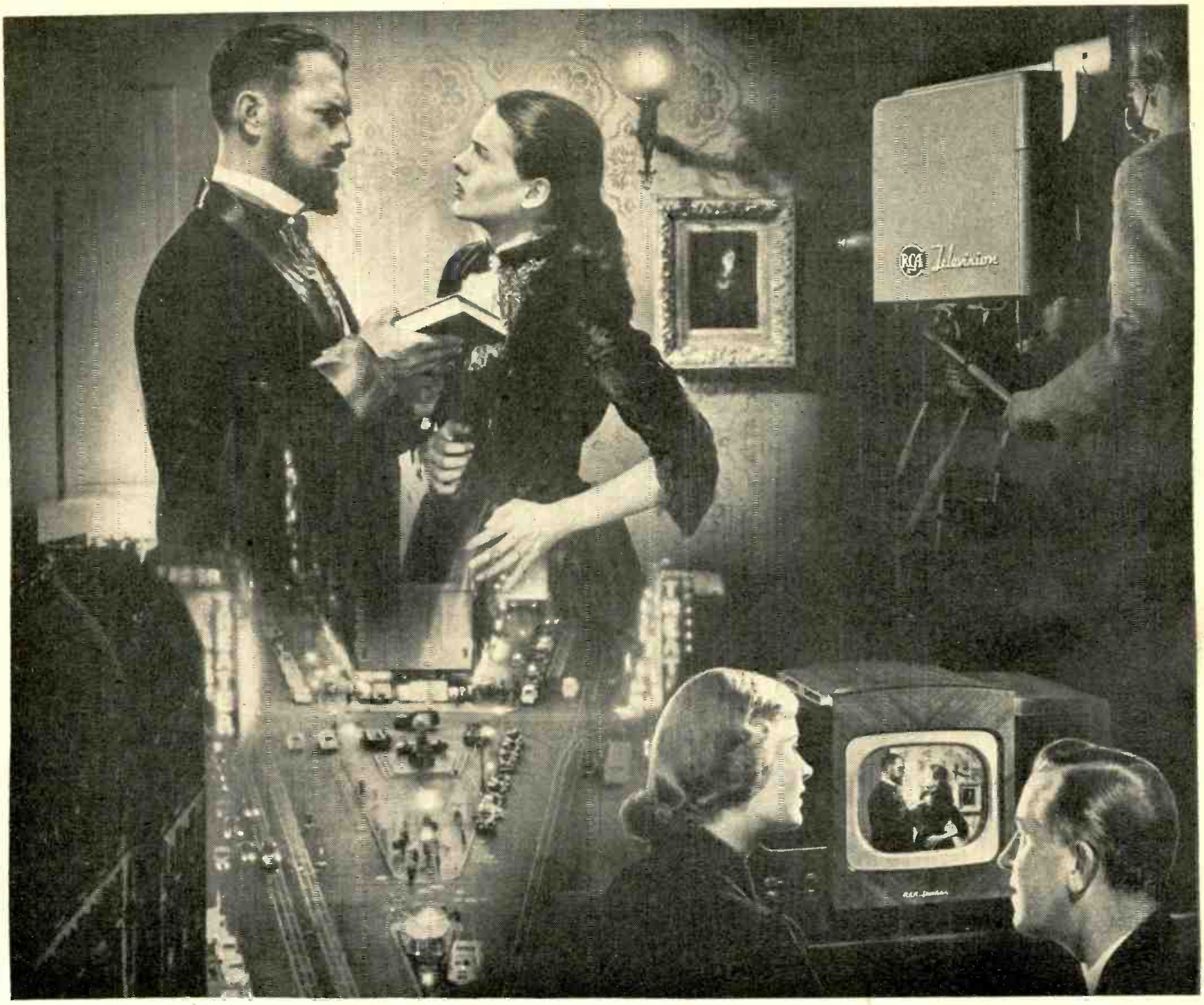
The schedule set up for the convention events was divided between two different days, but actually the program was contained within less than twenty-four hours. It was a fast round of meetings and talks, beginning with a banquet Monday evening, and winding up with a quick tour of exhibits and demonstrations at the Air Force's Wright-Patterson base Tuesday afternoon. For the latter alone an entire day would not have been sufficient for a thorough examination of the recent developments in electronics, communications, photography, and aircraft.

At a national defense symposium Tuesday morning, the AFCA members heard Maj. Gen. Harry C. Ingles, former Chief Signal Officer and now President of *RCA Communications*, Rear Admiral Earl E. Stone, Chief of Naval Communications, Maj. Gen. Francis L. Ankenbrandt, Air Force Communications Director, and Maj. Gen. F. O. Carroll of the Air Material Command, outlined the nature of their respective functions. General Ingles, discussing both civilian and armed forces communications, urged the military services not to provide communications services encroaching on the function of the international telegraph carriers, stressing the need for a strong civilian industry to serve the armed forces in peace and to afford a sizeable nucleous of facilities in the event of all-out mobilization.

At the banquet Monday evening, Brig. Gen. David Sarnoff, President of the *Radio Corporation of America* and President of the AFCA, read a message from President Truman to the convention, and then delivered his report as chief executive of the Association. Gen. Sarnoff stressed the need for cooperation of military and civilian interests to keep the nation's communications ready to meet a national emergency.

Thomas J. Hargrave, Chairman of the Munitions Board and President of the *Eastman Kodak Company*, outlined the objectives of his organization, announcing that single service procurement is virtually an accomplished fact. General Joseph T. McNarney, Commanding General of the Air Material Command (responsible for the far-flung research and development activities at Wright-Patterson), discussed the Command's goals. Another speaker who outlined mobilization aspects was Brig. Gen. H. A. Shepard, Chief of the Material Command's Procurement Division, who spoke at the Tuesday morning symposium.

Tuesday afternoon the AFCA convention visitors, by bus convoy, made a fast round of the enormous Air Force installation, Wright-Patterson Field. In the electronics-communications division they saw displayed a lightweight navigational radar, a radar height finder used for tracking the V-2 in upper atmosphere research, electronic equipment for measuring radome properties, radar



Great drama comes to television in NBC telecasts of Theatre Guild presentations.

How wide is "Broadway"?

To all the world "Broadway" means the theatre. So when NBC, in October, 1947, introduced regular telecasts of Theatre Guild productions, an expansion of "Broadway" began—and some day it will be nation-wide.

Today, if you live in a television area almost anywhere from Boston to Richmond, the new "Broadway" of television runs past your door. Now you can see great plays, professionally performed by noted actors. That's news, exciting news, to lovers of the theatre.

Celebrated artists run through lines and action before keen-eyed RCA Image Orthicon television cameras. At *your* end of the picture, on an RCA Victor home television receiver, action is sharp, clear, detailed . . . and voices flawless.

That television can make so important a contribution to American entertainment is in good part the result of pioneering and research at RCA Laboratories. Such research enters every instrument bearing the name RCA or RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

RCA RADIO CORPORATION of AMERICA

gunsight, radar control equipment, electronic beacons used in upper atmosphere research, freon cooled AN/APT-4, mechanical oscillation cathode-ray tube indicator, convectron tube, high intensity cathode-ray tube for daylight viewing, a collection of slot and flush-mounted antennas used in aircraft and guided missile installations, a model of a low frequency loran ground station with 1000-foot antenna, AN/ARN-7 radio compass, airborne distance measuring equipment, v.h.f. command set, Air Force combat interphone system, emergency rescue equipment, including AN/URC-2, AN/URC-4, AN/URQ-2, and AN/CRN-16, roto bridge for automatic circuit testing, experimental mercury delay line, two-gun storage tube, various lens antennas, control mechanism for constant level balloon, radio control and telemetering equipment installed in P-80 drone, precipitation static research equipment installed in C-45, night fighter equipment installed in P-82-F, sequence selector and electronic controls installed in a C-54 push-button aircraft.

For next year's meeting the AFCA members have an invitation from the Navy's Communication Chief, Admiral Earl E. Stone, to be present at whatever Naval installation may be decided upon for the 1949 national convention. Said Admiral Stone, "I should like to second the suggestion made by General Sarnoff, and hope that the Armed Forces Communications Association's third annual convention will be held in an area where the Navy may serve as your host."

* * *

AFCA Chapter News

Atlanta

Mr. Daniel A. McKeever, of the *J. E. Hanger Co.*, has been elected President of the Atlanta Chapter, and Mr. John L. H. Young, of the *Southern Bell Telephone & Telegraph Company,* has been elected 1st Vice-President.

Cleveland

The second annual meeting of the Cleveland Chapter was held on May 26th at the Cleveland Engineering Society. Mr. Oliver Henderson conducted a discussion on "Microwaves" as the feature of the meeting.

Decatur

The Decatur Chapter held a dinner meeting on May 20th. Among the guests was Mr. Charles Harris, Manager of the new *General Electric* plant which was recently established in Decatur for the manufacture of plastic products. The principal speaker was Mr. Kingsley W. Given, Chief, Lecture Branch, *Chemicals Division* of *General Electric,* who presented an illustrated lecture on plastics. A joint outing, in the form of a river trip and barbecue, is being planned by the Decatur and St. Louis Chapters for the latter part of July or early August.

Fort Monmouth

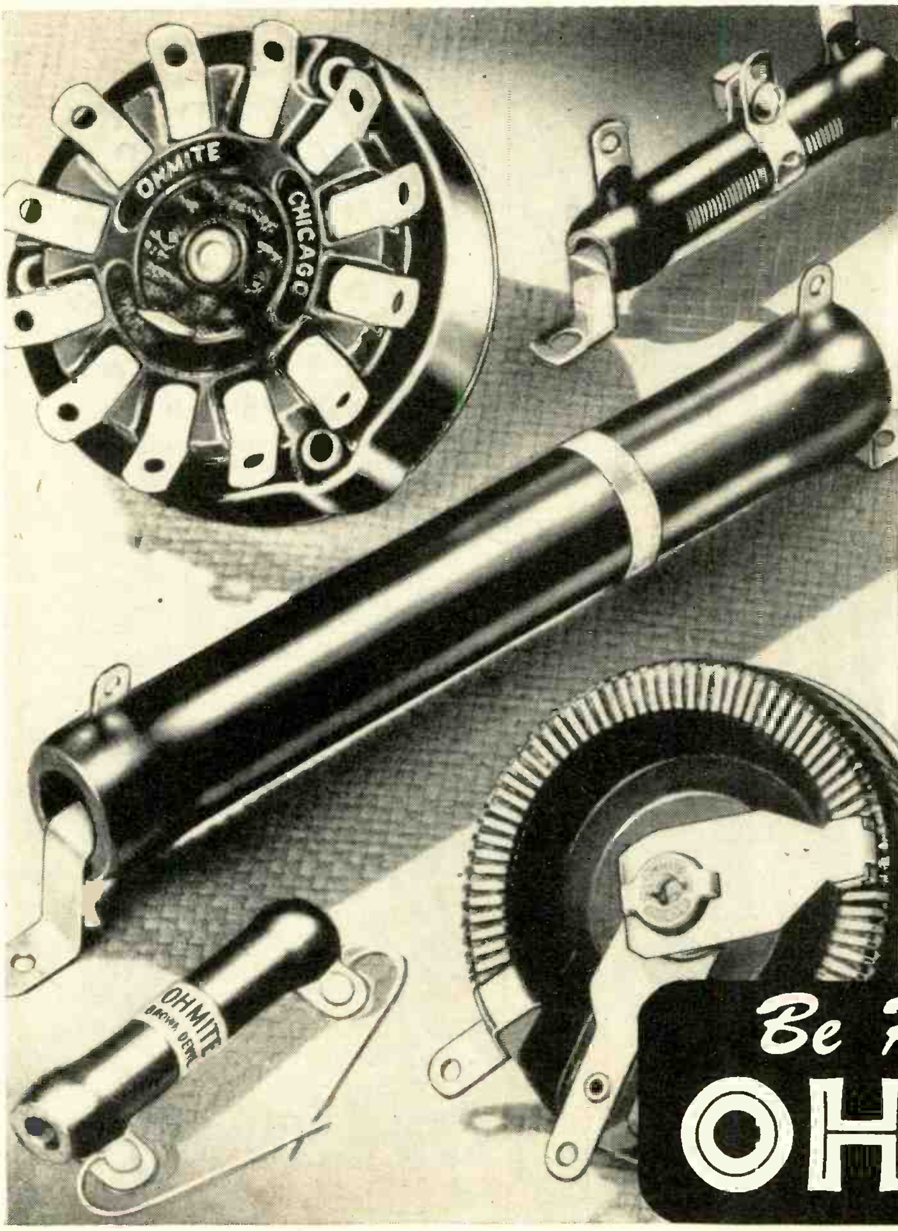
Over 100 members and guests attended the Fort Monmouth Chapter meeting on May 28th at Gibbs Hall. Col. William A. Beasley was installed as the new Chapter President. A demonstration of the latest in color photography was presented by Mr. H. C. Harsh, Manager of

(Continued on page 162)


An Entirely New Product
Non-metallic diaphragm for permanent superior acoustic performance.
Strong trunions lock projector in any position but never freeze—trunion parts are stainless steel and rust-proof metal.
Internally and externally completely corrosion-proof and rust-proof.
Weatherproof and anti-corrosion terminal box with removable cover.
Heavy, rugged U bracket with three holes making centering and "aiming" easy.
New Alnico 5 driver unit entirely enclosed within the one piece rigid horn, yet may be removed without special tools.
Jensen Hypex
Hypex
Exclusive Jensen Hypex formula (Patent 2,338,262) gives improved acoustical performance and wider sound distribution.
Four Reflex models from 24-inch to 9-inch. Two Reflex Radial models from 24-inch to 10-inch. Representing new highs in performance . . . new lows in price.
Jensen
6601 So. Laramie Ave., Chicago 38
Designers and Manufacturers of Fine Acoustic Equipment

"For Unfailing Dependability Give Me OHMITE"

You can be sure the resistors, rheostats, and tap switches you buy will provide accurate, dependable service if they're *made by Ohmite*. Every Ohmite product is designed and constructed to stand up under severe operating conditions ... to give extra performance ... to withstand the effects of shock, vibration, temperature extremes, altitude, and humidity. This *extra* performance is the reason thousands of particular parts buyers are regular Ohmite customers.



● Close Control RHEOSTATS

All ceramic and metal. Winding is permanently locked in vitreous enamel. Metal-graphite contact brush insures perfect contact with negligible wear on the wire. Available in 10 sizes from 25 to 1000 watts.

● Vitreous-Enameled RESISTORS

Vitreous enamel permanently locks and insulates each turn of wire on ceramic core. Prevents shorts, conducts generated heat away. All types and resistance values from 5 to 1500 watts.

● High Current TAP SWITCHES

Compact, dependable, and convenient to operate. Heavy, one-piece ceramic body is unaffected by arcing. Five models, A.C. ratings 10 to 100 amperes.

Write Today for Ohmite Catalog No. 19

Provides 16 pages of useful data on the selection and application of rheostats, resistors, tap switches, chokes, attenuators, and other equipment.

OHMITE MANUFACTURING COMPANY
4884 Flournoy St., Chicago 44, Ill.

Be Right with **OHMITE**

RHEOSTATS • RESISTORS • TAP SWITCHES • CHOKES • ATTENUATORS

Now Available! **STANCOR QUALITY**

midget REPLACEMENT TRANSFORMERS

DESIGNED FOR PERSONAL PORTABLE TYPE RADIOS

SINGLE PLATE TO VOICE COIL . . . Two primary impedance ratings are offered in the STANCOR A-3328 and A-3329 output transformers. These will match the majority of output tubes commonly used in personal portable-type radios.

The A-3328 is interchangeable with RCA Part Number 37806. It is designed to match a single tube 4,000 ohm plate impedance to a 3.5 ohm voice coil for use with tubes such as the 1S4 and 3S4. It has 1¾″ mounting centers and a small depth dimension to insure a fit in all cases. Overall dimensions are 1³⁄₁₆″ H. x 2⅛″ W. x 1″ D.

List Price . . . $1.45

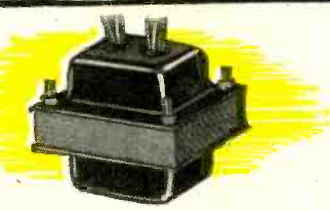
The A-3329 is similar to the A-3328 in all respects with the exception that it matches a single tube plate impedance of 8,000 ohms to a 3.5 ohm voice coil and is used with such tubes as the 1C5-GT, 1G5-G, 1Q5-GT/G, 1S4 and 3S4.

List Price . . . $1.45

DESIGNED FOR SPECIALIZED SERVICE APPLICATIONS

HUM-REDUCING TYPE . . . The STANCOR A-3330 is a special output transformer with an extra tap on the primary winding for use in hum-reduction circuits. The primary matches a single 2,000 ohm plate and the secondary is designed for use with a 3.5 ohm voice coil. Maximum allowable primary D.C. is 50 milliamperes. Used with such tubes as the 25B5, 25B6, 25L6, 35A5, 35L6 and 50L6. Maximum audio power is rated at five watts. Overall dimensions are 1⅜″ H. x 2⅜″ W. x 1⅜″ D. Mounting centers are 2″.

List Price . . . $2.10



Combination Plate and Filament

ULTRA-COMPACT SIZE

The STANCOR P-6348 is a special, midget size plate and filament transformer for small four- or five-tube receivers using either a type 6X4 or 6X5 rectifier tube. Primary operates from 117 volts, 60 cycles; high voltage winding delivers 480 volts CT at 60 ma.: 6.3 volts center tap winding delivers 2.75 amperes. Mounting area is 2³⁄₁₆″ x 2¹¹⁄₁₆″. Mounts in a STANCOR type "M" mounting by two bolts with 1²⁹⁄₃₂″ between centers. Overall depth is 2¾″.

List Price . . . $5.95

FREE! GET STANCOR'S NEW CATALOG TODAY!

Stancor's new catalog 140H contains important technical data and approximately 400 catalog items. Contact your authorized Stancor distributor or write direct.

standardize on **STANCOR** STANCOR **TRANSFORMERS**

STANDARD TRANSFORMER CORPORATION • 3580 ELSTON AVENUE • CHICAGO 18, ILLINOIS

Within the INDUSTRY

MILTON S. ROTH is the new Jobber Sales Manager for *Radiart Corporation* of Cleveland.

For six years prior to the war, Mr. Roth was Outside Service Manager for one of Cleveland's largest contract dealer service organizations. During the war he spent several years in the Signal Corps serving as a "roving" inspector. He joined the *Radiart* Engineering Staff in August, 1944 and has since held several positions with the company. He has served as a project engineer, antenna engineer, and engineering and production coordinator during his association with *Radiart*. He has since relinquished all but the post of antenna engineer to assume the new jobber sales manager's position.

* * *

D. E. WESTON has been named assistant sales manager for standard line receivers in *General Electric Company's* Receiver Division.

Mr. Weston joined *General Electric* in 1937 in the Appliance and Merchandise Department at Bridgeport, Conn.

Following separation from the Navy in 1945, he returned to the company as radio sales manager of *General Electric Supply Corporation* at Nashville, Tenn., a position he held until his new appointment.

* * *

DR. J. HOWARD DELLINGER, Chief of the Central Radio Propagation Laboratory of the National Bureau of Standards, retired recently after 40 years of government service.

He is known both here and abroad for fundamental research in radio and also for his work with the national and international conferences held to discuss radio problems in the past 35 years. A major achievement in the research field was the discovery of the simultaneous occurrence of solar eruptions and radio fadeouts, since called the Dellinger Effect.

In the advisory field, Dr. Dellinger organized the Interdepartmental Radio Advisory Committee which is responsible for the assignment of all radio frequencies used by departments or agencies of the Federal Government, and has served as chairman of the committee several times.

Dr. Dellinger will act as a radio consultant and adviser and will continue his present work as chairman of the Radio Technical Committee for Aeronautics.

* * *

H. H. SILLIMAN has been appointed General Radio Sales Manager of the *Westinghouse Electric Supply Company* at the headquarters office in New York.

Mr. Silliman has been connected with the radio industry in various executive capacities for the past 20 years. He has been associated with such companies as *Thomas A. Edison Inc.*, *United American Bosch Corporation*, and *Detrola Corporation*. He was most recently connected with the *Bendix Radio Division* of *Bendix Aviation Corporation* where he was manager of distribution and later merchandising manager.

He will be responsible for over-all radio sales management for the *Westinghouse Electric Supply Company.*

* * *

JOHN H. HAUSER has been named to the post of assistant manager of the distributor sales department for *Sylvania Electric Products Inc.'s* Radio Division.

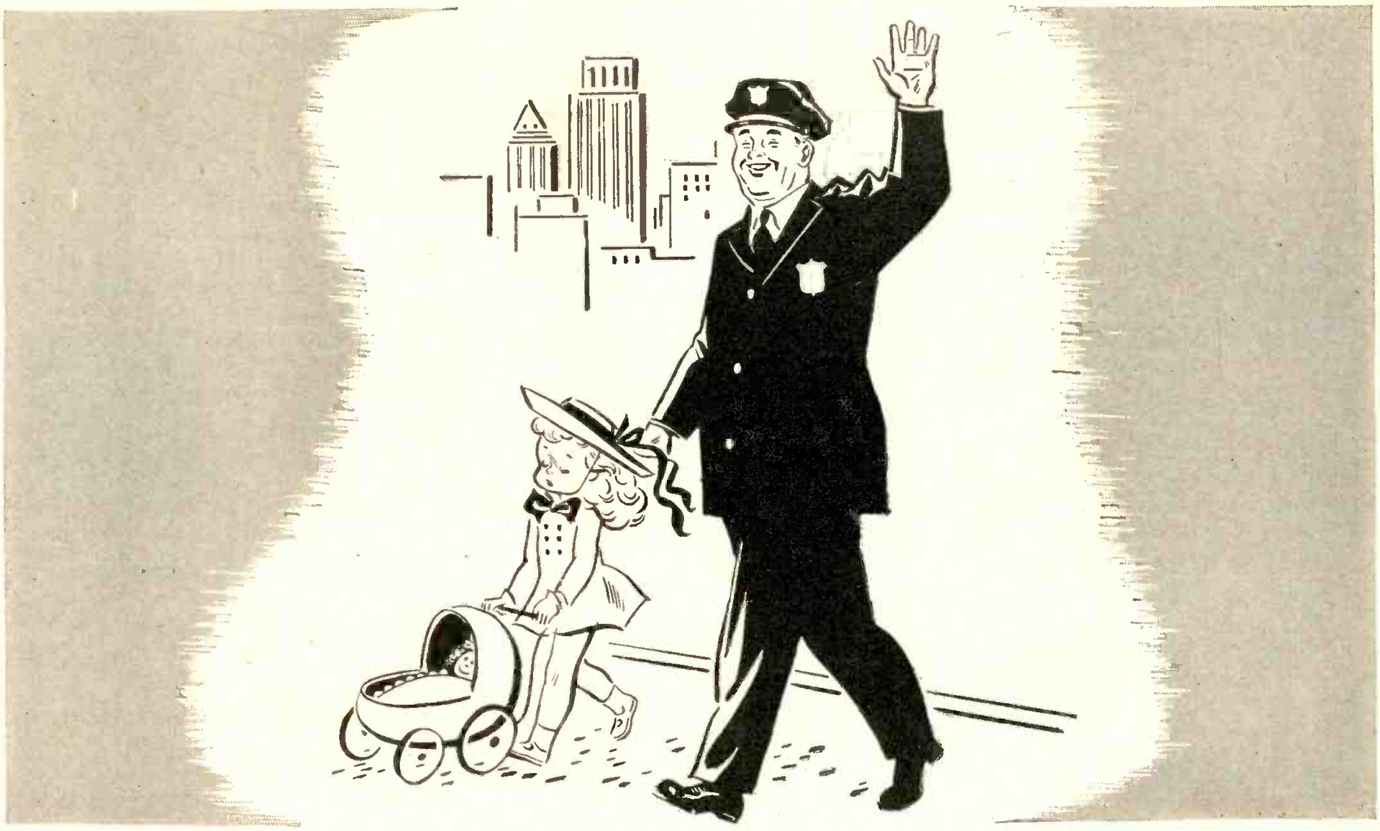
Mr. Hauser joined the staff of *Sylvania's* distributor sales department in 1941. During the war he was transferred to the cathode-ray department where he served as a production engineer to simplify and increase efficiency to meet wartime production demands. In 1944 he set up and directed the company's war surplus disposal program. He was appointed supervisor of the distributor sales department in January, 1946.

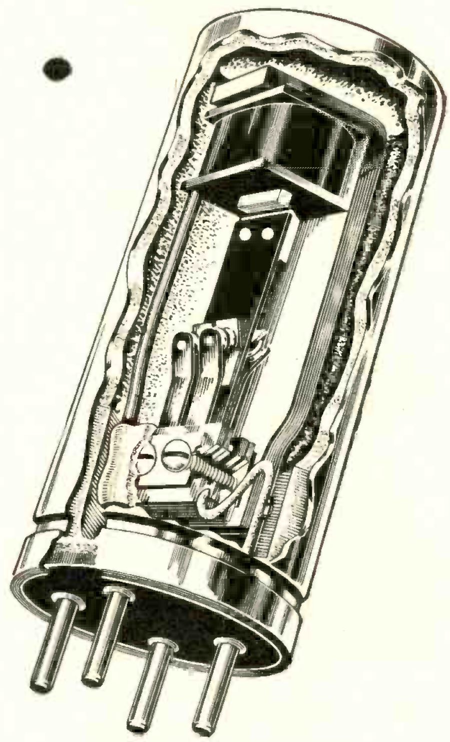
He will maintain his office at the company's Emporium, Pennsylvania plant but will report to H. H. Rainier, manager of distributor sales in New York.

* * *

KENNETH W. SICKINGER has been named assistant advertising manager for *Zenith Radio Corporation* of Chicago.

Mr. Sickinger has been associated





with the radio industry since 1942 when he joined *Belmont Radio Corporation* as government contract manager of the company. He held this post until 1946 when he became buyer of radio and appliances for *Oakes & Company* of Chicago. He joined *Zenith* from the radio division of *Stewart-Warner Corporation,* where he was advertising manager.

* * *

E. H. VOGEL, manager of the radio sales division for *General Electric* from 1936 to 1939, has returned to the company as a member of the staff of Dr. W. R. G. Baker, vice-president and general manager of *General Electric's* Electronics Department.

Mr. Vogel's headquarters will be at the company's new Electronics Park plant in Syracuse, New York.

As an advertising and sales executive for a number of prominent companies, Mr. Vogel has specialized in the field of merchandising since 1919 when he joined *Kohler Industries* as advertising manager. Four years later he became advertising and merchandising manager for the *American Piano Company.* Mr. Vogel held that position until 1930 when he left to become advertising and later sales manager for *RCA Victor.* After leaving *General Electric* in 1939 he became vice-president in charge of sales for *Farnsworth Television and Radio Corporation.* He resigned from that position in 1947.

* * *

RADIO ELECTRIC SERVICE CO. OF PENNA., INC. has announced the removal of its North Philadelphia store to a new location at 3412 Germantown Avenue, Philadelphia.

The new store provides over 11,000 square feet of space. Harry Brown, manager of the store at the old location, will continue to be in charge at the new site.

* * *

WILLARD W. JOHNSON is the new General Sales Manager of *Lynn Stewart Co.,* Chicago area distributors for *Arvin* radios and appliances.

Mr. Johnson has been Chicago district manager of the *National Pressure Cooker Company* for the last three years and prior to that time was associated with *Minnesota Mining and Manufacturing Company* and *General Mills* in sales capacities.

Lynn Stewart Co. maintains offices at 150 North Wacker Drive in Chicago.

* * *

BENDIX RADIO DIVISION has announced the appointment of two men in the receiver field.

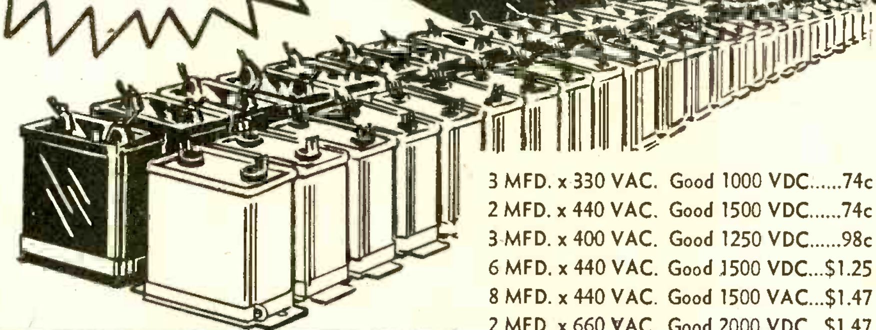
E. K. Foster, factory manager for eight years, has been named to the post of assistant general manager in charge of radio and television production. He will have complete charge of all phases of the company's broadcast, television, and

(Continued on page 147)

MID-SUMMER BARGAIN SPECIALS

SURPLUS FILTER CONDENSER CLEARANCE

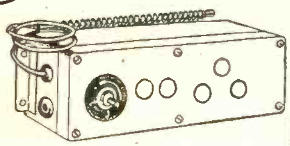
EXTRA BONUS VALUES EXTENDED ON SURPRISE TRADE-IN ALLOWANCES



3 MFD. x 330 VAC. Good 1000 VDC......74c
2 MFD. x 440 VAC. Good 1500 VDC......74c
3 MFD. x 400 VAC. Good 1250 VDC......98c
6 MFD. x 440 VAC. Good 1500 VDC...$1.25
8 MFD. x 440 VAC. Good 1500 VAC...$1.47
2 MFD. x 660 VAC. Good 2000 VDC...$1.47
2 MFD. x 2500 VDC. Oil filled. Well known mfg.
SINGLE LOTS $3.43 EACH
Two or more $3.25 EACH
Shpg. wt., 3 lbs., all types

Enthusiastic response greeted last month's announcement of bigger-than-ever trade-ins. This has prompted Walter Ashe to continue his unusual offer on your used, factory-built Test and Communication equipment. Take advantage now of this greatest of all opportunities to trade old for new at tremendous savings. Fill out and return the coupon today!

BOMBSHELL SPECIAL!

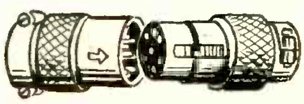


Reversible Motor

Originally used for heat control on Douglas Bombers. Ideally suited for rotation of lightweight Amateur, FM or TV beams. Geared down to ½ to 2 RPM with max. torque rating of 50 inch pounds. Size 2¾"x3¾"x9". Simple instructions included. Shpg. Wt. 6 lbs.

LIMIT OF ONE TO A CUSTOMER. ONLY **$7.45**

NOW AVAILABLE!



BC-654 Plug
Plug to fit input socket of BC-654 transmitter. Shpg. Wt. ½ lb.
ONLY **95c**

PE-103 Plug
Plug to fit output socket of PE-103 Dynamotor. Shpg. Wt. ½ lb.
ONLY **95c**

Number 1 Values In Used, Reconditioned, "Good - As - New" Test and Communication Equipment. For complete list of these bargains check and return the coupon right now.

CONVENIENT TIME PAYMENT PLAN

HAMS LOOK!

Not surplus, but brand new post-war design.

Real GALLON Transformers

TYPE E-5707
3000 Volts D. C. out of filter at 650 MA. (ICAS). Pri: 115/230 VAC 60 Cy.
Shpg. Wt. 47 lbs.
ONLY **$48.00**

TYPE E-5706
2500 Volts D. C. out of filter at 500 MA. (ICAS). Pri: 115/230 VAC 60 Cy.
Shpg. Wt. 33 lbs. ONLY **$33.00**

CARBON HANDMIKE

Type T-17B handmike. S. B. carbon with push-to-talk switch on handle. Brand new. Shpg. Wt. 3 lbs.
ONLY
Limit of one to a customer **$1.25**

TRANSMITTING KEY

Type J-37. Large coin silver contacts. Shpg. Wt. 2 lbs.
Only **98c**

HEADPHONES

Type HS-16A. 2000 ohms impedance. Canvas Web headband, and long standard type cord. Shpg. Wt. 3 lbs.
$1.47

GOOD LISTENING!

Hear Siebens' TRANS-AMERICAN ADVENTURES on the Ham Bands

When Harold Siebens decided to outfit his "Trans-American Adventures" with portable Ham Gear for his trailer he came to Walter Ashe Radio Co. for the best in equipment and service. Excitement, thrills, the fascination of far off places, are all yours when you're tuned to Trans-American Adventures. For details check and mail the coupon below. Meanwhile take a tip from Harold Siebens whose dramatic experiences from Alaska to Guatemala will be the source of many an interesting QSO. Equip at Walter Ashe!

Since 1922 one of America's leading suppliers of Test and Communication Equipment.

Use the Coupon to Prove That YOUR TRADE-IN'S WORTH MORE AT THE WALTER ASHE STORE
WALTER ASHE RADIO CO.
W. H. DuBord, WØQDF, Mgr., Amateur Div.,
1125 Pine St., St. Louis 1, Missouri RN-8
Gentlemen:
☐ Rush bigger-than-ever "surprise" trade-in allowance on my ______________ for
(describe used equipment)
____
(show make, model of new equipment desired)
☐ Send bargain list of reconditioned, good-as-new
☐ Test Instruments, ☐ Communication Equipment.
(check one or both)
☐ Mail my FREE copy of descriptive folder titled "Siebens' Trans-American Adventures."
☐ Put my name on your "Priority" list to receive your Big, New 1949 Catalog.
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Big, new 1949 Catalog now in production. Reserve your FREE copy today!

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All the big-name makes and models of new test and communication equipment . . . in stock, ready for delivery the day you write, wire or phone.

All prices F.O.B. St. Louis

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THE HOUSE OF "SURPRISE" TRADE-INS
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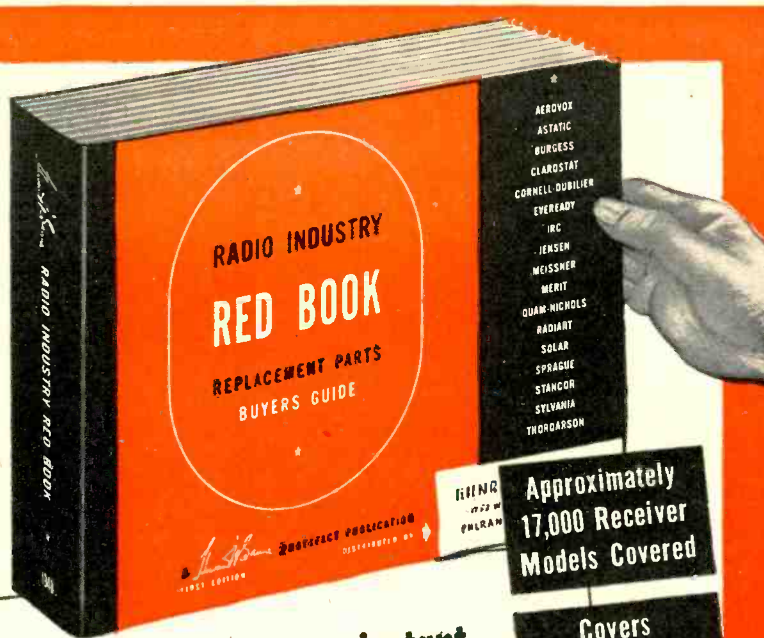

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ABC's of HOME *Television* SERVICING

(Top) The Philco Model 1001 video receiver and (Right) the RCA Victor Model 8TS 30 television set.

By

MORTON C. SHORE

Learn to analyze screen patterns—they will save you servicing time. To be able to localize trouble in TV sets in this way denotes professional skill.

HUNDREDS of men are today employed as television servicemen—and with stations starting up all over the country, there will soon be a need for thousands of these men. The expansion of television is not only dependent on the number of stations and type of programs presented, but on the quality of reproduction of the scene on the receiver screen. Not only must this quality be good, it must also be consistent. Because of this need for high quality reproduction many manufacturers and their authorized agencies employ a staff of men for the sole purpose of repairing and adjusting these television receivers.

On numerous occasions these men are able to perform complete service calls on the spot, and in those cases where this is not feasible or in compliance with company policy, they are able to at least correct some of the malfunctions. Following this, they write a concise but complete report which includes geographical location of the TV set, along with its action in operation, suggested points of trouble, and specific recommendations to aid time and money-saving repair.

The amount and quality of the service rendered in the home depends on adherence to a definite service procedure which, in turn, is based upon a thorough knowledge of the television receiver and the transmitter's radiated signal. Untrained men fail miserably in television servicing and they have often done more harm than good. However, the man with an understanding of the underlying principles of television not only can properly service the set, but he can also protect his reputation by preventing short-interval service calls.

It is the specific intent of this article to impress on the reader the importance of the above requirements, and to enable you to become even more proficient by presenting definite television service techniques, actual troubles, and suggested means of repair.

Pre-Servicing Considerations

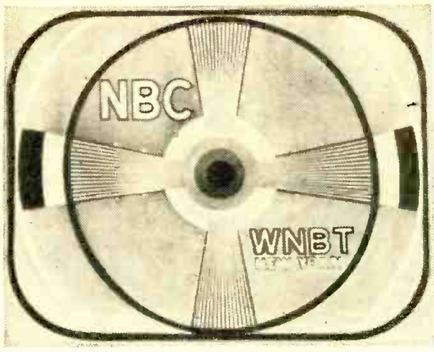
Before going out on a service call the repairman should check to be sure that he has a complete set of tubes for the receiver to be serviced, replacement parts most frequently needed, and all tools necessary for removing and reinstalling the set.

After entering the customer's home, the serviceman should consult the owner and ask him to describe any unusual "symptoms" exhibited by the receiver before the set became inoperative. From these facts, an analysis of the probable fault can be made and considerable time saved.

Following this, the receiver should be turned on and all stations on the air tuned in. If the trouble appears on only one station, it may possibly be that the antenna has rotated slightly and/or the oscillator is detuned. In those telesets which have an external control marked "fine tuning," it may be this control which requires readjustment. It should be remembered that the "fine tuning" control has to be reset for each station, and will not always be set on the same spot for the same station. Therefore, the need for the proper adjustment of this control should be explained in detail to the customer in non-technical language.

The same procedure as prescribed for "fine tuning" should be followed on all controls. That is, just as in the case of the automatic record changer, a large percentage of the service calls on television receivers are caused by the customer's lack of knowledge in regard to correct adjustment and operation. Therefore, he should be reinstructed as to the proper use of all controls. After the "lesson" you should then have the customer run through the complete operation while you "observe."

It is often true that the customer's inexperience in operating the unit is the cause of many service calls, but an almost equal number can be charged to



A normal video test pattern as it should appear on the screen of the TV receiver.

the salesman. Frequently, the store will call in a company serviceman because the demonstration set gives a very poor or jumbled picture. In many cases this call and the numerous sales that were lost in the interim could have been avoided if the salesman had been properly briefed on set operation. The salesman must understand the function of each control, the sequence of control setting, and the proper position of each control for the different stations. A thorough explanation concerning the correct position of each control, plus a complete demonstration of the set should be given all sales personnel before they start selling. The procedure should be rehearsed many times.

The next greatest problem encountered is in the installation. The author would like to point out that the installation (chassis adjustments) is not an easy task, nor one that can be done without painstaking care and effort. Failure to follow the manufacturer's recommended installation procedure often results in many unnecessary service calls. This is especially true of installations which require attention to such special features as the setting of the yokes, beam-bending (ion trap) coils, a.f.c., and automatic video control. Projection receivers often present even trickier installation problems for the serviceman. In this type of teleset it is often the position of the cabinet which gives rise to complaint. The maximum desirable receiving angle horizontally is approximately 60 degrees on each side of the screen and in the *Philco* Model 48-2500, vertically approximately 18 degrees above and below. A lack of understanding of these viewing limitations often sours the customer on projection television especially on sets operated in store windows, etc.

Although quite a few service calls can be traced to a misunderstanding or lack of experience on the part of the customer or salesperson, a far greater percentage may be attributed to the receiver and/or its antenna system. It is this malfunctioning of the receiver which requires patient work and a thorough background knowledge of television. In order to provide servicemen with a working knowledge of some of the most common faults found in television receivers, the author has listed herein common servicing complaints and the servicing procedure to be followed in order to correct the trouble.

A. *Sound, but no raster:* In this case one of several things may be at fault. The high voltage lead may be off the kinescope, the high voltage rectifier may be defective, the high voltage condenser shorted, the horizontal output tube open or shorted, any tube in the horizontal sweep section may be at fault, beam-bending coils not in proper position or a lead disconnected from one of the coils, or the background control might be improperly set or not functioning properly.

B. *No sound, no picture, but a raster:* The antenna may be detached from the set, one or both of the leads might be removed from the dipole, or the antenna may have rotated or fallen down. In this latter case check all guy wires, connections, and supports; if a chimney, gable or window-sill mounting install guy wires where necessary, and in a strong signal area where the external noise is insignificant, antenna mast stability should be given preference to antenna height. Under conditions where no sound, no picture, but a raster occur, it might be well to investigate the r.f., oscillator or mixer tube as it may be shorted or open. The r.f., oscillator, or mixer coils may cause the same condition if they are not making good contact or have opened. The balanced line feed-in to the r.f. amplifier may be open, shorted or detached. (See Fig. 1).

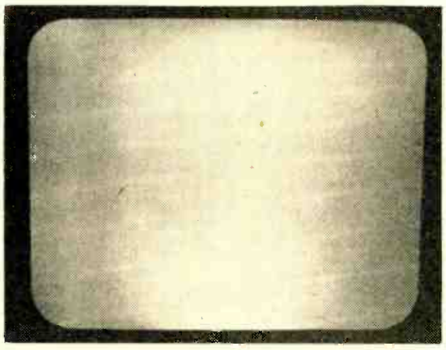


Fig. 1. Raster appearing on screen, but set has no sound and no picture. See B.

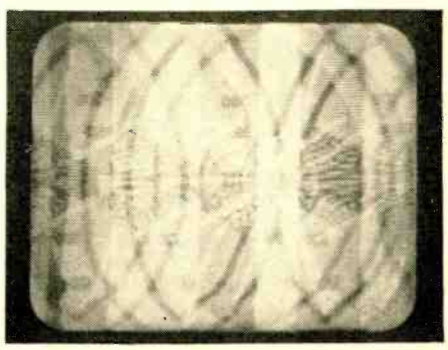
C. *No sound, no picture, and no raster:* Under this condition you should check to be sure all interlock connections are secure, check the low voltage power supply following the procedures used in ordinary console receivers, and check "A" and "B" as it may be a combination of parts in each.

D. *Sound and raster, but no picture:* In this instance it may be assumed that the r.f., oscillator, and mixer tubes are good since they are also a part of the sound circuit. Retune the oscillator slug or in some sets adjust the external "fine tuning" control. Rerotate the antenna for maximum intensity of the sound signal. Both of these points must be checked since the television sound signal is much stronger and less critical than the video. Thus video adjustments must be made with much greater care. Next you should look for an open or shorted video i.f., detector, or amplifier tube. (Since miniature tubes do not have very high current ratings and are usually operated close to maximum, they frequently burn out.) Finally check leads from the picture tube grid to plate of the final video amplifier.

E. *Two or more pictures blending into each other, but appearing correctly aligned vertically:* (See Fig. 2.) First carefully readjust the horizontal hold control, then replace, one by one, all tubes in the horizontal sweep circuits. In the early *Philco* sets (Model 48-1000) a 560,000 ohm, ½ watt resistor in series with the horizontal hold control frequently changed its resistance value due to insufficient wattage handling capacity. However, when it was replaced by one-watt resistor of the same ohmage, the set would again operate properly. In *RCA* receivers (Model 630-TS) the synchro-lock circuit may not be functioning properly in which case the horizontal oscillator control tube should be checked and the link on the back of the set should be reset from 2 and 3 to 1 and 2.

F. *Snow in pictures:* This trouble usually goes hand in hand with weak signal and frequently occurs with the addition of a new station. When this trouble occurs it may be that the contrast control is not turned up high enough. Since the contrast control is actually the video gain control, a setting near the bottom is the same as a weak picture and therefore is more easily affected by noise. If the set is in a weak-signal area, this noise interference can be extremely objectionable and even cause a blending of pictures. The antenna may have to be rerotated for maximum reception and in some instances it may be necessary to add a director, if the noise is directed towards the front of the antenna, or a reflector, if most of the noise is directed towards the rear of the antenna. Note that a reflector and/or a director has a tendency to narrow the bandwidth but strengthens the sensitivity of the receiver. If the streaks are caused by local noise disturbances, then raising the antenna should be tried as this also increases the sensitivity of the receiver. This procedure assumes that the antenna mast is the maximum possible distance away from outside traffic, usually the back of the house. If necessary, install coaxial cable for the lead-in (ground the shield to ground of the set) as it gives less attenuation than other types in current use. Coax should be used particularly when the lead-in has to be more than 75 feet

Fig. 2. Typical pattern in "picture blending". See point E for analysis of fault.



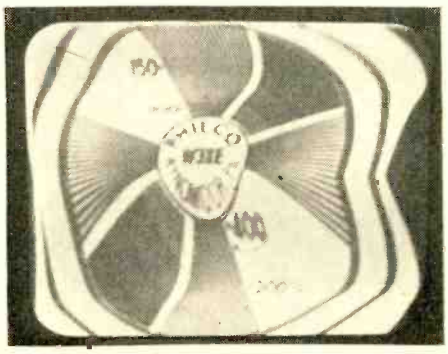
long. Because this cable is completely shielded, its use will cut down external interference. Note however that the *RCA* Model 630-TS uses a balanced input circuit and will not take coax unless a resistance pad is used between the cable and the input to the receiver. Another possible source of difficulty might be a defective a.v.c. tube (*Philco*) or circuit components. This circuit when operating properly will keep sync and pictures at a constant level despite fading which occurs especially in weak-signal areas.

If these procedures are not sucessful a special type of antenna such as a folded dipole with a reflector and/or director plus a matching stub (cut to ¼ wavelength of the weaker station), a stacked array, or rhombic antenna may have to be used. If expense is secondary, a separate antenna or motor-driven rotary antenna is usually the best. Complex arrays are usually not necessary if the height of the antenna is increased considerably and coaxial cable is employed. It should be remembered that each antenna installation presents its own individual problems dependent upon its geographical location with respect to present and projected stations, traffic and other similar disturbances, and the willingness on the part of the customer to pay for complex arrays and special setups.

Another fault to look for is that the a.v.c. control (*Philco*) may not have been correctly set in the original installation and so with the addition of new stations the pictures may appear weak. If the "fine tuning" control on *RCA, Emerson, Crosley,* etc. receivers is not properly set a weak signal may result. In cases where the original station or stations were very strong the televiewer may not be used to setting this control, then with the addition of new stations, it may be important that the customer know and understand the function of this control. Three other possibilities should be investigated, namely, one side of the lead-in wire is disconnected either at the set terminals or at the antenna proper, if coaxial cable is used it may have become ungrounded, or if "twin-X" is used it may have become damp, thus weakening the signal.

G. *Picture illegible with jumbled horizontal bars:* In this case try to lock the picture in by use of the vertical and horizontal hold controls. If this proves

Fig. 3. Sine wave pattern on side of raster. See point I for the "diagnosis".



unsuccessful then the fault may lie in the sync separator, sync amplifier and/or any circuit that preceeds the differentiating and integrating networks. These are the networks that are responsible for the application of the proper shape and size pulse at the correct time to the horizontal and vertical oscillator, respectively.

H. *Background of pic seems to remain the same, in spite of a change in scene:* If this fault appears check the d.c. restorer tube or crystal (in *Philco* receivers).

I. *Picture has sine-wave pattern on side of raster:* (See Fig. 3.) This pattern on the screen is the result of hum in the horizontal deflection circuit. Check the low voltage filter condensers or the low voltage rectifier tubes especially if these tubes exhibit a blue glow.

J. *Non-linear picture and white bar on side of raster that cannot be corrected by resetting linearity controls:* (See Fig. 4.) This defect is very likely to be caused by a defective damping tube. It might be well to check the horizontal and vertical linearity controls (these will not cause the white bar) with an ohmmeter. While replacing these controls, if defective, has been done by field servicemen, if company policy is against such

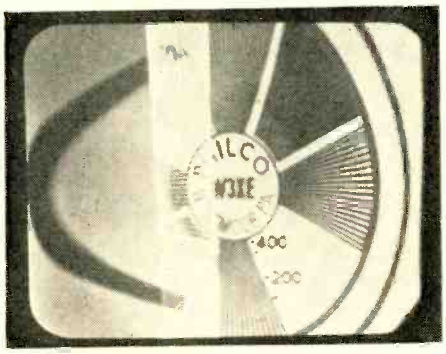


Fig. 4. A defective damping tube usually causes non-linear picture and white bar.

procedure then information concerning this defect should be entered on the report that you present to the service office.

K. *Bars in pictures:* (See Fig. 5.) One bar in the picture will indicate 60 cycle interference, two bars, 120 cycle interference, three bars, 180 cycle interference while 400 cycle interference will show up as about seven bars on the screen. Bars, varying in number and intensity, appearing and disappearing, will be sound interference in accordance with the FM sound signal (Fig. 6). When this occurs, it will be necessary to readjust the sound traps. This can be done in the field but this step is usually performed as a part of the formal alignment procedure in the shop.

L. *Channels can't be switched:* In *Philco* receivers any r.f. or oscillator coil which may be slightly out of its allotted compartment may cause this phenomenon.

M. *Thin horizontal bar across screen that can't be spread out vertically by turning the vertical size control:* (See Fig. 7.) This condition indicates the loss of vertical sweep. The tubes in the vertical sweep section should be replaced one by one. Next the height (vertical size) control

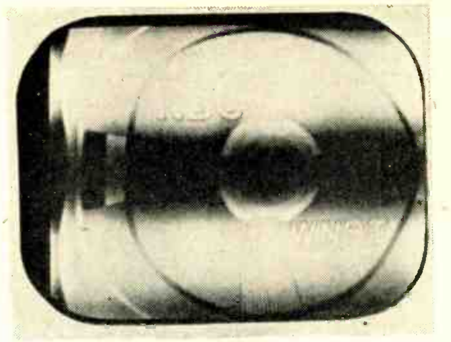


Fig. 5. Black bar on screen denotes 60 cycle interference. See point K in text.

should be checked. Some firms permit their servicemen to replace such a control, if found defective, in the home.

N. *Thin vertical bar across the screen that can't be spread out by turning the width control:* Here a loss of horizontal sweep is evident. Substitute tubes, one by one, in the horizontal sweep section and check the width control.

O. *Strong, high-pitched noise which increases with increase of volume:* This condition is very likely to be caused by a microphonic tube. A tube at the beginning of the circuit, such as the r.f., oscillator, or mixer tube is probably the cause.

P. *Picture appears very black and in some cases may be highly non-linear:* First, turn down the contrast control (always reset "brightness" after making contrast adjustments) then if this isn't successful one of the following procedures should be tried. Turn down the a.v.c. control (in *Philco* sets), install a separate antenna for the stronger station (this can be a folded dipole made from "twin-X"); in a strong signal area, a quarter-wave matching stub with no antenna can be used, the original antenna being rotated in favor of the weaker station thus giving better overall reception.

Q. *Moving hum pattern (a thick grey bar that rotates at a slow rate over the entire picture. This bar will get darker, and even become very black if the receiver itself has poor filtering.):* This phenomenon occurs when a program is switched to another city. That is, the other city will usually have a slightly different power line frequency and thus cause a movable 60 cycle hum to interfere with the picture.

R. *Picture and sound go off sporadically*

(Continued on page 153)

Fig. 6. Bars of varying number and intensity will indicate sound interference.

A tubeless device for a.f. and r.f. signal tracing which gives either "sight" or "sound" operation.

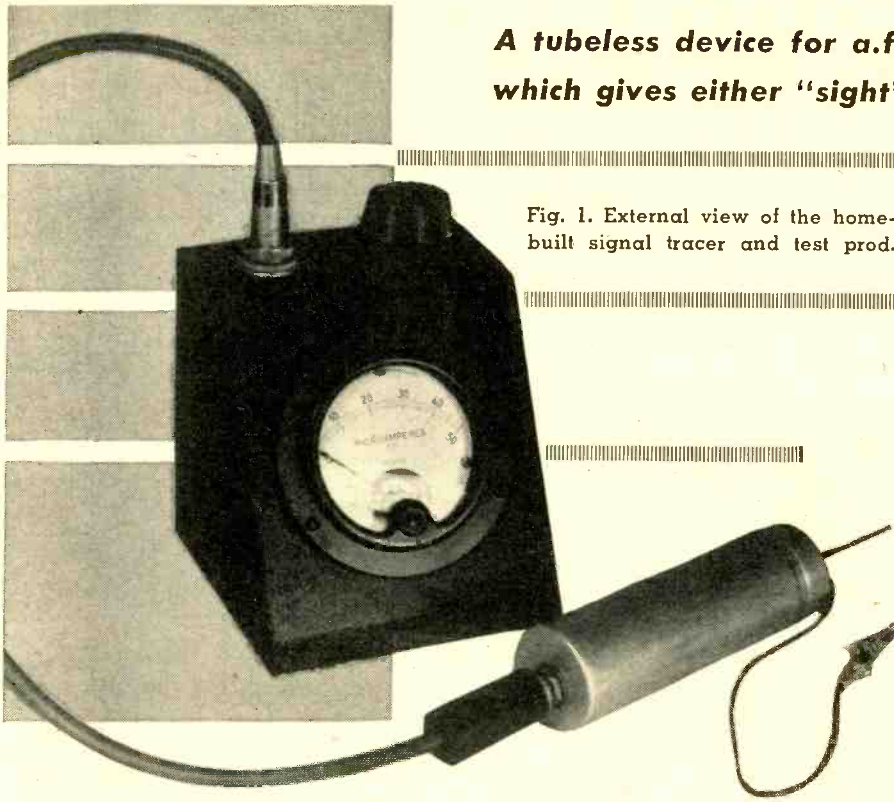


Fig. 1. External view of the home-built signal tracer and test prod.

By

RUFUS P. TURNER,
W1AY

Sensitive A.F.-R.F. SIGNAL TRACER

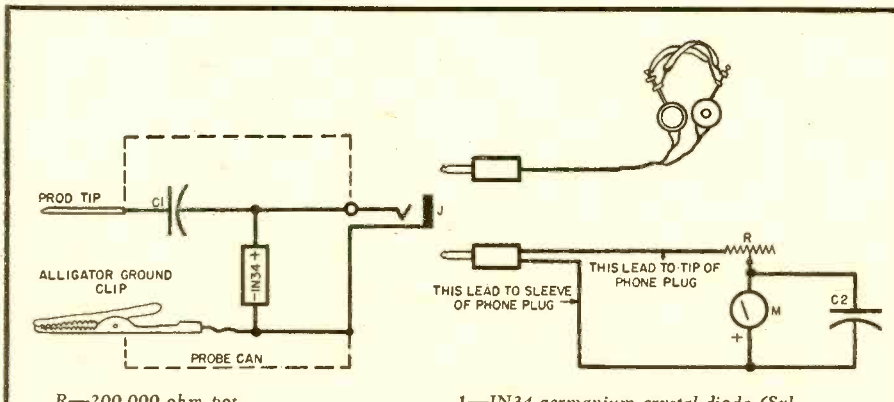
WHEN the utmost simplicity is desired in a test instrument, the crystal diode will often satisfactorily replace tubes and power supplies. Since the very first appearance of germanium crystals on the market, these crystals have been used in a variety of untuned signal tracers, some good and some not so good. The well-known advantages of the germanium crystal in such applications are its ability to withstand abuse from high signal voltages and its wide frequency response (from the lowest audio frequencies to more than 100 megacycles).

In most "simple" signal tracers previously described, the crystal has served only as a signal rectifier mounted in the handle of a test probe. The rectifier has been followed up by a high-gain audio amplifier or by a d.c. vacuum-tube voltmeter. The amplifier and the meter employ tubes and require power supplies or batteries. This certainly is not the simplest possible arrangement, and the extreme simplicity and economy of the crystal diode would seem to be defeated in such setups.

For visual signal tracing in both a. f. and r. f. circuits, the amplifier and v. t. voltmeter may be replaced by a low-range d. c. microammeter. Panel-mounting microammeters no longer are expensive, delicate instruments out of the range of radio servicemen and amateurs. For aural signal tracing in a. f. and r. f. circuits, the amplifier or v. t. voltmeter may be replaced by a pair of high-resistance headphones. In r. f. circuits, it is only necessary to employ a modulated test signal. This arrangement makes a really sensitive, "non-electronic" signal tracer, utilizing the full advantages of the crystal diode.

The accompanying photographs and circuit diagram show such a signal tracer which is no more complicated than a non-electronic a.c. voltmeter and is as simple to use. It allows a signal to be traced either visually or aurally all the way through a radio receiver from antenna and ground terminals to the speaker voice coil. In a receiver, it will check r. f., i. f., detector, and oscillator signals. It also permits visual or aural tracing of a signal all the way through an audio amplifier of any kind. This instrument is small in size, easy to build, and has a multitude of uses in the radio shop and experimental laboratory.

Fig. 2. Complete circuit diagram of signal tracer, including test prod.



R—200,000 ohm pot.
C1, C2—.01 mfd. mica cond.
J—Midget open-circuit jack
M—0-50 d.c. microammeter
1—IN34 germanium crystal diode (Sylvania)
CAUTION: Do not use silicon crystal diodes in this application. Examples of silicon crystals are the types IN21, IN21B, etc.

Exploring Probe

The hand-gripped exploring probe which encloses the crystal diode and coupling condenser may be seen in Figs. 1, 3, and 4. It is made from a salvaged aluminum electrolytic condenser can, 4½" long and 1½" in diameter. A ¼"-thick bakelite disc is fastened into the open end of the can. The test prod (a pointed 2-inch length of ⅛-inch brass rod) is threaded into a small metal stud screwed to the center of this disc. A midget phone jack is mounted through the closed end of the can and receives either the headphone plug or the microammeter plug. Wiring inside the probe

(Continued on page 127)

RADIO FACSIMILE May Print "Newspapers of Tomorrow"

NEW YORK TIMES WQXR-FM FACSIMILE

Facsimile Edition

1 P.M.

The New York Times

TRUMAN ORDERS STEEL INQUIRY

MARKETS DROP IN DULL TRADING

ASKS U.N. GUARD FOR JERUSALEM

BAYONETS USED IN CZECH STRIFE

Group Reduces for Canal Zone

U.S. Urges Defiance Of Russia on Korea

LONDONERS NEARLY MISS TEA

Details of The New York Times-WXQR-FM facsimile edition published experimentally early this year.

By **FRANKLYN K. LAUDEN**

Newspaper Publisher's Faximile Service

FACSIMILE has come of age; the FCC has set standards, opened FM channels to commercial faxcasting, and given the promising young medium its blessing. How the varied possibilities of fax will be put to work by broadcasters is anyone's guess, but one sample has been provided by WQXR-FM, *The New York Times* station.

Before describing the *Times*-WQXR-FM facsimile operation, which introduced the new medium to thousands of people in Manhattan, it may be well to explain fax briefly.

Facsimile is the system for transmitting pages of graphic material—anything that can be printed in a newspaper—by wire or radio and receiving them in permanently recorded form on paper. The postwar, high-definition facsimile standardized by the FCC uses FM radio to deliver four magazine size pages in a regular 15-minute broadcast period. The fidelity with which both pictures and type are reproduced at the receiving end is amazing.

The facsimile system used by WQXR-FM was devised by John V. L. Hogan, president of WQXR and WQXR-FM, head of *Radio Inventions, Inc.*, and *Faximile, Inc.*, and a pioneer in radio development. The *Hogan* "Faximile System" works like this:

A page of printed or pasted-up text and pictures is wrapped around the drum of a "scanner." As the drum revolves, a photocell "scans" the page line by line (105 lines to the inch), changing the graphic material into a fluctuating current. This current is amplified and otherwise modified, and then is used—just like the signal from a microphone—to modulate an FM carrier wave.

When this FM signal is picked up by an FM receiver (or AM receiver with FM converter), it is changed back into an AM current and fed into the facsimile "recorder" instead of to the loudspeaker. The recorder (about the size of a standard record-player and changer) contains a roll of paper which has been treated so that it will conduct current. As a motor-driven reel pulls the paper between two thin metal blades, the facsimile current is fed into one of the

(Continued on page 148)

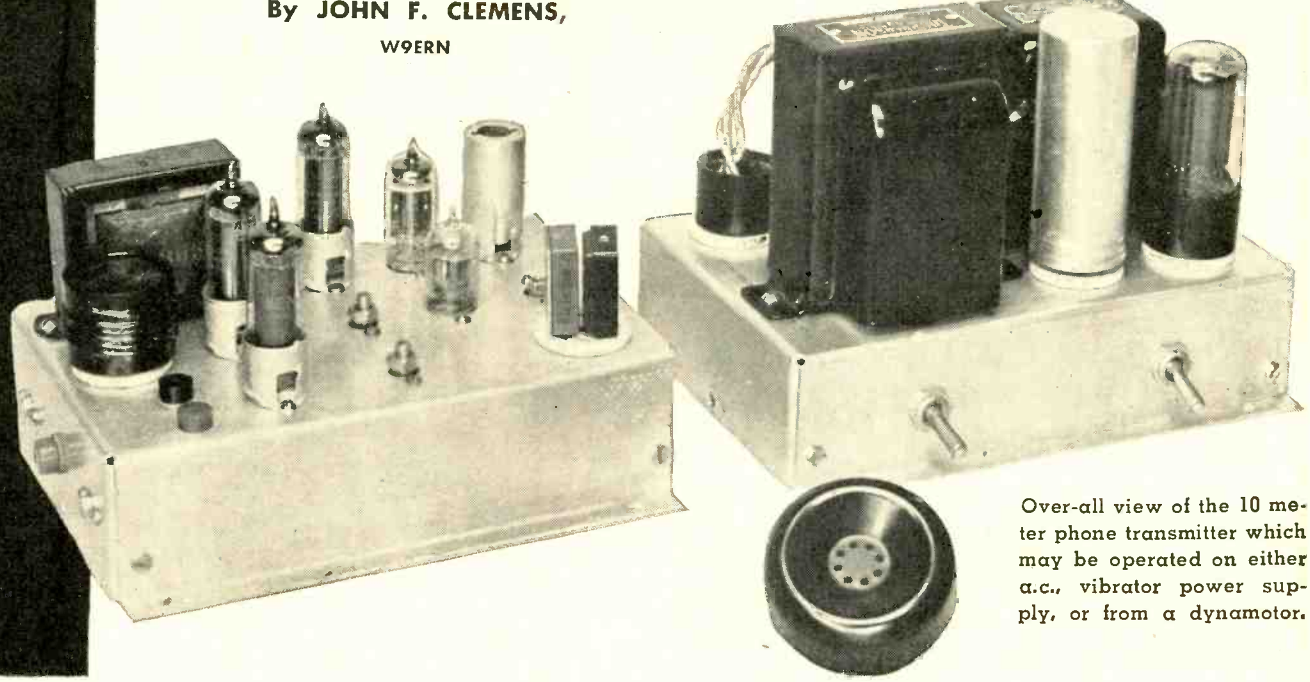
Page one of The New York Times facsimile edition on the scanning drum of the transmitter. An electric eye at the rear of drum picks up the black and white images of the page, converts them into electrical impulses which are transmitted by station WQXR-FM. Above is photograph of front page of The New York Times as reproduced from the transmitted copy.

★

The makeup staff pastes articles and pictures in page form to be scanned by facsimile. Six issues are faxcast daily.

A PUSH-PUSH PORTABLE

By JOHN F. CLEMENS, W9ERN



Over-all view of the 10 meter phone transmitter which may be operated on either a.c., vibrator power supply, or from a dynamotor.

Construction details covering a 15 watt, 10 meter, miniature-tube phone transmitter.

HAMS in the larger cities can appreciate the value of a small 10 meter phone transmitter as an auxiliary rig for use in local contacts. The transmitter to be described was designed for such use with a mental note that the unit should be capable of operating from a vibrator power supply or dynamotor for mobile use.

To enhance the utility of the transmitter, provision was made for coupling to various types of antenna feed systems. A pi-section output circuit provides coupling to coaxial cable or quarter-wave antennas which is particularly advantageous in auto installations. The final tank coil is mounted above the chassis in order to be accessible to a coupling link for balanced feed line systems. There is no plate voltage on this tank coil or elsewhere above the chassis.

During the development of the final version of the rig, several modifications were tried. A pair of 6C4's was first used in the final amplifier. With plate voltages under 250 volts, these tubes give excellent performance. They do not hold up at 300 volts under plate modulated conditions. On the other hand, 6AQ5's operate well within their dissipation ratings at 350 volts on the plates. The transmitter has been operated from the receiver power supply at 225 volts and provided satisfactory local coverage with an indoor half-wave folded dipole or a quarter-wave vertical antenna.

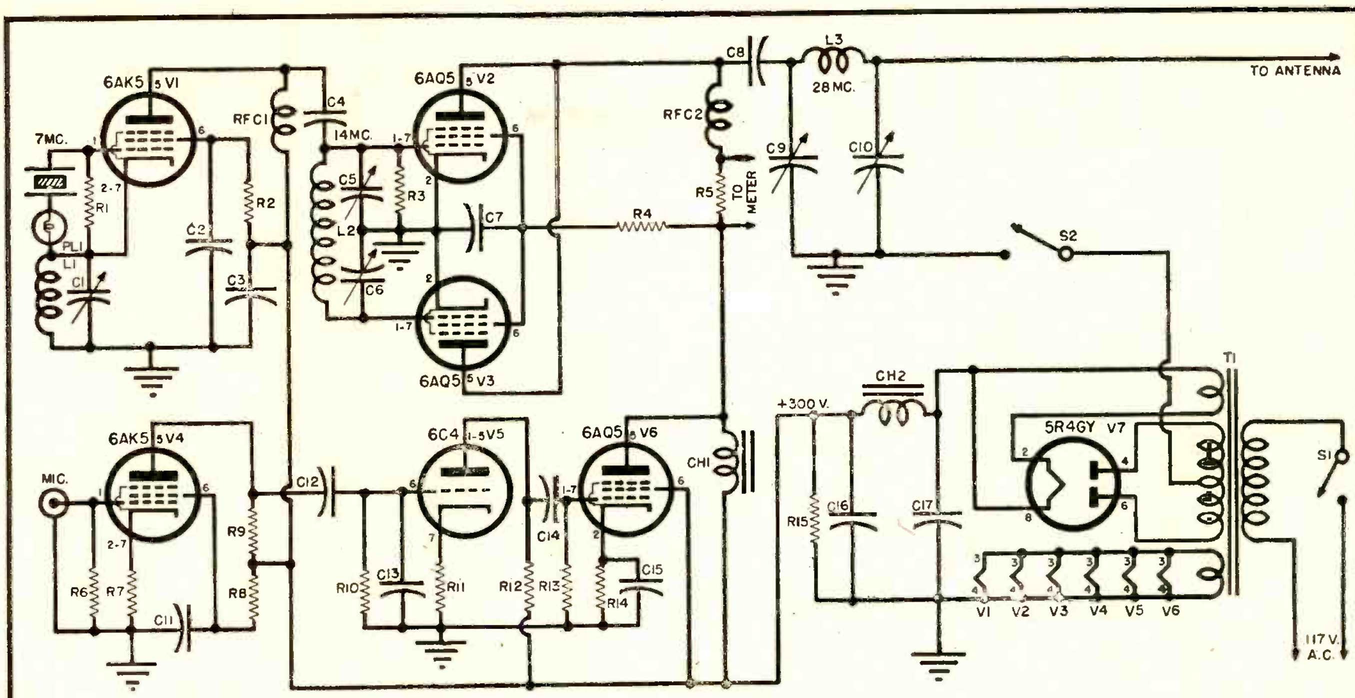
The circuit consists of a 6AK5 tri-tet crystal oscillator-doubler operating from a 40 meter crystal. A pilot bulb is used to indicate r.f. crystal current and should show no color whatsoever. It has been found that a low L/C ratio is desirable in a tri-tet oscillator to achieve low crystal current and the cathode coil specifications given should result in proper oscillator tuning (maximum output) with the cathode tuning condenser almost fully closed and no indicated crystal current.

The plate circuit of the 6AK5 oscillator is of the balanced type with two tuning condensers and is tuned to 20 meters. Splitting the tank provides the necessary push-pull excitation and has the further desirable effect of placing the input capacities of the two 6AQ5's across the 20 meter coil in series. The use of two trimmer condensers across the tank permits balancing the excitation to the 6AQ5 and compensating for the unbalance due to the 6AK5 output capacity across one half the plate coil. The output of the 6AQ5 push-push doubler stage, while not critically dependent on equal grid excitation, is at a maximum under the balanced condition.

The push-push doubler stage operates at almost the same efficiency as a straight-through amplifier and at the same time provides complete freedom from regenerative effects, neutralization therefore being completely unnecessary. The output connection of the pi-section tank circuit is made at the pin-jack on the side of the chassis between the two tuning condensers. A pair of pin jacks on top of the chassis provides for metering the plate current of the final amplifier. The drop in voltage across the meter resistance is negligible, being only about 2.5 volts and at the same time the inaccuracy in meter reading due to the shunting effect of the resistor is only about 2% with the average 1000 ohms-per-volt meter.

In the speech amplifier and modulator the coupling condensers are of rather small capacity to decrease the tendency toward motorboating and to attenuate bass frequencies. The condenser shunting the 6C4 grid serves to similarly attenuate the higher frequencies. Both of these restrictions of the audio response tend to utilize the communication audio spectrum most completely. The two speech amplifier tubes are operated with unbypassed cathodes to stabilize the speech amplifier and save space, but in order that the inverse feedback will not reduce the gain to too great an extent, both resistors are only 270 ohms. This value is quite enough to prevent any peak-clipping in the audio stage. The 6AQ5 modulator is operated with more than the recommended bias to safeguard the tube at 300 volts, which is in excess of the ratings for class A operation, and to bring the plate current down to approximately 35 milliamperes. The 6C4 and 6AK5 combined draw a total of about 3 milliamperes.

It was decided not to use a carbon mike in this transmitter although compact design might suggest it, because a crystal mike was available and a little layout planning soon revealed that a transformer and voltage supply would



R_1, R_2, R_3—47,000 ohm, 1 w. res.
R_4—27,000 ohm, 1 w. res.
R_5—47 ohm, 1/2 w. res.
R_6, R_{10}—1 megohm, 1/2 w. res.
R_7, R_{11}—270 ohm, 1/2 w. res.
R_8—2.2 megohm, 1/2 w. res.
R_9—560,000 ohm, 1/2 w. res.
R_{12}—100,000 ohm, 1 w. res.
R_{13}—470,000 ohm, 1/2 w. res.
R_{14}—400 ohm, 10 w. res.
R_{15}—50,000 ohm, 10 w. res.
C_1, C_{10}—100 mmfd. var. cond. (APC type)
C_2, C_4, C_7, C_8, C_{12}, C_{14}—.001 mfd. cond.
C_3, C_{11}—.01 mfd., 400 v. cond.
C_5, C_6, C_9—35 mmfd. air cond. (APC type)
C_{13}—470 mmfd. mica cond.
C_{15}—25 mfd., 25 v. elec. cond.
C_{16}, C_{17}—10 mfd., 450 v. elec. cond.
L_1—18 t. #28, 3/8 inch diam., 1/4 inch long
L_2—20 t. #18, 1 inch diam., 1 1/8 inch long
L_3—5 1/2 t. #18, 1 1/8 inch diam., 5/8 inch long
CH_1—4 henry, 130 milliampere iron core choke coil
CH_2—10 henry, 150 milliampere, 150 ohm filter choke
RFC_1, RFC_2—100 microhenry r.f. choke
PL_1—#47, 150 milliampere pilot lamp
S_1, S_2—S.p.s.t. toggle sw.
T_1—325-0-325 v. a.c. at 150 milliamperes, 5 v. at 3 amps.; 6.3 v. at 5 amps. (Thordarson T22R06 or equivalent)

Circuit diagram and parts list for the 15 watt, 10 meter transmitter and its associated power supply.

have occupied more space. In long evening QSO's the smoother response of the crystal microphone is appreciated. After the transmitter was completed, a 1000 ohm earphone from a surplus headset was tried as a mike. The results were so good that it has replaced the more fragile crystal mike for portable operation. As shown in the photograph, shielded wire terminating in a phono type plug couples the earphone to the transmitter. No audio gain control is provided, the level being correct for normal close talking several inches from the microphone. Although it is theoretically impossible to obtain 100 per-cent distortionless modulation with the Heising modulation system shown, listeners' and panoramic receiver checks of the modulation show it to be quite close to full modulation.

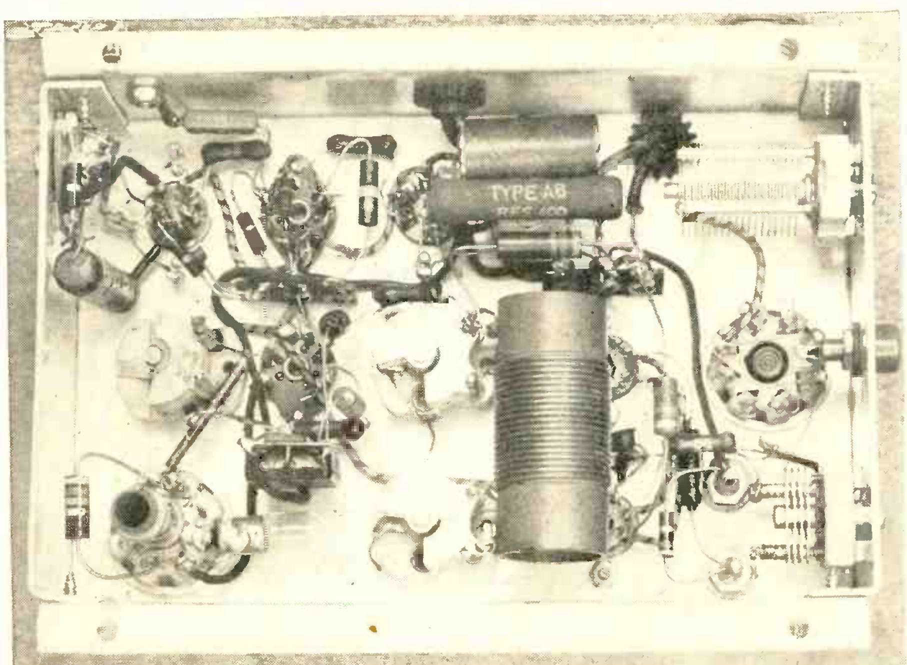
It may be noted that unusually small r.f. chokes are specified for shunt feeding the oscillator and final amplifier. While these are commercial units, satisfactory chokes may be made by winding a one watt, half-megohm resistor with a single layer of number 30 or 32 enameled wire. These chokes are more convenient to use than the old standby "2.5 millihenry" type and have lower distributed capacity than most other types. Since r.f. chokes in applications such as these are always operated above their resonant frequency, i.e., the frequency to which they are tuned by the capacity of the circuit, additional inductance is not necessary. The only requirement which must be satisfied is that the inductance of the choke must be high in comparison to the associated tank coil inductance.

An octal socket is used for the crystal. It will accommodate two FT-243 military crystals so that a spare crystal is always at hand. A short piece of 3/8 inch bakelite tubing is cemented in the recess for the octal key pin on the underside of this socket to provide a form for the oscillator cathode coil.

The final amplifier may be loaded to 50 milliamperes or so and the oscillator

(Continued on page 135)

Under-chassis view of transmitter showing simplicity of wiring. The oscillator plate coil mounts directly on the tuning condenser stators. The r.f. indicating bulb is soldered to one octal socket pin.



Build the W3KPX Multi-Unit NBFM, Crystal Oscillator and Signal Spotter

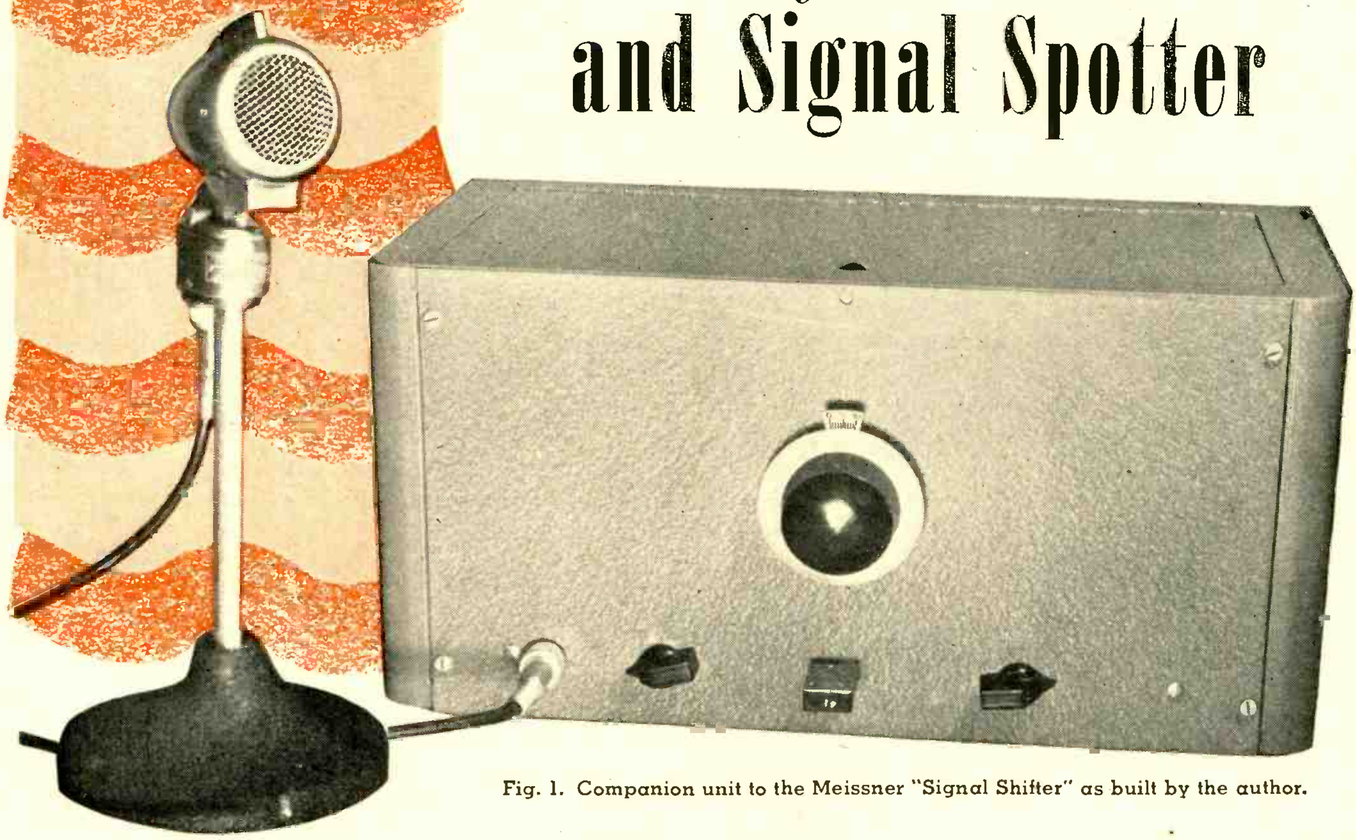


Fig. 1. Companion unit to the Meissner "Signal Shifter" as built by the author.

By **HARRY D. HOOTON,**
W3KPX

Construction details covering an easily-built companion unit to the Meissner "Signal Shifter".

THE author, like many other hams, is the owner of a prewar *Meissner* "Signal Shifter" which, incidentally, is still a very good variable-frequency exciter unit. However, in order to realize the full benefit of the "Signal Shifter," it is necessary to utilize some of the accessories which were supplied with it. One of the most useful accessories was the "Signal Spotter" which permitted quick calibration checks of the variable-frequency unit and also functioned as a crystal-controlled oscillator for spot-frequency operation. Since these prewar units are no longer available, it was decided to build a piece of equipment which would serve the same purpose as the original unit and also incorporate additional features considered desirable in modern amateur practice.

During the course of some experimental work with FM *crystal* oscillators, it was discovered that much greater frequency deviation can be obtained when the crystal oscillator circuit is made regenerative and modulated by a fairly husky reactance tube such as the 6F6. In addition, like most hams, the author stocked up on the inexpensive surplus military crystals, many of which had to be reground to amateur frequencies. It was considered necessary, therefore, to select a good reliable circuit which would oscillate with *any* crystal.

The unit shown in Fig. 1 is the final design. It is designed to serve as a companion unit to the "Signal Shifter" only and takes its power requirements from that source. The selector switches on the "Signal Shifter" front panel determine whether the v.f.o. or crystal control is used. The controls on the front of the accessory unit select either ordinary crystal control or narrow-band FM operation, as desired. The dial at the center is the plate tuning control of the crystal oscillator; the pointer knob at the left is the speech amplifier "gain" (deviation) control; and the pointer knob at the right is the oscillator regeneration control. The gain control also includes an "off-on" switch which opens the cathode circuits of the speech amplifier and reactance tubes when the crystal oscillator only is used. This control is normally left in the "off" position except when transmitting narrow-band FM.

As shown in Fig. 2, the tube line-up consists of a 6SJ7 crystal microphone input amplifier, a 6J5 audio-frequency amplifier, a 6F6 reactance-modulator and a 6C5 regenerative crystal oscillator. The speech amplifier circuit is more or less conventional, the values shown being selected for clean, crisp voice quality. It will be noticed that there is a liberal use of decoupling resistors and electrolytic condensers. Some of these condensers could be omitted. However, even a small amount of residual hum in an FM unit can cause considerable trouble and it was felt that the extra precautions were well worth the cost of the electrolytics. It is essential that the input lead from the crystal microphone jack to the control grid of the 6SJ7 be shielded by braided copper tubing which is grounded to the chassis. It may be necessary to shield the grid resistor, R_1, in a similar manner, to prevent r.f. pickup when operating on 10 meters.

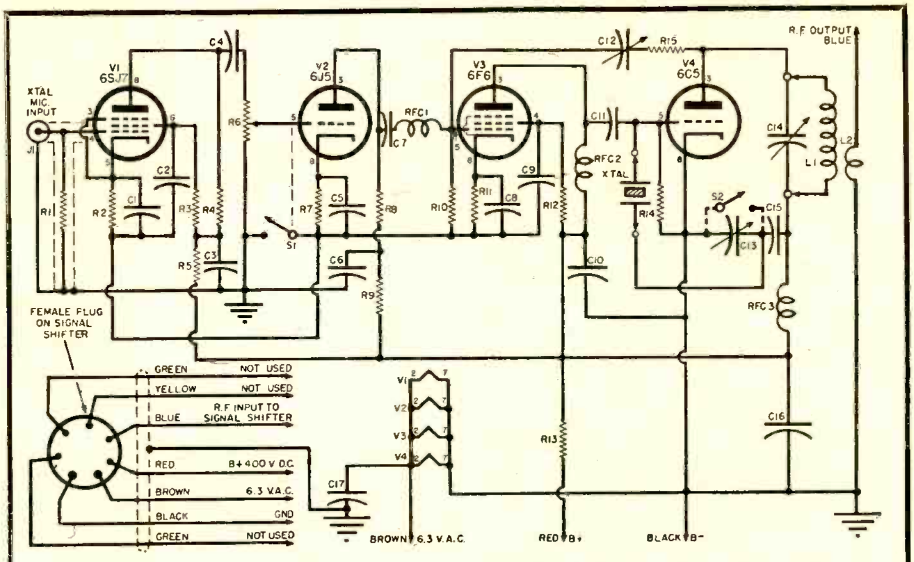
The 6F6 is connected as a reactance

tube in order to obtain the necessary capacitive and inductive reactance effect across the crystal. This circuit differs slightly from some of the conventional reactance modulators in that the feedback voltage is taken from the plate of the crystal oscillator tube and the necessary phase shift is obtained by adjusting the C_{12} R_{15} network to the correct values. The components in both the 6F6 reactance tube and 6C5 crystal oscillator circuits are somewhat critical and the constructor should not deviate widely from the values given if optimum results and trouble-free operation are to be obtained.

The crystal oscillator is a regenerative triode type with provision for removal of the regeneration, if desired. It will be noticed that the regeneration control condenser, C_{13}, is connected in series with the 0.006 mfd. plate bypass condenser and ground. The crystal is not returned to ground or cathode as in the usual circuit, but is connected to the junction between the two condensers. These condensers, C_{13} and C_{15}, then form a reactance-type r.f. voltage divider and the lower the capacitance (higher the reactance) of C_{13}, the greater will be the r.f. voltage developed across it. Since this r.f. voltage is of the proper phase relationship to reinforce oscillations in the 6C5 circuit, it may be fed back through the crystal and used as a source of regeneration. The value of C_{13} is such (75 mmfd.) that regeneration is barely perceptible with the plates in full mesh. The front rotor plate of C_{13} is bent over in such a manner that the variable condenser is short-circuited at full mesh thereby connecting the crystal and the plate bypass condenser C_{15} to ground. There is no regeneration in this position.

The plate tank tuning condenser is a standard receiving-type 140 mmfd. variable. The 6C5 plate tank coil, L_1, is a standard 5-prong, air-wound, m i d g e t transmitting type. The coil shown in Fig. 3 has an adjustable link at the center; the end-linked type is to be preferred in this circuit and the adjustable-link feature is not necessary. One end of the link is connected directly to ground and the other end is connected to the *blue* wire in the "Signal Shifter" cable. The r.f. output from the oscillator is approximately two watts depending upon the frequency in use.

To operate the unit as a crystal-controlled oscillator, rotate the "Signal Shifter" selector switch to *"XTAL"*; turn the auxiliary unit gain control to the "off" position and tune a communications receiver to the output frequency of the "Signal Shifter" or to one of its harmonics. Open the plates of C_{13} very slightly and rotate the 6C5 plate tuning condenser. If the receiver dial has been accurately set, the carrier level meter should read S9 or better when the plate tuning condenser is rotated through the point of resonance with the crystal frequency. With the coils and tuning condenser shown, the correct setting of C_{14} will be with the plates nearly all out of mesh. With the b.f.o. on the receiver, listen to the signal while rotating C_{14}



R_1—1 megohm, 1/4 w. res.
R_2, R_7—1500 ohm, 1 w. res.
R_3—1.5 megohm, 1/2 w. res.
R_4—50,000 ohm, 1/2 w. res.
R_5—250,000 ohm, 1/2 w. res.
R_6, S_1—1 megohm vol. control & sw.
R_8—100,000 ohm, 1/2 w. res.
R_9—10,000 ohm, 1/2 w. res.
R_{10}—500,000 ohm, 1/2 w. res.
R_{11}—390 ohm, 1 w. res.
R_{12}—100,000 ohm, 1 w. res.
R_{13}—20,000 ohm, 25 w. wirewound res.
R_{14}—50,000 ohm, 1/2 w. res. (see text)
R_{15}—500,000 ohm, 1/4 w. res.
C_1, C_5—20 mfd., 25 v. elec. cond.
C_2—.1 mfd., 600 v. cond.
C_3, C_6, C_{16}—16 mfd., 450 v. elec. cond.
C_4, C_7—.01 mfd., 400 v. cond.
C_8—10 mfd., 50 v. elec. cond.
C_9—.02 mfd., 600 v. cond.
C_{10}, C_{15}, C_{17}—.006 mfd. mica cond.
C_{11}—.00015 mfd. mica cond.
C_{12}—2-10 mmfd. var. air trimmer
C_{13}—75 mmfd. var. cond. (see text)
C_{14}—140 mmfd. var. cond.
RFC_1, RFC_2, RFC_3—2.5 millihenry, 125 milliampere miniature r.f. choke
L_1—Standard 5-prong plug-in coil, air-wound for band in use (Barker & Williamson)
L_2—1 or 2 t. around cold end of L_1
S_1—S.p.s.t. sw. on R_6
S_2—Bent plate on rotor of C_{13} (See text)

Fig. 2. Circuit diagram and parts list for companion unit to the "Signal Shifter".

back and forth across resonance and at the same time adjusting C_{13} for less capacitance. A setting of C_{13} will be found where the 6C5 will "take off" into self-oscillation and the crystal no longer controls the frequency. Increase the capacitance of C_{13} slowly until this condition ceases and the circuit becomes stable. The rotation of C_{14} will have practically no effect on the *frequency* of the oscillator when the oscillator adjustments have been correctly made. As the plate tuning condenser is rotated, however, the circuit will "plop" out of oscillation suddenly on the *high-capacitance* side of resonance but will usually stay in oscillation from resonance to the end of the dial scale on the low-capacitance side. If the exciter is feeding an amplifier stage with a grid meter, the plate condenser can be rotated for maxi-

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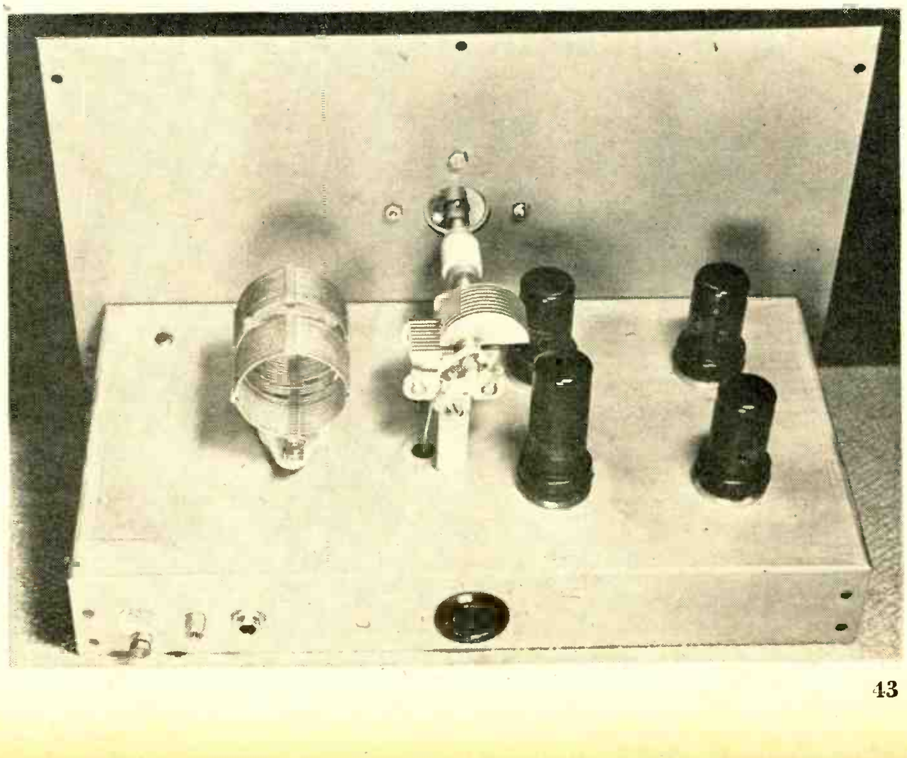
Fig. 3. Top chassis view of unit. Note that coil has an adjustable center link.



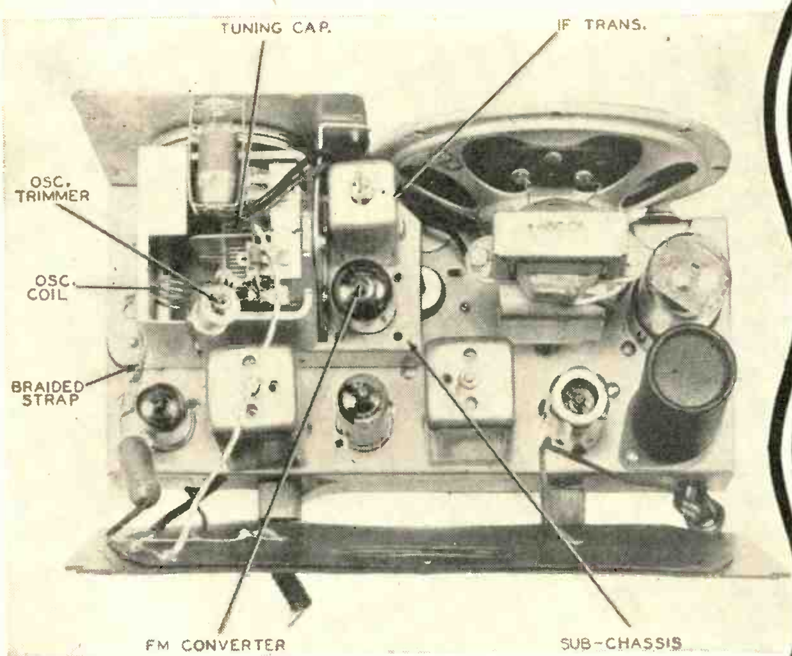


Fig. 1. Top view of Howard Model 474 with FreModyne detector.

New Trends in RECEIVER DESIGN

By W. WILLIAM HENSLER

Staff Eng., Howard W. Sams & Co., Inc.

Part 3. A discussion of automatic frequency control circuits used in FM receivers and the FreModyne FM detector circuit.

THE increasing popularity of FM has resulted in the incorporation of many new features and innovations in the design of FM receivers. Some of these are the use of the ratio detector, which eliminates the need for limiters; the double superheterodyne for increased sensitivity; automatic frequency control; and a new circuit for FM detection and amplification known as the "FreModyne." This article discusses the various versions of a.f.c. circuits and the "FreModyne."

Automatic Frequency Control

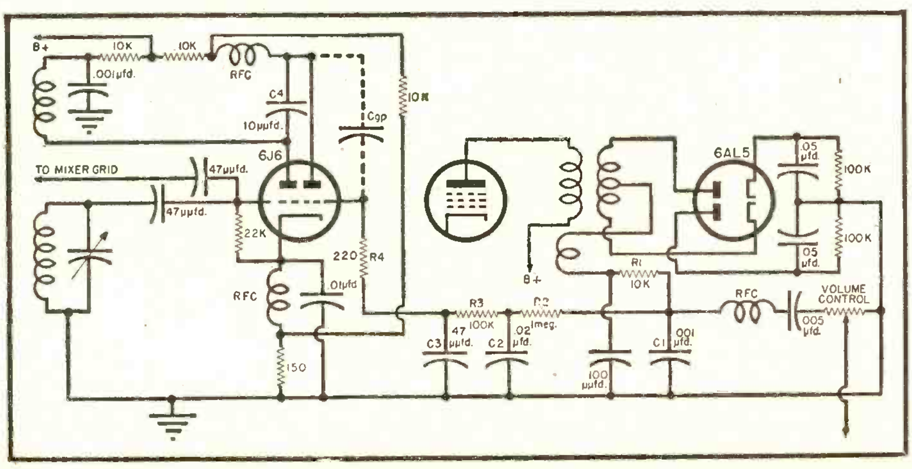
The automatic frequency control circuits incorporated in FM receivers are quite similar to those used in prewar AM receivers. One exception is that no additional frequency sensitive circuit is required since one is already incorporated for FM detection. To employ automatic frequency control in an AM receiver, it is necessary to add a discriminator to detect a deviation from center frequency. Since this requires the adtion of at least one transformer and one tube, it is normally used in only the more expensive and elaborate receivers. Also, due to the close spacing of the AM channels, considerable difficulty is experienced in the receiver being "pulled" from one channel to the other as one signal fades. Of course, this is not the case when the receiver is tuned to a strong signal since it will definitely "hold" on frequency and the operation is quite satisfactory. Most of the AM receivers incorporating a.f.c. have a switch on the control panel to disable the circuit when its use is not required.

Three of the most important features of a.f.c., especially in FM receivers, are; (1) the ability of the a.f.c. circuit to "pull" the receiver to center frequency after being tuned with push-buttons; (2) the a.f.c. circuit will "hold" the receiver on center frequency regardless of line voltage fluctuations or any slight change in electrical values of the component parts of the oscillator circuit; and (3) the elimination of the need for a tuning indicator. All these features are much more valuable in an FM receiver than in an AM receiver, since high fidelity reception of an FM signal requires exact tuning. Although there is a certain amount of tone distortion when an AM signal is not properly tuned, even greater distortion is experienced when an FM signal is improperly tuned. The incorporation of an a.f.c. circuit aids in manual tuning since it will take over the tuning for the operator as soon as the receiver is tuned close enough to the station frequency.

To date, we have examined FM receivers employing two types of a.f.c. circuits for FM tuning. In each case, the manufacturer has employed a 6J6 as a combination oscillator and reactance tube for a.f.c. A schematic of the *Hallicrafters* FM detector and a.f.c. circuit, as used in their fifteen tube chassis, is given in Fig. 2.

The operation of an a.f.c. circuit must rely on a frequency discriminating circuit to detect a deviation from the center frequency. In the case of this receiver, the FM detector is used. Since this is a balanced detector, the voltage at the audio takeoff point will be zero

Fig. 2. Schematic of a.f.c. circuit used in the Hallicrafters 15-tube chassis.



when the receiver is properly tuned. Although an audio signal is present at the junction of the de-emphasis network, C_1 and R_1, when the signal is modulated, the average voltage will remain zero. This is true because the FM signal is swept above and below the center frequency an equal amount when being modulated. If the receiver were tuned too high in frequency, it would result in a frequency higher than 10.7 mc. being fed to the i.f. amplifier. This would result in improper detection and a potential having positive polarity would appear at the junction of C_1 and R_1. Conversely, if the receiver were tuned too low in frequency, a negative polarity would result. Thus it can be seen that by sampling the average voltage out of the FM detector, an indication of any error in tuning of the receiver can be obtained. It is this voltage that is used to control the a.f.c. circuit.

The sample voltage is fed through a filter network comprised of R_2, C_2 and R_3. This filter network is comparable to the automatic volume control filter network with which all are familiar. The voltage at the junction of C_3 and R_4 is d.c., since all of the audio signal has been lost in the filter network. C_3 has a very low reactance at the FM oscillator frequencies and for all practical purposes the junction of C_3 and R_4 is at r.f. ground.

Since a reactance tube is used as a "variable tuning condenser" for shifting the oscillator frequency, a discussion of the theory of the operation of this circuit is in order. Since an error in tuning on the high frequency side gives a positive polarity reading, it can be seen that a capacitive reactance tube will "pull" the oscillator back on frequency. For example, a more positive voltage on the grid will result in more current flow, which corresponds to a decrease in reactance or an increase in capacitance. This effective increase in capacitance, which is shunted across the oscillator tube, will lower the frequency to the proper point. In order to make the tube appear as a capacitive reactance to the oscillator, the grid-to-plate capacity, represented by C_{gp} in Fig. 2, and R_4 are used to obtain a phase shift between the oscillator voltage applied to the grid and the oscillator voltage itself. The oscillator voltage is coupled to the reactance tube by the 10 mmfd. condenser, C_4, in the plate circuit. The out-of-phase voltage present on the plate of the reactance tube causes the tube to appear as a capacitance to the oscillator.

Although the discussion to date has assumed that the receiver has been improperly tuned by the operator, it should be noted that the a.f.c. circuit will "hold" the receiver on frequency if the oscillator should start to drift. This drift might be caused by a change in line voltage or a change in the interelectrode capacitance of the tube during warm-up. The a.f.c. circuit also permits the receiver to be tuned properly by push-buttons since the push-button setting is close enough for the a.f.c. circuit to take over and "pull" the oscillator to the correct frequency.

The schematic of Fig. 3 shows the circuit used in the *Radio Craftsmen* Model RC-1 FM-AM receiver. The theory of operation of this circuit is the same as the previous one. The receiver, however, uses a conventional discriminator for FM detection. The voltages across R_1 and R_2 will be equal and of opposite polarity when the receiver is properly tuned, resulting in net voltage of zero, as was the case in the preceding FM detector. A deviation to either side of center frequency will result in a positive or negative reading. Thus it can be seen that the control voltage from the discriminator is the same as in the previous circuit.

No provision has been made for disabling the a.f.c. circuits from the control panel in either of these receivers.

The "pull-in" limits on these a.f.c. circuits and their method of measurement are usually obtainable from the manufacturers and should be checked carefully to insure proper operation. However, a preliminary check may be made, as follows, to see if the a.f.c. circuit is operating. Ground the grid of the reactance tube and tune the receiver slightly to either side of center frequency. Remove the ground from the grid and the a.f.c. circuit should "pull" the oscillator to properly tune the receiver. The a.f.c. circuit should also "hold" the receiver on frequency as it is tuned slightly on either side of the FM signal carrier giving the effect of very broad tuning.

When operating properly, this circuit also tends to eliminate the two "false" peaks which are located on either side of the correct peak. These "false" peaks occur as the receiver is tuned on the sides of the i.f. passband response curve,

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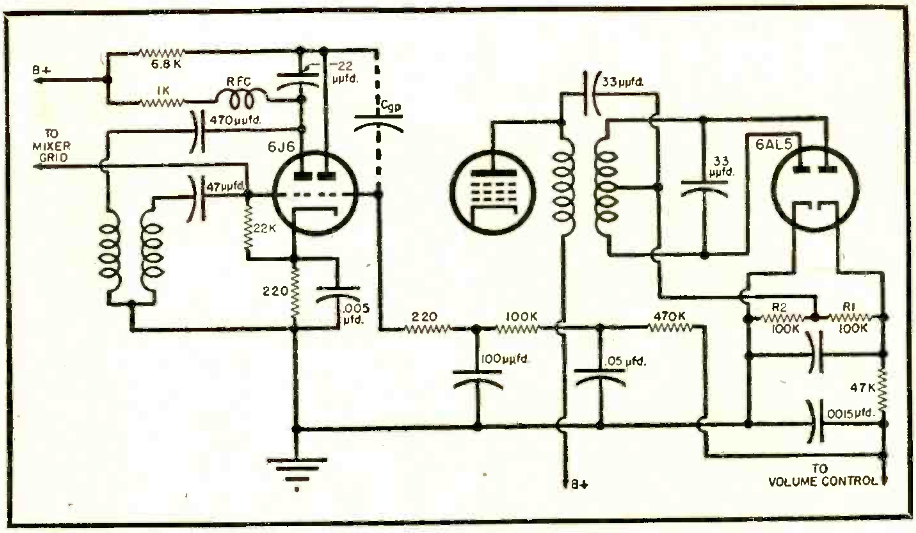
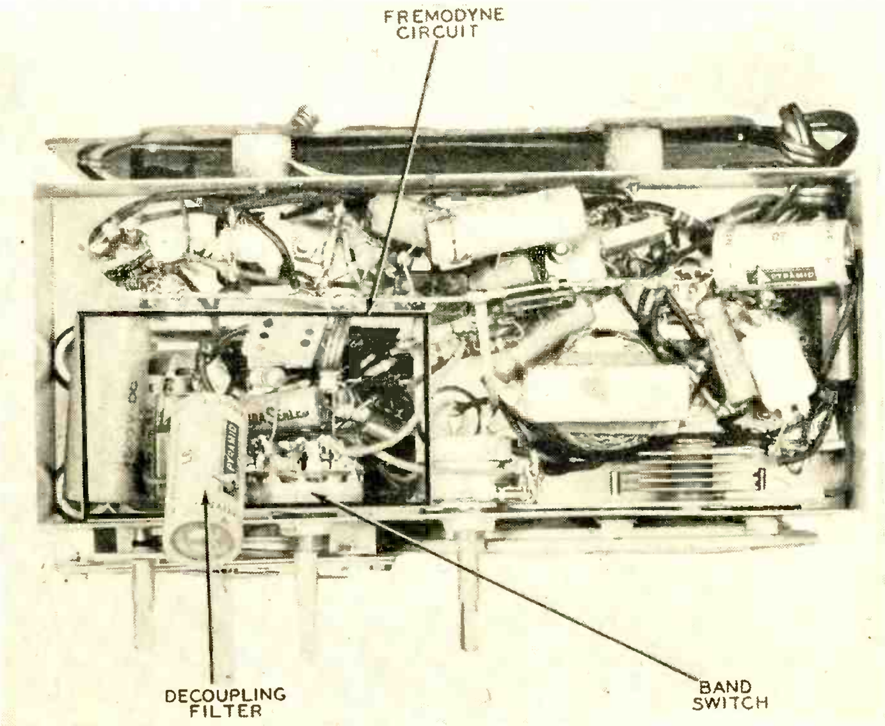
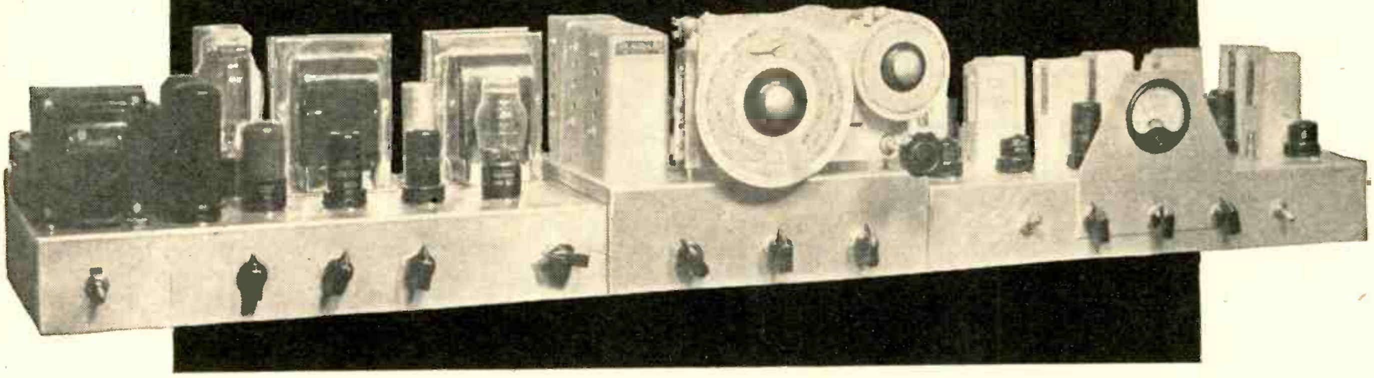


Fig. 3. The a.f.c. circuit used in the Radio Craftsmen Model RC-1 receiver.

Fig. 4. Bottom view of Howard Model 474 chassis showing FreModyne FM detector.



Build Your Own Communications Receiver



A typical assembly consisting of power supply and audio amplifier, tuner, and i.f. chassis.

By J. T. GOODE
Standard Coil Products Co.

Part 1. The first of this series covers the design and construction of amplifier and power supply unit.

NOT too many years ago it was common to build your own radio receiver instead of buying one. People with little or no radio experience built receivers that operated satisfactorily. Over a period of years, mass production of radio receivers reduced the expense of such equipment, bringing radios into almost every home. Thus, the actual expense of a complete radio was less than the price of the parts if the parts where purchased piece-by-piece at wholesale prices. Seldom would a home-built receiver compete in all respects with a manufactured radio using the same number of tubes.

Time changes everything and the radio industry is no exception to the rule. A complete set of parts for a nine-tube receiver can now be purchased for far less than the cost of a manufactured nine-tube radio. Not only can the receiver be built for less money but it can be made to outperform the manufactured set or at least equal the performance. Anyone with a basic knowledge of radio can build such a receiver. Oddly enough the most expensive manufactured receiver is the easiest for the home builder to duplicate both dollar- and performance-wise.

The major reason for considering any project of this type is to realize a maximum return for a minimum investment, and in the case of this home-built receiver a certain amount of personal pride in a job well done will be involved.

If you want a $20.00 radio, buy it. You can't build one for $20.00 that will give you anything more than the commercial product at that price. If you want a $75.00 radio, remember that the amount of money saved in building your own receiver may not justify the difference between the cash outlay for parts and the purchase price of a commercial unit.

If you want a $200.00 radio you have now reached the price range where home construction becomes worthwhile. This is true of either broadcast or communications receivers. An investment of $100.00 in radio parts will make it possible to construct a receiver that will include many features not found in commercially-built sets at this price. Similarly, receivers in the $500 and $1000 price range can be duplicated even more successfully and at a proportionately greater saving. Of course, these statements hold true only when building a receiver for your own use. You cannot build a receiver to sell at a profit under these conditions.

Before starting any project it is good business to compile sufficient information on the equipment to gain a complete picture of the work to be undertaken. The following information is provided in order to create just such a picture for anyone considering the advisability of building his own receiver.

First of all, the electrical engineering must be complete or such that additions can be made at a later date in order to prevent obsolescence. The mechanical design must be such that satisfactory electrical design is possible. The type of dial or dials should be selected early in the construction since this item will affect the mechanical design and the mechanical design can affect the electrical design.

Space limitations require serious consideration. It is more economical to increase the size of a radio cabinet by one inch than to try and decrease the size of the completed radio chassis by the same amount.

Fabrication of a radio chassis is difficult when proper equipment is not available. Decide in advance how and where the chassis will be obtained.

An estimate of the total cost should be made well in advance by preparing a complete list of materials needed. An early decision will have to be made regarding how the equipment is to be mounted, whether in a wood cabinet, metal cabinet, relay rack, or in individual cabinets.

All of this may sound a little difficult but just such planning as this will result in a good finished product that anyone would be proud to own.

The radio described in this series of articles has had the majority of the problems mentioned worked out in detail, namely those involving the mechanical and electrical engineering, and the selection of different type dials.

The average so-called "junk box" will yield many of the necessary resistors, condensers, tubes, coils, and chokes.

Calibrating a three-band receiver may appear to be a rather complicated job—

EDITOR'S NOTE: *While many excellent books, dealing with almost every phase of engineering, are available to the public such publications explain the operation of various electronic circuits but usually do not indicate actual values of components. To the average radio enthusiast who wants to build a good radio such information is of little value.*

There appears to be a gap between engineering and actual construction of complete radio receivers from the home constructor's viewpoint. Mr. Goode has attempted to fill this gap in these articles.

The equipment described is the result of experience gained in the actual manufacturing of radio equipment. The author's experience covers the marine transmitter and receiver field, designing and building aircraft transmitters and receivers, broadcast station operation, the mass production of broadcast and communications receivers and precision electronic test equipment.

The only mathematics required to construct this receiver will be that needed to calculate the cost of the parts.

actually it isn't. The method for making a quick and accurate calibration will be covered in the section dealing with the tuner. The three-band calibration for the tuner took approximately thirty minutes.

Receiver Construction

A modern radio receiver can be broken down into four main sections; power supply, audio amplifier, intermediate amplifier and detector, and r.f. tuner. By analyzing each section separately, a receiver can be designed to meet almost every requirement.

Power Supply: A well-designed power supply should have the following features: (1) Adequate voltage and current ratings for present and future applications. (2) Adequate filter so that hum-free operation is possible. (3) Voltage regulation for high frequency oscillator operation minimizing drift due to plate voltage variation. (4) Tubes, transformers, chokes and condensers with an adequate safety factor.

Audio Amplifier: The audio amplifier should meet the following requirements: (1) An output of at least 10 watts with less than 10 per-cent distortion. An amplifier with such a level will be practically distortionless at room volume. (2) Tone controls that increase or decrease the low as well as the high frequency response of the amplifier. Operation of these controls should not cause the average volume to change noticeably. (3) Frequency response that is substatially flat from 100 to 15,000 cycles. (4) Hum level sufficiently low to allow satisfactory quiet-room operation. (5) Adequate gain for present and future needs.

Intermediate Amplifier and Detector: The requirements for this section are as follows: (1) Adequate selectivity for the type of service required. Some applications will require variable selectivity. (2) Sufficient sensitivity with high signal-to-noise ratio of at least ten-to-one. (3) Low distortion detector. (4) Additional features that can be included are noise limiter, limiter and narrow-band FM, and an "R" meter. (5) Complete elimination of regeneration.

R.F. Tuner: The tuner requirements include: (1) Complete coverage for all frequencies desired. (2) Sensitivity in the order of twenty microvolts for the broadcast band and one microvolt on short-wave. (3) Signal-to-noise ratio of at least ten-to-one. (4) Image ratio sufficiently high to practically eliminate this type of interference. The degree of image rejection designed into a tuner is usually a compromise between satisfactory operation and dollars invested.

The modern FM receiver requires the same four sections with the main difference in design showing up in the intermediate frequency amplifier and detector section.

Up to this point an effort has been made to indicate how and why home construction of *good* radios is interesting and economically sound. The next step is the design of just such a receiver.

The following is a list of features which have been incorporated in the receiver discused in these articles. (1) Heavy duty power supply; (2) audio output, 15 watts, 6L6 tubes in push-pull, low distortion; (3) bass boost; (4) high frequency control that will increase or decrease highs; (5) sufficient audio gain for present and future needs; (6) variable output impedance; (7) voltage regulation; (8) hum-free operation; (9) selector switch for radio, phono, etc.; (10) wide-band i.f. channel for high fidelity radio reception; (11) narrow-band i.f. channel for communications and broadcast; (12) sharp-band i.f. channel for communications; (13) i.f. gain control; (14) a.v.c.; (15) a.n.l.; (16) b.f.o. variable frequency control; (17) a.v.c. switch; (18) narrow-band FM with limiter; (19) "R" meter; (20) three-band general coverage tuner, 550 kc. to 16,000 kc., one r.f. stage; (21) standby, receive, transmit switch; (22) separate tuner, two r.f. stages for 75 meters only; (23) separate tuner, two r.f. stages for 40 meters only; (24) separate tuner, two r.f. stages for 20 meters only; (25) separate tuner, two r.f. stages for 10 and 11 meters; (26) separate tuner, one r.f. stage for 6 meters; (27) separate tuner, one r.f. stage for 2 meters; and (28) switch to select any tuner. Dial lights on tuners indicate which tuner is being used.

To engineer such a receiver as this onto one chassis would cost at least $10,000 in the average radio laboratory. One of the main engineering headaches in receiver design is the interaction of one section of a receiver on another section on the same chassis. This problem has been practically eliminated with this receiver by the use of separate chassis.

The power supply and audio amplifier occupy a single chassis. This unit is wired and tested before the construction of the other units is started. With this unit working properly, the builder can forget about it. In the meantime he has a fine piece of equipment that can be used for p.a., playing phonograph records, as a modulator, or used to replace the inadequate audio amplifier of some radio.

The power supply has ample reserve to supply 250 volts at 100 milliampers and 6.3 volts at 2 amperes. This additional power can be used to furnish excitation for a dynamic speaker, etc. The amplifier can also be used for recording.

The i.f. channel is constructed on a separate chassis. This eliminates interaction with the r.f. section. Most interaction difficulties take place between the i.f. and r.f. sections.

This receiver was designed to be built a stage or section at a time. First the wide-band amplifier is wired and tested. Next the narrow- and sharp-band channel is wired and tested. The next step

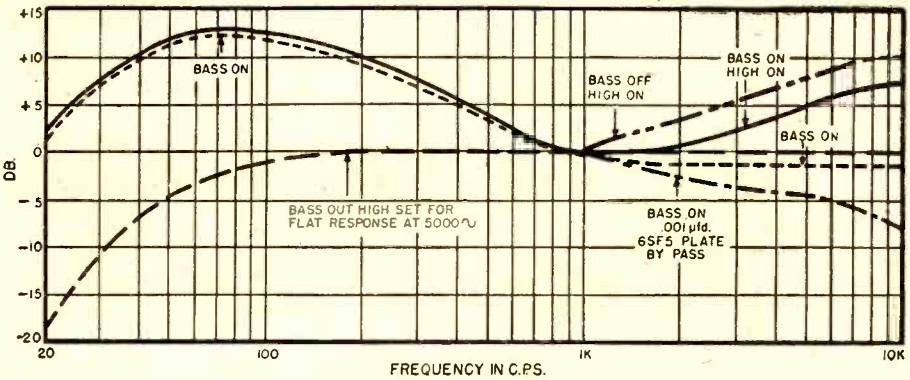


Fig. 2. Amplifier response curves for various tone control settings.

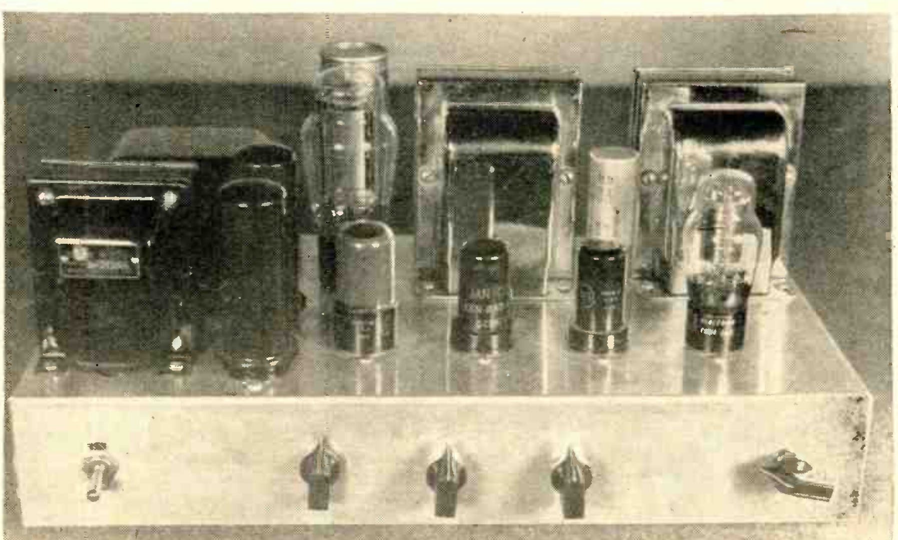
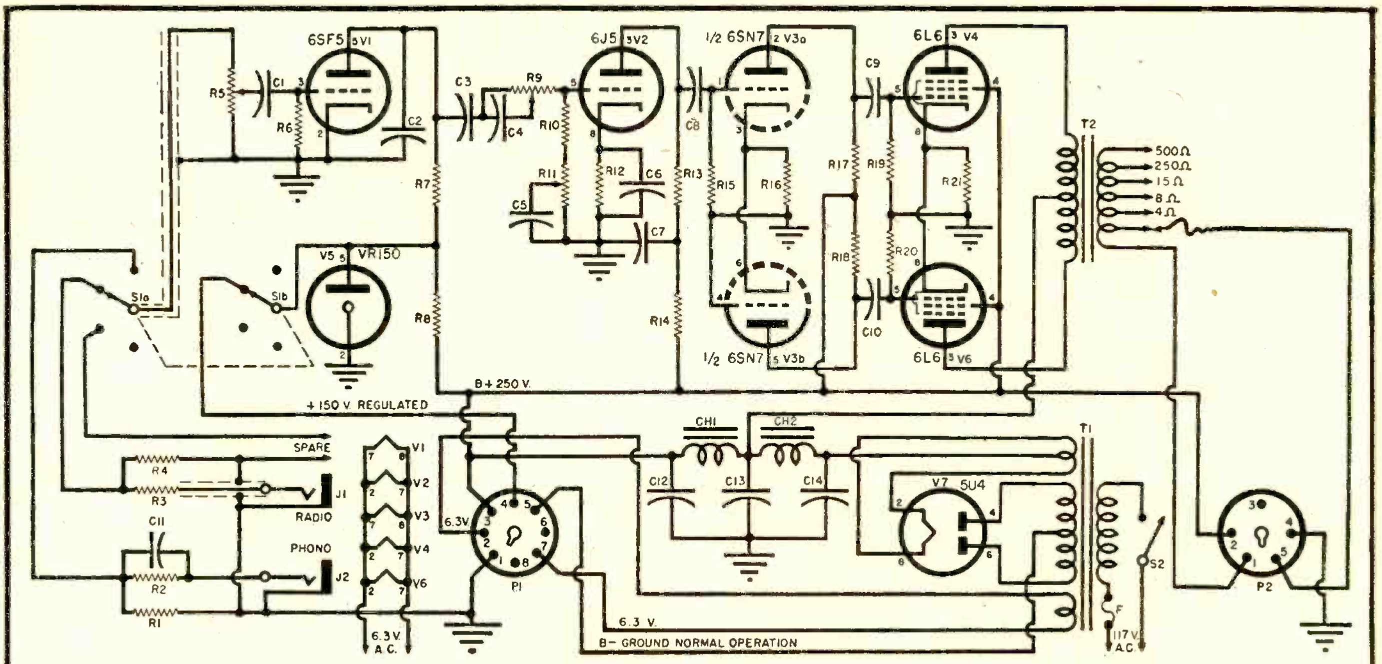


Fig. 3. The amplifier and power supply section described in this article.



R_1, R_4, R_7, R_{13}, R_{14}—47,000 ohm, 1/2 w. res.
R_2—390,000 ohm, 1/2 w. res.
R_3, R_{15}—470,000 ohm, 1/2 w. res.
R_5, R_{11}—250,000 ohm pot.
R_6—10 megohm, 1/2 w. res.
R_8—2500 ohm, 10 w. wirewound res.
R_9—1 megohm pot.
R_{10}—22,000 ohm, 1/2 w. res.
R_{12}, R_{16}—3900 ohm, 1 w. res.
R_{17}—27,000 ohm, 1/2 w. res.
R_{18}, R_{19}, R_{20}—100,000 ohm, 1/2 w. res.
R_{21}—150 ohm, 10 w. wirewound res.
C_1—.006 mfd., 400 v. cond.
C_2—.001 mfd., 400 v. cond.
C_3, C_5—.01 mfd., 400 v. cond.
C_4—175 mmfd. mica cond.
C_6—10 mfd., 25 v. elec. cond.
C_7—4 mfd., 450 v. elec. cond.
C_8, C_9, C_{10}—.05 mfd., 600 v. cond.
C_{11}—250 mmfd. mica cond.
C_{12}, C_{13}—20/20 mfd., 450/450 v. dual elec. cond.
C_{14}—20 mfd., 450 v. elec. cond.
S_1—D.p.4-pos. rotary sw.
S_2—S.p.s.t. toggle sw.
J_1, J_2—Phone jack
P_1—Octal socket
P_2—5-prong socket
CH_1—10.5 henry, 110 milliampere filter choke (Stancor C-1001 or equivalent)
CH_2—8.5 henry, 200 milliampere filter choke (Stancor C-1721 or equivalent)
T_1—Power trans. 350-0-350 v. at 200 milliamperes; 5 v. at 3 amps.; 6.3 v. at 5 amps. (Stancor P6314 or equivalent)
T_2—Output trans. 5000 ohm plate-to-plate to 4, 8, 15, 250, 500 ohms, 30 w. rating (Stancor A-3800 or equivalent)
V_1—6SF5 tube
V_2—6J5 tube
V_3—6SN7 tube
V_4, V_6—6L6 tube
V_5—VR150 tube
V_7—5U4 tube

Fig. 4. Over-all schematic diagram of audio amplifier and power supply.

is the b.f.o. and a.n.l. section. The last section to be wired is the narrow-band FM.

Most receiver design troubles come from doing too much at one time and the interaction which results from this procedure is most difficult to troubleshoot. By building one small section at a time and testing it, practically all such difficulties are eliminated. If trouble is experienced, it is simple to isolate.

Each r.f. tuner is constructed on a separate chassis. Bandswitching r.f. tuners appear complicated when surrounded by the other components of a receiver. On a separate chassis the wiring looks less complex. Each r.f. section is wired completely and tested.

Builders not interested in the communications features of this receiver can simplify the construction by completely eliminating the i.f. chassis. A 6SF7 tube and another i.f. transformer can be placed on the all-wave tuner chassis. The 6SF7 diode in this case will be used as a second detector. The connections that normally would go to the i.f. channel now go to the tuner. Regular input and output i.f. transformers should be used.

The advantages of building separate tuners for each ham band are obvious, but a few of the not-so-obvious points will be discussed. The gain of a radio frequency amplifier is governed by the mu of the tube and the *"Q"* of the circuit. A coil with a *"Q"* of 400 will give only a slight increase in gain when compared with a coil with a *"Q"* of 200, if the *"Q"* of the circuit is only 50. Each component part that connects to the coil tends to lower the *"Q."*

One of the most common difficulties experienced in all-wave tuner design is the reduction of grid and plate lead length. It is not uncommon to have at least nine inches of lead connecting the coil to the grid of a tube. By the time this lead leaves the coil, goes to and through the bandswitch, over the variable condenser, and eventually arrives at the grid, the *"Q"* of the circuit is greatly reduced. Not only is the *"Q"* reduced but the circuit capacities have been added between the grid of the r.f. stage and the mixer. This results in poor image rejection and possible regeneration.

Soldering to the chassis probably causes more receiver difficulties than any other single thing. A more acceptable procedure is to place a solder lug under each tube socket mounting screw. This places the ground connections exactly where they should be. All bypass condensers used in each stage should be grounded at the same point. Sometimes this is not possible, but in a majority of cases this procedure if entirely feasible. The use of an aluminum chassis makes such wiring necessary. Steel chassis can be used with equally good results. A painted chassis presents a serious ground problem but with a certain amount of care satisfactory construction is possible.

Punching holes in a blank chassis can be simplified by following this procedure. Draw the chassis layout to scale on a large piece of paper. Attach this paper to the blank chassis by means of "Scotch" tape. Center punch through the paper and mark the size of each hole on the paper for quick reference. Make all small holes first. In case of an error, the result can be used as a guide hole for the next sized larger drill. All tube socket mounting holes are spaced 1-5/16 inches. If 1½ inch mounting center sockets are used, make these corrections on the paper layout before punching. If parts other than those specified are used, move the mounting holes accordingly. The general layout, however, should remain the same.

The following test equipment will be required to align the receiver; a signal generator, a v.t.v.m. similar to the *"Junior VoltOhmyst,"* and a frequency meter for calibration. If the builder does not have such equipment it can undoubtedly be borrowed for the short time required to align the receiver.

The frequency meter is used to establish the error of the signal generator calibration. By checking three points on each band, the signal generator calibration error can be determined. From this point on, calibration can be made in a matter of minutes for each band.

If the receiver is to be constructed omitting the communications features, a slide rule dial can be used on the tuner

(Continued on page 159)

The RECORDING and REPRODUCTION of SOUND

Fig. 1. RCA accordion cone, 7-inch permanent magnet speaker.

By
OLIVER READ
Editor, RADIO NEWS

Part 18. A discussion of factors influencing behavior of reproducers at audio frequencies.

IT is unfortunate that so many personal prejudices and economic considerations enter into current discussions of high fidelity. If a group of people are asked to express their preference, the comparison should be presented to them in terms of "live" music (which true high fidelity would simulate indistinguishably) as opposed to low fidelity reproduction. Music appreciation is largely a matter of conditioned reflexes. There is a distinct danger in current trends to dull the senses and limit measurably the scope of tonal appreciation in future generations. Furthermore, the willingness of the public to pay for high quality reproduction is underestimated. The term "high fidelity" has been so misused as to almost destroy its value.

Modern designing knowledge makes it possible to produce vacuum tube devices with almost any desired frequency response. With suitable filter networks, it is not difficult to compensate electrically for the response curve of the ear at different intensity levels, as well as for frequency range limitations in broadcast and recording practice. But the variation with frequency in sound pressure from a loudspeaker is too violent to be disposed of practically in this manner. The point is that the selection and design of loudspeakers and associated enclosures probably deserve more contemporary engineering attention than any other field of associated development. The difference in the quality of the end result when a really good loudspeaker system is substituted for the reproducer in an average home radio is greater than even most technicians in the industry realize.

Speaker Placement

Innumerable texts and common knowledge dictate the intelligent placement of loudspeakers in most large installations. Strangely, although the experimental facts have been widely published, optimum placement of speakers in homes and small rooms is rare. This ideal position is in a corner, preferably at the floor or ceiling junction with the walls. This location has been shown to produce three or four times as much radiation of low frequency energy as mid-wall placement. Where semi-permanent special enclosures may be constructed, a triangular cabinet or close fitting flat baffle fitting the corner from floor to ceiling is desirable. However, simply moving a standard console radio to form a hypotenuse across the corner of a room results immediately in a noticeable improvement in low frequency radiation.

Enclosures

Completely enclosed cabinets eliminate cancellation of low frequencies from the interaction of front and backside radiation. However, the natural frequency of the speaker will be effectively dependent on the compliance of the enclosed volume of air, thus varying with the cabinet size. The use of absorptive material aids in lowering the resonant frequency of the system. The installation of a speaker in the wall between two rooms represents the extreme (and ideal) condition for complete enclosure.

Labyrinth type cabinets, which may or may not be of semi-exponential design, are usually lined with absorptive material to eliminate high frequency distortion from interacting radiation between the speaker cone and labyrinth mouth. Reinforcement in a limited range of middle low frequencies is obtained by the phase shift resulting from the transmission time delay of the back wave through the labyrinth. This effect is greatest when the labyrinth is a ¼ wavelength and functions as a mechanical counterpart for a ¼ wavelength tuning stub with respect to impedance relationships. When radiation from the labyrinth mouth is maximum, the speaker diaphragm looks into a high impedance and is highly damped. At very low frequencies the phase shift may be practically eliminated and cancellation will take place.

Bass reflex speaker enclosures have gained increasing popularity because of the excellent results obtained. The theory of their design is interesting and not too widely understood. Absorptive material is used in these cabinets to eliminate high frequency radiation from the reflex opening. Incidentally, it is worthy of note that the absorption coefficients in published tables for acoustic materials at the lower frequencies indicate negligible absorption in this range. The cabinet is usually designed in a dimensional relationship that avoids air column resonance; it need not be as large as either a complete enclosure or labyrinth type to achieve comparable results.

An ideal speaker diaphragm would

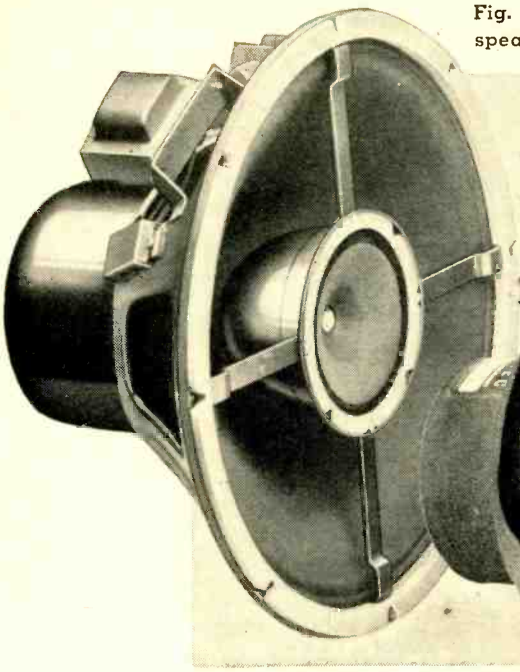


Fig. 2. The Jensen dual-unit coaxial loudspeaker suitable for large installations.

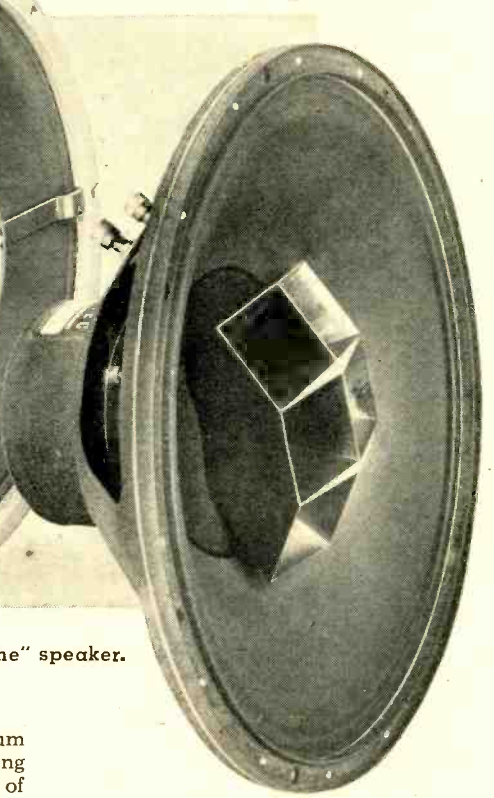


Fig. 3. Altec Lansing multicell "Diacone" speaker.

have minimum inertia, and minimum distortion from flexure and centering cone edge supports. The cross section of air in the opening of a reflex cabinet is effectively such an idealized diaphragm. The speaker cone is coupled to the opening through the elasticity of the enclosed air in the cabinet.

The reflex opening is deliberately made large and placed close to the speaker cone. Within a relatively broad range above and below a specific low frequency, the coupling will be such as to highly damp the speaker cone and produce the major portion of radiation from the virtual source represented by the reflex opening. There is no time delay involved in producing this phase shift. It results from the equivalent *L-R-C* circuit of the coupling medium, the speaker cone, and the reflex opening. It is clear that at some frequency in the lower ranges the coupling will lag by 180 degrees as a result of the compliance of the coupling medium. Since the virtual diaphragm is effectively undamped at this time, its swing will greatly exceed the amplitude of the speaker cone. This means not only that the radiated energy will be increased in this frequency range, but also that the undistorted conditions of the idealized virtual diaphragm of the reflex opening will be realized at maximum efficiency.

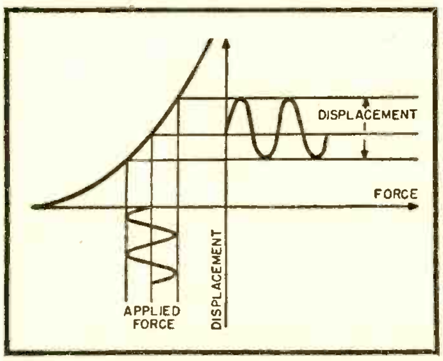


Fig. 4. Characteristic curves showing result of non-linear relationship between front and back radiation impedance.

Bass reflex cabinets may be designed haphazardly (as they often are) with the probability of improving the response of a speaker selected at random. However, to achieve anything approaching the full advantages available from such enclosures, they should be devised in terms of the characteristics of a specific loudspeaker.

Many shapes of loudspeaker cones have been developed experimentally, but the most efficient and satisfactory design is circular. Elliptical cones were early abandoned because of problems in mechanical structure and other disadvantages. Although flared cone sides are not as strong for a given weight as straight sides, the response is appreciably improved above 5000 c.p.s. However, in speakers designed primarily for high power handling capacity and moderate frequency response, straight sides are used almost exclusively.

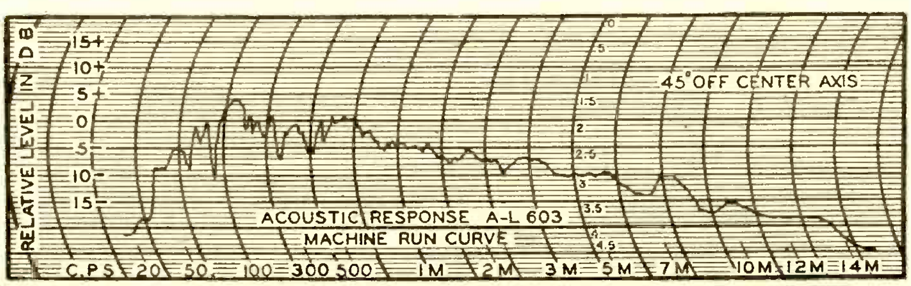
Most cones are made of specially fabricated papers. Where efficiency in quantitative transfer of energy is important at the expense of smooth response, very hard papers are used. More flexible structures are selected for high quality reproduction. A compromise is sometimes made between mechanical strength and smooth response by closely spaced annular rings in which the fibrous structure is deliberately broken down. Very soft material similar to blotting paper may be used to smooth the response and eliminate sharp dips and peaks still further in the response curve, but high frequency response is sacrificed. Another compromise is achieved in polyfibrous cone types where as many as three different degrees of hardness are used in the construction of a single cone. The cone is usually divided into three bands of approximately equal width with the material becoming softer and increasingly fibrous away from the voice coil.

One of the most interesting developments is the so-called "accordion cone" speaker, Fig. 1. Here the outer edge of the cone floats without contact to the metal structure, and a supporting structure of cone material is folded back accordion-wise to provide centering. This small speaker has an exceptionally smooth response and an extended frequency range that covers from 80 to 7000 cycles-per-second with excellent fidelity, tapering off to 30 cycles down and 14,000 cycles upward. This type of folded edge cone support extends the lower frequency limit at least one octave below that obtainable with conventional construction for the same unit. The amplitude of piston swing at low-level low frequencies is a contributing factor in the effective transducing efficiency of the unit. Four of these speakers in a suitable cabinet will handle twelve watts complex wave, and are difficult for the most critical listener to distinguish from systems costing ten times as much. There appears to be no reason why this principle cannot be applied to speakers of larger cone diameter with equally desirable results. It is suggested that similar results might be obtained perhaps with better acoustic loading by folding the edge of the speaker cone forward to its support when physical depth is not a factor.

Dual Combinations

There are many reasons why it is not practical to cover the entire audible frequency range with a single transducer.

Fig. 5. Curve of acoustic response for the Altec Lansing Model 603 shown in Fig. 3.



Among these is the fact that mechanical and electrical impedances vary with frequency, and it is clear that the wider the frequency range, the more difficult it is to provide an approximate match throughout. It is also true that a desirable directional characteristic over a wide frequency spectrum is incompatible with contemporary fundamentals of design. In order to obtain the most efficient transfer of energy, particularly at low levels where mechanical damping is effectively high, it is common practice to use a speaker of a large cone diameter for low frequencies.

At high levels this is also necessary in order that the cone may be free to swing over the required amplitudes at low frequencies. There are other considerations involved in this requirement, but directivity at low frequencies is not a problem. At high frequencies, where the tendency to beam becomes pronounced, it is of great importance that the diameter of the source be small compared with the wavelength of the sound energy. Contrary to what might be expected at first consideration, the angle of directivity varies inversely with the physical size of the sound source when compared with the wavelength. Thus a large speaker cone, or large horn mouth acting as a virtual source, decreases the angle of distribution at high frequencies. Where an effort is made to design a single unit to cover an excessively wide frequency range, the distortion caused by transients and cross modulation effects from various modes of vibration at the extremes of the spectrum is greatly increased.

It is of practical value to note that multiple speakers of identical response characteristics may be used to advantage in extending the low frequency range of a system. Although the total cost may be somewhat increased, it is sometimes more economical to use several relatively low cost speakers than a single more expensive one. These may be installed in a single cabinet with the desired result of extending the low frequency response more than might be achieved with a single unit of high cost. This practice will almost invariably increase the power handling capability of systems of comparable cost. It is also true that spatial distribution of the source within an extension of six to ten feet is considered pleasing by most listeners, even in relatively small rooms. Obviously, placing these speakers at different angles will improve the dispersion of high frequencies.

Where dual speakers are used to cover high and low frequency ranges respectively, it is usually desirable to use an electrical dividing network to channel each section of the spectrum to its corresponding speaker. It is sometimes possible to simplify this network with carefully selected speakers and permit the ranges to overlap considerably. In such instances it is only necessary to eliminate the very low frequencies from the high channel because of power handling considerations. However, the design of frequency dividing networks is relatively simple and the optimum arrangement is more easily achieved electrically than acoustically. The point of crossover may vary considerably, but commercial networks are generally designed to divide in the region between 500 and 1000 cycles-per-second.

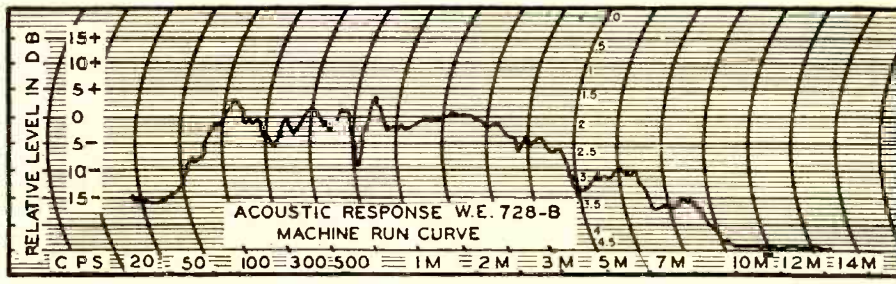


Fig. 6. Acoustic response curve for the Western Electric Model 728-B (Fig. 8, left).

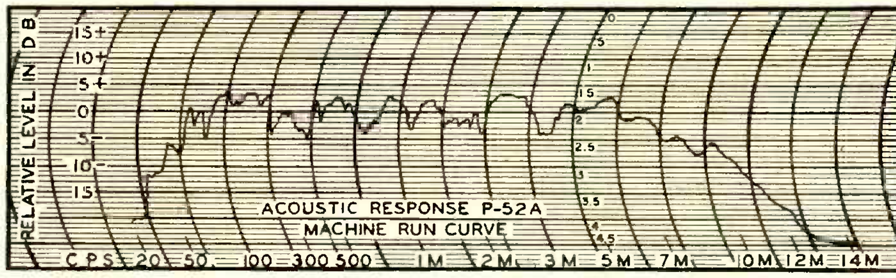


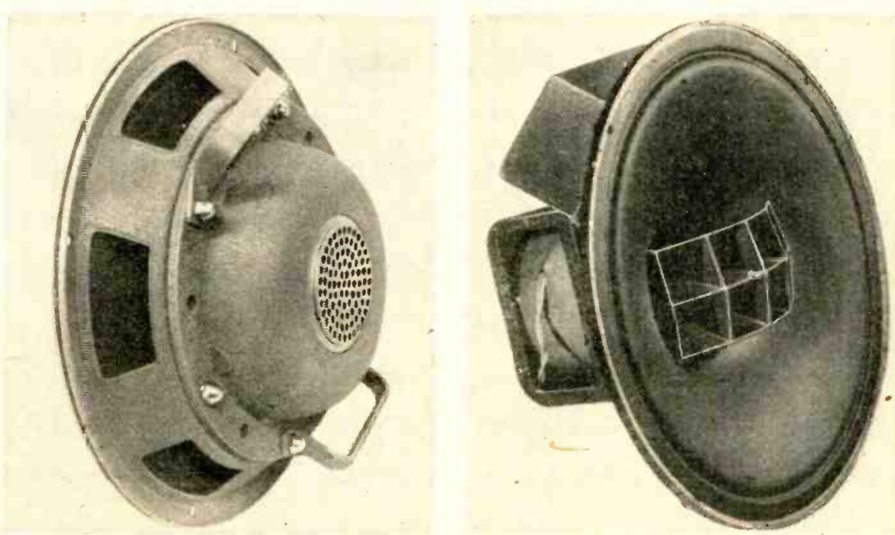
Fig. 7. Acoustic response curve for the Tru-Sonic Model P-52A shown in Fig. 8, right.

While large installations usually involve low frequency speakers fed into folded horns and high frequency driving units acoustically coupled through honeycombed projectors, the recent development of dual speakers for home installations or other moderate power requirements favors coaxial mounting of two units (Fig. 2). This arrangement is mechanically convenient but appears to contribute little to the acoustic properties of the system. However, it is of importance to note that dual speaker arrangements require the coordinated design of each unit in order to obtain optimum results. It is possible to improve the range of a single large diameter speaker with the addition of a high frequency speaker and suitable dividing network, but it is fallacious to assume that a small cone diameter implies good high frequency response. In the smaller units it is generally worthwhile to supplement the usual cabinet enclosure with shutters placed over the high frequency opening so as to improve the spatial distribution. One manufacturer uses a small coaxial mounted multicellular horn for the dispersion of high frequencies, even in relatively low power handling units (Fig. 3).

In connection with honeycomb horns, an interesting aspect of elliptically shaped speaker cones and rectangular horn mouths is often important. There is a widespread misconception regarding the angle of distribution achieved in terms of placement of the long axis. Actually the widest horizontal distribution angle is obtained when the long axis is placed vertically. Although this phenomenon is minimized by radial curvature of the horn mouths, the distribution may sometimes be improved

(Continued on page 143)

Fig. 8. (Left) The Western Electric Model 728-B speaker. (Right) The Tru-Sonic Model P-52A coaxial speaker. This small, two-way sound reproducing assembly allows a vertical sound distribution of 40 degrees and horizontal distribution of 80 degrees.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

BARNEY WALKS ON SAND

MAC'S eyes were glued to the rather drunken-looking "X" on the face of his oscilloscope as he made delicate adjustments of the secondary-trimmer of a discriminator transformer. Barney, his red-headed assistant, was busy removing a chassis from a console cabinet. Miss Perkins came to the door that separated the office from the shop and started to say:

"Mac, Mr. Bishop just called and said that he is leaving on a two-week vacation Sunday and that he would like to have you check over all of his radios while he is--is--E-e-e-e-e-k!"

As her voice sailed upward in a shriek, Miss Perkins' high heels beat a staccato retreat from the shop. Mac whirled around to see Barney, his face screwed up in such a look of distaste that the freckles were rubbing each other, holding out at arm's length a small and very dead — long dead — mouse.

"It was under the rectifier socket," he explained.

"Hm-m-m-m! That's a black mark against my diagnosing,' Mac admitted. "When the lady said her radio began to smell funny after it got warm, I guessed she had a power transformer going out. Well, you had better park Mr. Mouse outside; and better go out the back way, or Mac's Radio Service Shop will be needing another office girl."

Barney and the burnt offering disappeared through the alley door, and Miss Perkins ventured back inside the door.

"You surely find a lot of funny things in radios," Barney observed as he came back inside.

"Everything from bobby pins to poker chips," Mac agreed; "but you find few things worse for a radio than mice. If they nest in a set for long, they will damage it almost beyond repair. The tough part is that lots of customers do not like being told they have mice."

"How do you handle that one?"

"Well, if I know them well, I just tell them the truth; but I kind of take the edge off things by telling what a time *we* had getting rid of the little cusses at our house. If, on the other hand, I am doubtful about how they might take any mouse-talk, I simply install wire-mesh or cheese-cloth "dust-shields" on the back of the set. You have to be careful to get all the openings stopped, though, for it is amazing what a small crack a mouse can squeeze through."

Barney went to work on an a.c.-d.c. midget at his end of the bench, but he kept looking out of the corner of his eye at Mac's alignment of the FM receiver. "Say, Mac," he finally said.

"Uh huh," Mac grunted as he finally got the two lines to cross exactly in the center of the screen.

"When do I start learning how to use the scope?"

Mac laid aside his aligning screwdriver, backed up the intensity control of the oscilloscope, and bent a quizzical look on his helper.

"Do you think you are about ready to graduate from the multimeter?" he asked.

"Well," Barney replied, "there are lots of things you can't do with simple instruments. Take this set for instance. I'll be darned if I can puzzle out what is the matter with it, but I'll bet you could take the scope or the vacuum-tube voltmeter and spot the trouble in a minute."

"What's the complaint?"

Barney glanced at the job card, although he knew it by heart: "Set gets weak at night; volume fair during day," he read. "I figured the change in line voltage must have something to do with it, and I used the voltage-regulator to run the supply voltage up and down. At 105 volts, the 35Y4 rectifier puts out only fifty volts; but that goes up to over a hundred volts when the line voltage is set at 117."

"So far, swell! What was your next deduction, Sherlock?"

"It sounded like the 35Y4 was weak on emission; but when I tested it, the emission showed quite good, even when I cut the filament voltage down to tweny-five volts. In the set, though, there is a full thirty-five volts across the filament."

"A very baffling case indeed," Mac said with the grin-wrinkles deepening around his eyes. "Slide the line voltage down to 100 volts."

Barney adjusted the voltage regulator until the a.c. voltmeter showed exactly 100 volts. The set was barely audible.

"Now watch closely while I employ this very complicated service instrument," Mac said as he reached over and slipped the No. 47 pilot bulb from its bayonet socket. Immediately the volume came up with a rush.

"I'll be darned!" Barney said softly. "Why?"

"That 35Y4 has a tapped filament with the pilot lamp shunting a portion of it. The emission of the cathode heated by the untapped portion is low; but the emission of that part heated by the shunted portion is still good. In the checker, the whole heater and cathode are uniformly heated, and the good portion of the cathode gives you a high reading. In the set, the pilot lamp shunt lowers the temperature of this good portion and causes the output voltage to drop. A new tube is the remedy."

"I was not kidding, Barney, when I said I was using a 'very complicated service instrument' on that set. The best piece of service equipment any man can have is a good sound knowledge of radio theory coupled with the ability to reason in a straight line from some observed effects back to a cause. All any service instrument does is to collect information for the brain to work on. With simple instruments, the brain has to work a little harder, for it does not have such plain clues to study; but that is exactly what we want to teach you to do; to use your head."

"You mean that I will be a better serviceman for sticking with the signal generator and the multimeter for a while longer?"

"That is right. Remember in geometry that you could not use anything but a compass and a straight-edge? You really had to beat your brains to construct some angles, when you could have constructed them in a few seconds if you had been allowed to use a protractor. But the practice you got in logical reasoning made all the math that came after that much easier. It is the same way in radio servicing."

"Why use complicated instruments at all, then?"

(Continued on page 134)

A Single Sideband Selector for Ham Use

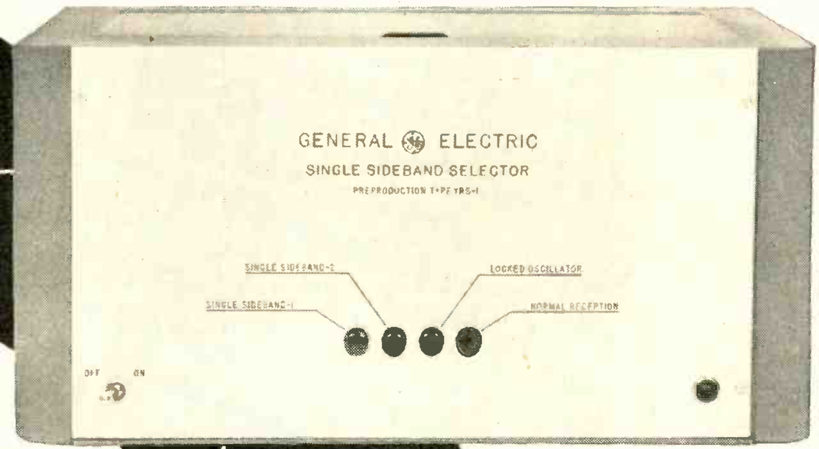


Fig. 1. General Electric's Model YRS-1 Single Sideband Selector which can be connected to any communications set.

By
JACK NAJORK, W2HNH
Spec. Div., General Electric Co.

Amateurs and DX-ers can now enjoy the advantages of SSB reception without using complex equipment.

Although single sideband transmission and reception systems have been used for years by commercial stations, the complex equipment required for the successful operation of such systems has discouraged amateurs from adapting these methods of communication for use in amateur bands. Commercial single sideband receivers, for example, often occupy six-foot relay racks which abound with complicated and expensive filter networks, phase shifters, and crystal controlled heterodyning oscillators. Small wonder, then, that amateurs have evinced little interest in single sideband systems.

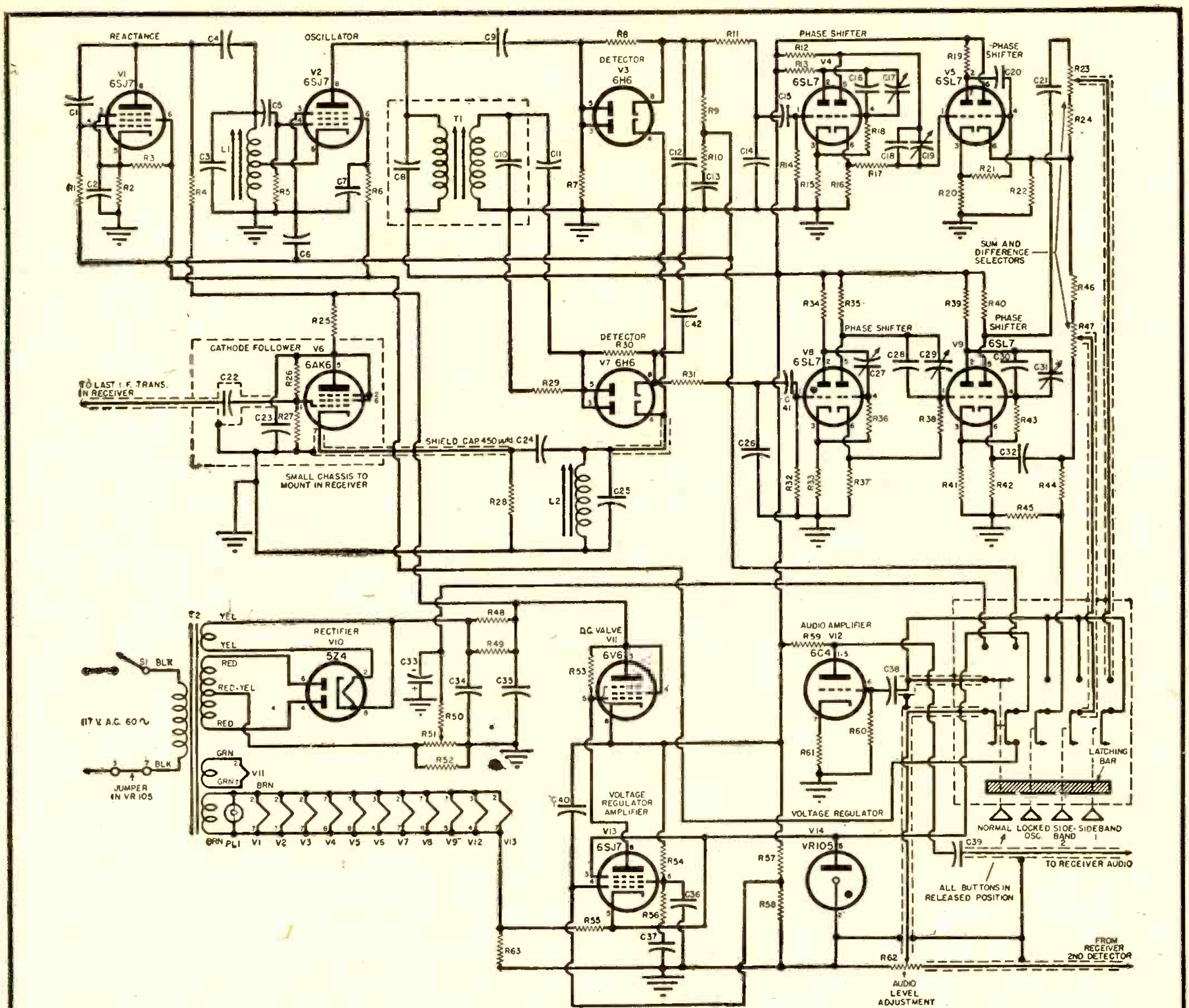
A recently developed, simplified method of selective single sideband reception which requires no critical filter networks, crystals, or other specialized components now promises to change this entire picture and it is not unlikely that in the near future you will be hearing the amateur at the other end saying, "Your upper sideband is covered with QRM but I am reading your lower sideband perfectly."!

This new system of selective single sideband reception (abbreviated SSB) is the outgrowth of extensive development work by D. E. Norgaard, W2KUJ, of the *General Electric* Research Laboratory. The Norgaard system has been adapted to amateur use and the first Single Sideband Selectors are now being produced commercially (see Fig. 1) in the form of a compact adapter unit which can be readily connected to almost any type of communications receiver. These adapters (Type YRS-1) when properly connected and aligned to a communications receiver having an i.f. of approximately 455 kc., permit single sideband reception of conventional amplitude modulated and unmodulated (c.w.) signals, as well as single sideband transmissions. Either sideband can be accepted or rejected to cope with existing interference conditions, this selection being made manually by means of push-buttons which are centrally located on the front panel of the unit. The YRS-1 can also be used for carrier-reinforced double sideband reception, a condition which reduces distortion caused by selective fading. A fourth operating condition permits the receiving equipment to function in the normal manner. Once connected and aligned, the YRS-1 requires no further attention or tuning other than the selection of the desired mode of operation which is simply a matter of pushing the proper button. No additional power is drawn from the receiving equipment to which the YRS-1 is connected. See Fig. 2 for a schematic of the YRS-1.

Although rejection of an undesired sideband range is accomplished by a system which provides the effect of extreme selectivity, *the quality of modulation contained in the accepted sideband is not impaired in any manner* and is generally restricted only by the i.f. passband of the particular receiver in use. This is because the audio frequency response of the YRS-1 is in excess of 70 to 7000 cycles-per-second, whereas the over-all frequency response of the average communications receiver falls off rapidly above approximately 5000 cycles-per-second due to sideband cutting in the i.f. amplifiers. Superior fidelity is therefore attained in one sideband as compared with normal crystal selectivity utilizing both sidebands. The net result is greatly improved intelligibility without sacrifice of selectivity.

Single sideband reception will also be a boon to the serious shortwave listener who has, in the past, been plagued by serious distortion introduced by selective fading conditions. With SSB reception, the entertainment value of high frequency broadcast stations is limited almost solely by the program material because audio distortion associated with selective fading is not present. The effect of selective fading under SSB reception conditions is that of altering the shape of the audio passband, but no harmonic distortion can occur. The fading, as such, is just as pronounced in one sideband as in the other, but the method of reception does not allow the sidebands to "fight" one another and cause the type of distortion generally associated with conventional double-sideband reception.

To illustrate the operation of the YRS-1, consider an amplitude modulated signal as shown in simple form in Fig. 4A. The modulation process creates two sidebands, *A* and *B*, which are symmetrically located on either side of the carrier and which represent the modulating component. If an interfering carrier of almost the same frequency is superimposed as shown in Fig. 4B, the result will be a heterodyne whose fre-



R_1, R_{25}—470 ohm, 1/2 w. res.
R_2—820 ohm, 1/2 w. res.
R_3—33,000 ohm, 1/2 w. res.
R_4, R_5, R_{27}, R_{55}, R_{63}—100,000 ohm, 1/2 w. res.
R_6—4700 ohm, 1/2 w. res.
R_7, R_8, R_{24}, R_{26}, R_{29}, R_{30}, R_{46}—220,000, 1/2 w. res.
R_9, R_{60}—1 megohm, 1/2 w. res.
R_{10}—39,000 ohm, 1/2 w. res.
R_{11}, R_{31}—47,000 ohm, 1/2 w. res.
R_{12}, R_{16}, R_{35}, R_{37}—2000 ohm, 1 w. res. ± 1%
R_{13}, R_{15}, R_{33}, R_{34}—1000 ohm, 1 w. res. ± 1%
R_{14}, R_{32}—2.2 megohm, 1/2 w. res.
R_{17}—82,000 ohm, 1 w. res. ± 1%
R_{18}, R_{36}—51,000 ohm, 1/2 w. res.
R_{19}, R_{20}, R_{39}, R_{41}—3000 ohm, 1 w. res. ± 1%
R_{21}—560,000 ohm, 1 w. ± 1%
R_{22}, R_{40}, R_{42}, R_{54}—3900 ohm, 1/2 w. res.
R_{23}, R_{47}, R_{62}—500,000 ohm pot.
R_{28}—10,000 ohm, 1/2 w. res.
R_{38}—100,000 ohm, 1 w. res. ± 1%
R_{43}—470,000 ohm, 1 w. res. ± 1%
R_{44}—390,000 ohm, 1/2 w. res.
R_{45}, R_{58}—470,000 ohm, 1/2 w. res.
R_{48}, R_{49}—2200 ohm, 10 w. wirewound res.
R_{50}—39,000 ohm, 2 w. res.
R_{51}—150 ohm wirewound pot.
R_{52}—100 ohm, 2 w. res.
R_{53}—150,000 ohm, 1/2 w. res.
R_{56}—3300 ohm, 1/2 w. res.
R_{57}—330,000 ohm, 2 w. res.
R_{59}—22,000 ohm, 1/2 w. res.
R_{61}—1800 ohm, 1/2 w. res.
C_1—5 mmfd. ceramic cond.
C_2, C_6, C_{40}—.1 mfd., 400 v. paper cond.
C_3—15 mmfd. ceramic cond.
C_4—.001 mfd. mica cond.
C_5—100 mmfd. mica cond.
C_7, C_{23}, C_{24}, C_{36}, C_{37}, C_{38}, C_{39}—.01 mfd., 400 v. paper cond.
C_8, C_{10}—Part of T_1
C_9, C_{11}, C_{22}—50 mmfd. mica cond.
C_{12}, C_{14}, C_{26}, C_{42}—200 mmfd. mica cond.
C_{13}—1 mfd., 400 v. cond.
C_{15}, C_{21}, C_{32}, C_{41}—.05 mfd., 400 v. cond.
C_{16}—680 mmfd. mica cond.
C_{17}, C_{27}, C_{29}—100-590 mmfd. compression mica padder
C_{18}—.0043 mfd. mica cond.
C_{19}, C_{31}—600-1350 mmfd. compression mica padder
C_{20}—.01 mfd. mica cond.
C_{25}, C_{30}—.002 mfd. mica cond.
C_{28}—.0011 mfd. mica cond.
C_{33}—10 mfd., 150 v. elec. cond.
C_{34}, C_{35}—15/15 mfd., 450 v. elec. cond.
L_1—2.5 millihenry tapped iron core inductance
L_2—50 microhenry iron core inductance
T_1—455 kc. i.f. transformer (Special)
T_2—Power trans. 290-0-290 v. a.c. at 90 milliamperes; 5 v. at 2 amps.; 6.3 v. at .45 amp.; 6.3 v. at 3.5 amps.
PL_1—6.3 v. pilot light

Fig. 2. Circuit diagram of the YRS-1 adapter unit which permits single sideband reception on most communications receivers.

quency will be equal to the frequency difference of the two carriers. Normally, if the amplitudes of the two carriers are approximately equal, the resulting heterodyne will be of sufficient amplitude to partially or completely mask the intelligence contained in *both* sidebands of the desired carrier because conventional communications receivers cannot discriminate between the two carriers and may demodulate sidebands *A* and *B* against the interfering carrier. This is illustrated in Fig. 4C where a typical selectivity curve has been imposed on the heterodyned signal of Fig. 4B. Observe that the curve is sufficiently broad to encompass both sidebands. Even if the receiver is tuned slightly off the carrier in an attempt to discriminate against the heterodyne, the flaring of the skirts of the curve indicates that an appreciable portion of the heterodyne will be passed.

If the receiver possessed an extremely sharp, essentially straightsided response curve as shown in Fig. 4D, fairly good separation of the sidebands would be possible. Such selectivity, while desirable from the standpoint of communications, might seriously restrict the audio fidelity, because the higher and lower audio frequencies would be clipped off along with the heterodyne. This is the reason signals lose intelligibility when the crystal filter is switched into the i.f. amplifier of a communications receiver.

The YRS-1 Single Sideband Selector combines the advantages of the broad response curve for audio fidelity and the sharp response curve for selectivity, without the disadvantages of either.

Amplitude	Freq.	Input Phase	Output Phase
	Network A		
1 unit	M c.p.s.	0°	0° + X°
	Network B		
1 unit	M c.p.s.	+ 90°	90° + (X-90) = 0° + X°

Table 1

	Freq.	Input Phase	Output Phase
Network A	M c.p.s.	0° + X°	1 unit
Network B	M c.p.s.	0° + X°	1 unit
Sum	M c.p.s.	X°	2 units
Difference	M c.p.s.	....	0 units

Table 2

Amplitude	Freq.	Input Phase	Output Phase
	Network A		
1 unit	M c.p.s.	0°	0° + X°
	Network B		
1 unit	M c.p.s.	−90°	-90° + (X-90) = * X° -180°

* Is equal to a negative signal of phase X deg.

Table 3

	Freq.	Input Phase	Output Phase
Network A	M c.p.s.	0° + X°	1 unit
Network B	M c.p.s.	X°	-1 unit
Sum	M c.p.s.	....	0 units
Difference	M c.p.s.	X°	2 units

Table 4

This is accomplished by special detector circuits which split the received signal into two components, which, when shifted in phase and added or subtracted, reject undesired interference in one sideband or the other. This makes possible the reception of signals which normally would be unreadable because of heterodyne interference.

A detailed analysis of the theory of operation of the YRS-1 is beyond the scope of this article, but the following simplified explanation will give the reader an understanding of the basic principles involved and will pave the way to a better understanding of theoretical papers which will no doubt be presented in the future.

If a carrier frequency, F, is amplitude modulated by a single audio frequency, M, an upper and a lower sideband will be produced. These two sideband frequencies are $(F+M)$ for the upper sideband, and $(F\text{-}M)$ for the lower sideband. The conventional AM receiver, of course, incorporates a detector which, when delivering such a signal, demodulates it to restore the original intelligence frequency M. In so doing, both sidebands are utilized and necessary. The YRS-1 likewise incorporates a detector, but in this case of novel design, which when used in conjunction with phase shift networks, results in a system capable of reproducing *separately* the intelligence in the upper sideband and the intelligence in the lower sideband.

Fig. 6 shows in block form the circuit arrangement of the YRS-1 upon which the following explanation is based. Two detectors are shown. Each is supplied with the amplitude modulated i.f. output of the receiver, and each receives a strong signal from the locked oscillator shown as source 2. However, the phase of the locked oscillator voltage fed to detector 2 differs by 90 degrees from that fed to detector 1. Because of this, the demodulated outputs from these detectors differ in phase by 90 degrees. Assume now that network A introduces a phase shift of X degrees and that the phase shift in network B is smaller by 90 degrees. Thus, considering the $(F\text{-}M)$ sideband only, and assuming the amplitude to be 1 volt, the output from the two networks can be tabulated as shown in Table 1.

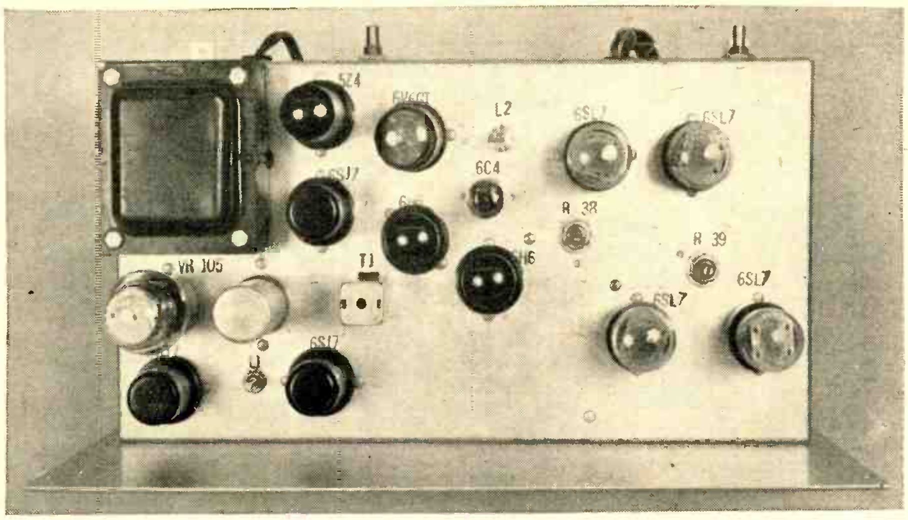


Fig. 3. Top chassis view of the YRS-1 with components properly identified.

When the outputs of networks A and B are added or subtracted, the mixed signals combine as indicated in Table 2. Thus, the audio output for a radio frequency signal $(F\text{-}M)$ will be M cycles-per-second with a phase delay of X degrees and a strength of 2 units when the *sum* is taken, and will be zero amplitude when the *difference* is taken.

The same treatment, with minor variations, can be applied when only the upper sideband $(F+M)$ is present. Whereas in the previous case, for the lower sideband, the demodulated output from detector 2 led that from detector 1 by 90 degrees, in this case it *lags* by 90 degrees. Hence, the summation of Table 3 applies to the output for the two networks.

When the output of networks A and B are added and subtracted, the mixed signals combine as indicated in Table 4. This time, the audio output for a radio frequency signal $(F+M)$ will be *zero* when the sum is taken, and will be M cycles-per-second with a phase delay of X degrees and a strength of 2 units

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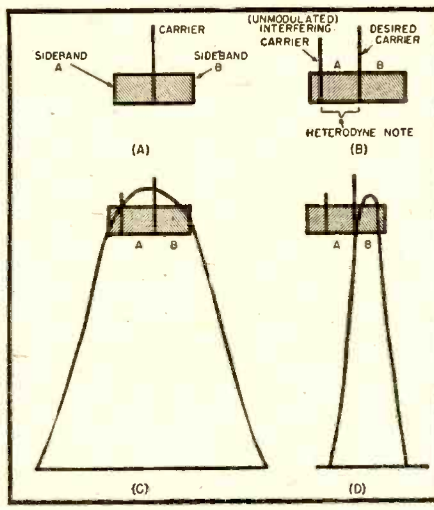


Fig. 4. (A) Simple amplitude modulated signal. (B) With interfering carrier of almost same frequency superimposed. (C) Typical selectivity curve superimposed on the heterodyned signal of B. (D) Sharp essentially straight-sided response curve.

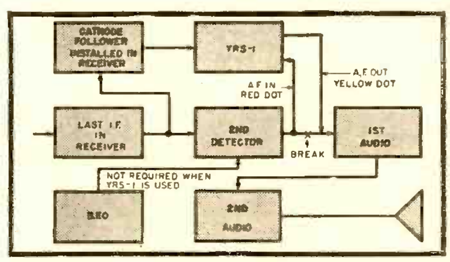
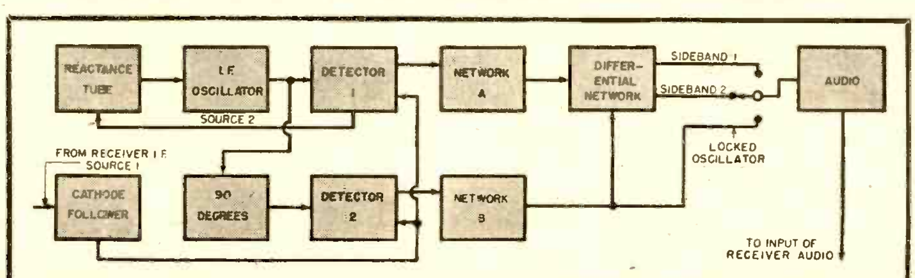


Fig. 5. Block diagram showing how YRS-1 functions as a complete second detector and beat frequency oscillator unit.

Fig. 6. Block diagram of the circuit arrangement of the YRS-1 SSB selector.



FM DETECTORS

By M. S. KAY

A discussion of the two types of FM detectors found most frequently in present-day video and FM receivers—the Foster-Seeley discriminator and the ratio detector.

PERHAPS the least understood section of an FM receiver is its detector and yet this is the most important stage, for much of the noise reducing qualities of FM depend upon the proper functioning here. Most radiomen, by now, are fairly familiar with the basic differences between AM and FM and can trace the signal path through an FM receiver to its second detector where the conversion of the signal to its audio equivalent occurs. The processes of amplification and frequency conversion that occur in a superheterodyne prior to the second detector are exactly similar for AM and FM signals.

In an AM second detector, the amplitude variations of the carrier are "skimmed" off, the i.f. removed, and what remains is the desired audio signal. With FM signals, the intelligence or modulation is contained in the instantaneous frequency variations and in order to derive the original audio signal, we must somehow convert these frequency variations into their equivalent audio variations. This, then, is the purpose of an FM detector—of any type. If we were to draw the desired response curve for such a detector, it would look like the curve of Fig. 1. Each frequency variation produces a certain audio output and the relationship between the two is linear. In this way, distortionless conversion is achieved.

In current television receivers, we find two types of FM detectors. The older of the two is the Foster-Seeley circuit; the more recent one is the ratio detector. Both are used extensively and both should be well understood by the serviceman. For purposes of explanation, an earlier form of discriminator known as the Travis discriminator will be examined briefly. While not in use today, it is useful in explaining the operation of both the Foster-Seeley and ratio detector. Its circuit is shown in Fig. 2.

The transformer coupling between the stage preceding the FM detector and the detector itself consists of a primary winding and two secondary windings. Each tuned circuit is peaked to a slightly different frequency. L_1 and C_1 are peaked to the i.f. carrier value, say 21.25 mc. It is made broad enough to pass between 200-300 kc. with almost uniform response. For an FM signal, such as used in television receivers, the bandpass need only be 50 kc. However, to minimize variations in oscillator frequency, the above bandpass is designed.

L_2 and C_2, the top secondary circuit, are peaked to a frequency approximately 75 to 100 kc. below the carrier i.f. value; on the other hand L_3 and C_3 are peaked to a frequency the same number of kilocycles above the carrier i.f. Actually it makes little difference which circuit is above or below, provided both are not peaked to the same value. The response of each secondary circuit is shown in Fig. 3A.

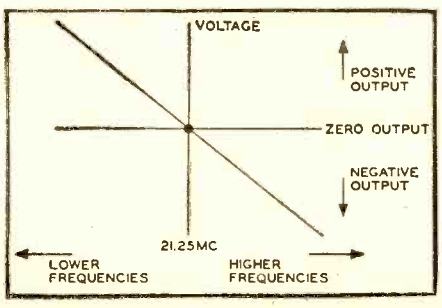
Each secondary circuit is an AM detector circuit in itself, complete with diode rectifier and load resistor. The resistors are placed end to end, as shown in Fig. 2, with the result that the output voltage is actually the difference voltage of the two.

The operation of this circuit in detecting FM signals can now be readily understood. When the incoming signal is at the center i.f., the voltage developed in each secondary winding will be the same. This is shown in Fig. 3B. Since each tube receives the same voltage, equal currents will flow producing equal voltages across R_1 and R_2. The total output, however, is zero because of the back-to-back placement of the load resistors. This is as it should be, for when the signal is at the carrier i.f. value, it contains no modulation and no audio output should be obtained.

Suppose now that the modulation is applied and the carrier shifts to a frequency above the center i.f. The voltage across L_3, C_3 will be greater than that developed across L_2,C_2 because the signal frequency is now closer to the resonant peak of L_3 and C_3. Hence, while some voltage may be present across R_1 to cancel part of the voltage at R_2, there will be considerable voltage remaining across R_2 and this will appear across terminals A and B. As the frequency of the carrier shifts back and forth, due to the modulation, the output (at A-B) will rise and fall, through positive and negative values, and the frequency variations will be converted into the corresponding audio variations.

Since the output voltage represents the difference between the potentials developed across R_1 and R_2, both curves can be combined into one resultant curve. This is done in Fig. 3C. If properly designed, the response curve will be linear throughout the operating range X to Y and no distortion will be introduced in the conversion of FM to audio voltages. C_4 and C_5 bypass the i.f. currents around R_1 and R_2.

Fig. 1. The desired characteristic for all frequency-modulation detectors.



Foster-Seeley Discriminator. The Foster-Seeley discriminator, in which the secondary circuit is reduced to one winding, might be considered a refinement of the Travis circuit. Some (but not all) of the steps in the transition are indicated in Fig. 6 and from these the reader can perhaps gain a better understanding of the close relationship between the two circuits. In the secondary tuning circuit, the two coils have been reduced to one unit possessing a center-tap. In addition, only a single tuning condenser is placed across the coil. The final step, which includes the addition of a small fixed condenser, C_3, and an r.f. choke, L_4, is shown in Fig. 4. This is the Foster-Seeley FM detector. Bear in mind, however, that in spite of these changes, the secondary tuning circuit must still accomplish what it did in the previous circuit, namely, to apply to each diode voltages which vary linearly with frequency. Once the operation of this altered secondary tuner is understood, this detector will fall into the same category as the Travis circuit and its operation will follow the same pattern. The placement of the two diodes and their load resistors remain substantially the same.

Coil L_1 is linked magnetically to the secondary. We designate the top half of the secondary as L_2 and the bottom half as L_3 because their effects on V_1 and V_2 differ. This will become evident as we proceed. Thus, L_1 induces a voltage into the secondary which, to the secondary coil and condenser, looks like a series voltage. See Fig. 5A. The voltage, labeled E_{in}, has a complete path through the secondary coil and C_2 and, consequently, current will flow. The impedance offered the current will depend upon the frequency of the induced voltage. If the resonant frequency of the circuit is the same as the frequency of the incoming signal, the series impedance of the circuit will be low because the inductive and capacitive reactances will completely cancel each other, leaving only the incidental resistance in the coil and circuit wiring. Hence, the secondary current I_s will be in phase with the induced voltage E_{in} at this frequency.

Note that we still do not know the voltage across the secondary coil. E_{in} is the voltage induced in the secondary winding and it is the voltage which causes the secondary current to flow. *But it is not* the voltage across L_2,L_3. To determine this, we note first that I_s is in phase with E_s. This is shown vectorially in Fig. 5B. When I_s flows through L_2, L_3, the voltage developed across each coil section will be 90° ahead of the current. This is true of the voltage and current relationship for any inductance. Hence, to the vector diagram of Fig. 5B, add E_s for the coil, leading E_{in} by 90°. The result is indicated in Fig. 7A.

The next step is to determine the phase relationship between E_s and E_1, the primary voltage. The induced voltage E_{in} is 180° out-of-phase with the primary voltage E_1. This is true because E_{in} is in the same position as the back e.m.f. of E_1, having been produced by the primary lines of force. When E_1 is added to the vector diagram of Fig. 7A, we derive the vector relationship of Fig. 7B. Now it can be seen that E_1 and E_s are 90° out-of-phase. This is the relationship we were seeking. Keep it in mind.

In the circuit of Fig. 4, C_3 connects from the top of L_1 to L_4. The opposite end of L_4 connects through C_5 to ground, thereby completing the circuit. Since C_3 and C_5 offer negligible opposition to the i.f. signal currents flowing through L_1, whatever voltage appears across L_1 is also placed across L_4. The two are in parallel. V_1, then, receives the voltage across L_2 (let us call this E_2) and the voltage across L_4 (label this E_{L4}.) V_2 receives E_3 and E_{L4}. If this circuit is to function in a manner similar to the Travis discriminator, then these combinations of voltages (E_2 and E_{L4}, and E_3 and E_{L4}) must vary with frequency. As the signal frequency changes, the voltages applied to each tube should vary, thereby producing results similar to those of the Travis circuit.

To indicate how these voltages vary, let us investigate circuit conditions when the incoming signal is at the carrier i.f. value. At that time, as indicated previously, E_1 and E_s are 90° out-of-phase with each other. Since E_1 and E_{L4} are the same, let us add E_{L4} to E_2 and also to E_3. Fig. 8A illustrates E_{L4} and E_2; Fig. 8B has E_{L4} and E_3. The resultant of each pair, E_{V1} and E_{V2}, are both equal in length, which means that V_1 and V_2 receive equal voltages and therefore develop equal voltages E_{R1} and E_{R2}. Being back-to-back, E_{R1} cancels E_{R2} and the net output voltage is zero.

This is identical to the Travis circuit. E_2 and E_3 are combined in opposite directions with E_{L4} because of the center-tap on the secondary winding.

When the signal varies from the carrier i.f., a 90° phase relationship no longer exists between primary and secondary. Fig. 8C and 8D indicate what happens when the signal frequency drops below the carrier value. V_1, in this instance, receives more voltage than V_2 thereby producing a greater output across R_1. For frequencies above the

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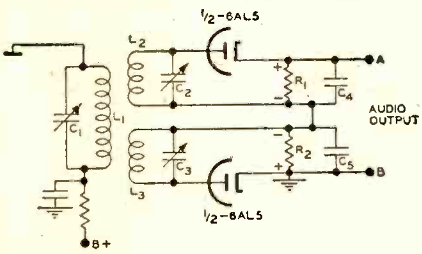


Fig. 2. The Travis FM discriminator.

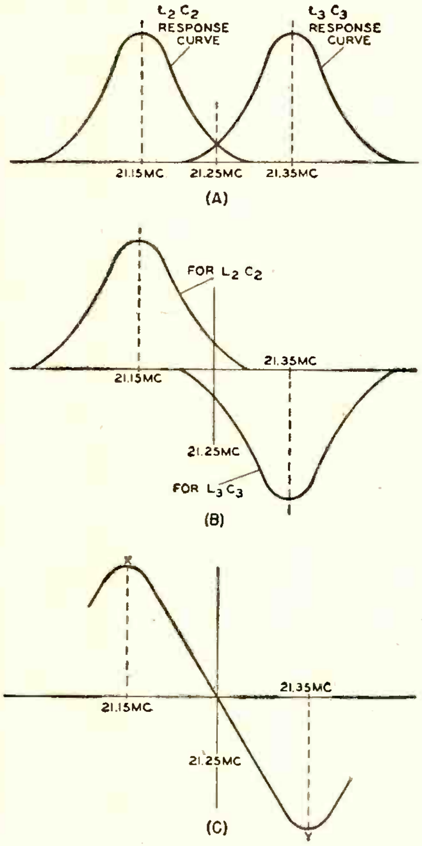


Fig. 3. (A) The individual response curves of each secondary winding. (B) The curves placed according to output polarity. (C) The combined response of the two curves.

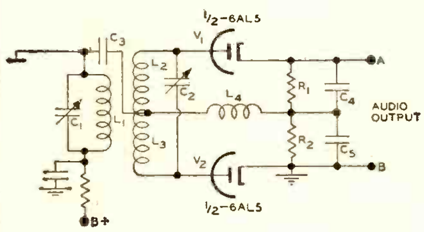


Fig. 4. The Foster-Seeley FM detector.

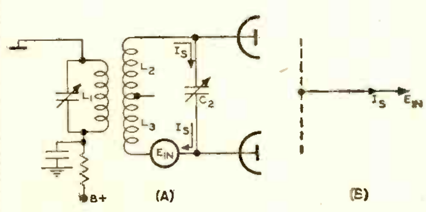


Fig. 5. (A) The voltage which is induced in the secondary winding acts as though it were in series with this secondary. (B) The phase relationship between E_{in} and I_s as it appears at circuit resonance.

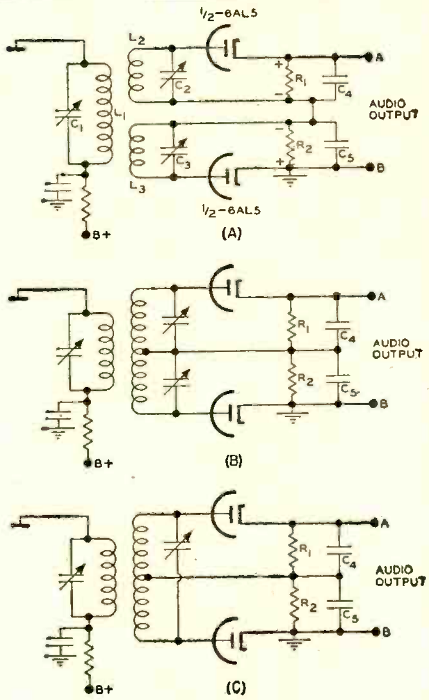


Fig. 6. Some (but not all) of the changes which the Travis circuit must undergo to become a Foster-Seeley type of detector.

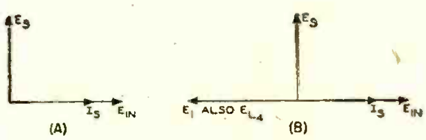


Fig. 7. Phase relationships between the primary and secondary windings of the discriminator transformer of Fig 4.

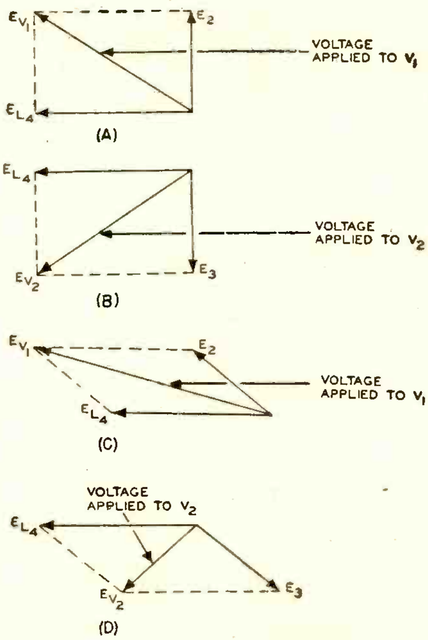


Fig. 8. The various voltage relationships in the secondary circuit of the Foster-Seeley frequency-modulation detector.

AN ELECTRONIC PHOTO TIMER

By E. BRUCE PRAY
Eng., Sylvania Electric Products Inc.

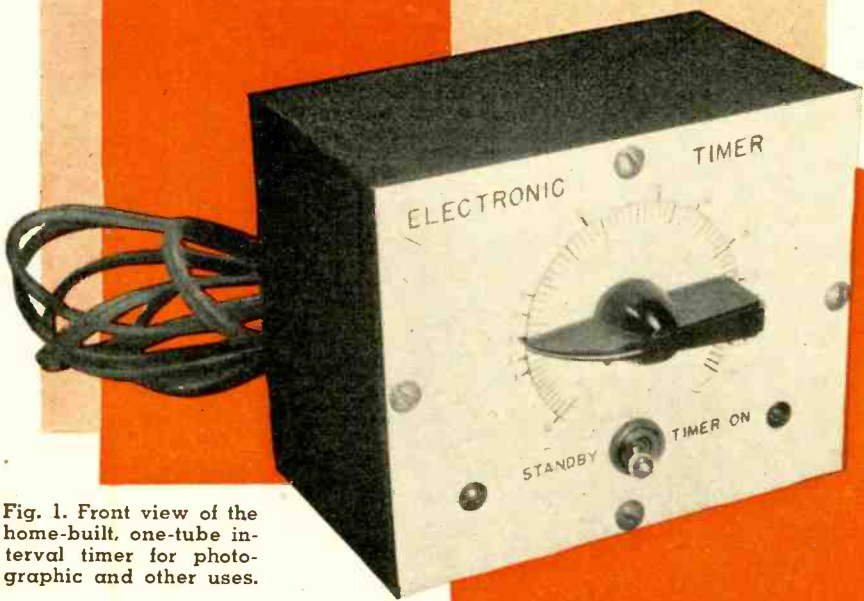


Fig. 1. Front view of the home-built, one-tube interval timer for photographic and other uses.

Construction details for building a simple, one-tube interval timer covering periods from 1 to 60 seconds.

AN interval timer for use around the workshop, hobby-room, or dark-room need not be a large cumbersome device nor an extremely expensive piece of apparatus. A sturdy, one tube, compact interval timer is described herein which meets all the requirements as to small size, low cost, and dependable operation.

The number of operating controls has been limited to a minimum of two which are located on the front panel. The time interval selector covers time intervals from one second to sixty seconds and is adjusted by means of a continuously variable control. The dial, which is hand-drawn and calibrated, is sufficiently large to allow for ease of reading under difficult conditions such as might be experienced in a photographic darkroom. The only other control on the front panel is the standby switch, of the toggle variety, which is used for starting or stopping the timing cycle.

Devices which are to be controlled by the timing circuit are connected to the relay contacts by means of the two-prong receptacle located on the rear panel. The contact arrangement chosen will depend upon the requirements of the device to be controlled and may be either normally open or normally closed. Those radiomen who are also photographers will find the small size and light weight of this unit acceptable for direct mounting to the enlarger or the printer by means of a suitable bracket.

Fig. 4 shows the chassis layout with the midget thyratron cushioned between the capacitance in the rear, the filament transformer on the right, the potentiometer in front, and the relay on the left.

The chassis measures 2¾ by 3-3/32 by 13/16 inches and is constructed from sheet aluminum which is one of the finer materials when it comes to workability. Other types of metal may be used equally well. However, extreme care should be exercised with the harder types of metals in removing the burrs which develop when drilling.

The metallic rectifier is mounted on the under side of the chassis directly beneath the filament transformer by means of a flat-head machine screw. The hole for this machine screw should be countersunk on the top side to allow the screw to set flush with the chassis. In this manner the transformer can be mounted on the top-side of the chassis directly above the rectifier with no loss of space.

It is well to mention at this point that a hole should be drilled directly beneath the wiring contacts of all the components located on the top of the chassis to which a wire is to be attached. In this way, unsightly wiring strewn on top of the chassis will be avoided and all major wiring will be carried on beneath the chassis.

The standby switch, of the toggle variety, is located below deck with the operating shaft protruding through the front panel directly under the potentiometer shaft. The fuse holder which accomodates a 3AG type of fuse is also located on the under-side of the chassis directly beneath the relay.

The four resistors and the electrolytic condenser fit readily into the remaining available space and should present no problem (Fig. 3). The author used two resistors for R_3 accounting for the extra resistor observed in Fig. 3.

The electrical circuit consists of a miniature thyratron connected in such a way that the entire anode current is directed through the relay coil when the tube is ionized by the application of the proper grid potential. It is this tube current which activates the relay and produces the desired control of the a.c. output.

The relay chosen for this unit has the conventional single-pole, double-throw contact arrangement allowing for either type of operation. For photographic purposes, normally closed contacts should be used in order that the circuit be opened when the tube is ionized after the desired time delay.

The grid circuit, which contains the time delay components, is tied to the cathode by means of the *RC* network (R_3-C_1) and the 10,000 ohm wire-wound potentiometer (R_2). This potentiometer, which is connected in series with the 13,000 ohm resistor (R_1), should be a linear control and a *Centralab* type VF 137 or BF 108 is recommended for use in this circuit. Controls having more taper than that found in the type BF 108, should not be used if crowding at the extreme ends is to be avoided.

It should be noted that the value of the *RC* network remains fixed and the actual time delay is accomplished by means of the potentiometer which preselects the desired voltage level. When the timing switch (S_2) is closed the negative voltage present on the grid, as a result of the setting of the control (R_2), now begins to decay at a rate determined by the values of the *RC* network. When this negative voltage, which is sufficient to keep the tube from firing, decreases to the optimum value the tube will ionize. This control (R_2)

should be connected in such a way that complete clockwise rotation results in maximum time delay.

The rectifier is the dry-disc type, being a *Sylvania* type selenium unit, which is very compact, measuring only 1⅜" in diameter by 13/16" thick. This type of rectifier, besides being of small size, has no filament to heat, resulting in economical operation and a definite saving of space.

The resistor (R_5) acts as a bleeder for the power supply while the condenser (C_2) is the only filter necessary.

It can easily be seen from the schematic diagram (Fig. 2) that switch (S_2) in its "off" position is actually standing-by. When closed, it supplies one side of the a.c. line to the outlet located on the rear panel as well as completing the tube circuit by making connection to the cathode. Switch (S_1) is the line switch and is located on the potentiometer (R_2).

In order to design this unit in such compact form great care was exercised in the selection of the individual components. Besides the selenium rectifier and the miniature thyratron, we have selected a Type LS5 *Potter and Brumfield* relay, measuring only 2⅝ by 1⅜ by 1⅜ inches and containing twenty-five hundred ohms coil resistance which is ideal for inserting in the plate circuit of the thyratron. The condenser is a *Tobe* Type OM-601 of the oil-filled class and measuring 1⅜ by ⅝ by 2-5/16 inches. The other unit is a *Stancor* Type P6134 filament transformer which is rated at 6.3 volts at 1.2 amperes and measures 1⅝ by 2-13/16 by 1½ inches.

As soon as all parts have been properly positioned and permanently secured, the actual wiring may be started. No particular caution need be exercised in wiring the unit except the need for using short, direct, mechanically secure, and well-soldered connections.

Connections between the a.c. line and the selenium rectifier should be made by means of the 100 ohm resistor (R_4) to the unidentified terminal of the rectifier. The other terminal of the rectifier, marked "Cath," is the terminal which will furnish the positive d.c. output for the operation of the timing circuit.

After the wiring is finished it is advisable to pretest the circuit before inserting the thyratron. This is a precaution against damaging the tube, and the only instrument required is a volt-ohm-milliammeter.

Those readers interested in a more detailed discussion of the use of a volt-ohm-milliammeter than is covered in this article, are referred to the book "Radio Test Instruments" by R. P. Turner. This publication covers, very thoroughly, the construction, calibration, and operation of practically any type of test instrument.

To test the unit, proceed by first testing the a.c. potential present at the filament terminals of the tube socket. Select the required a.c. range of the test instrument and connect the test leads to pins 3 and 4 of the socket, and turn on the line switch (S_1). The voltage at these pins should be between 5.7 and 6.9 volts and there should be no voltage reading between the chassis and either one of the two filament connections.

Next, select a higher a.c. range on the instrument and transfer the test leads to the terminals of the timer outlet. The voltage present at these terminals should be equal to the incoming line voltage when both switches and the relay contacts are closed.

Next, switch over to the ohmmeter circuit and check for continuity between the chassis and various points in the circuit. As will be noted in the schematic diagram, the entire circuit is isolated from the chassis to avoid the danger of shock to the operator, and there should be absolutely no continuity between the chassis and any points of the circuit.

After we have assured ourselves that there is no direct connection to the chassis, transfer the test leads to the cathode terminals of the selenium rectifier and the cathode of the tube. With both switches in their "off" positions the resistance between the two cathodes should be equal to the resistance of R_5. Should it be much lower than the specified 10,000 ohms, the condenser C_2 should be tested for leakage.

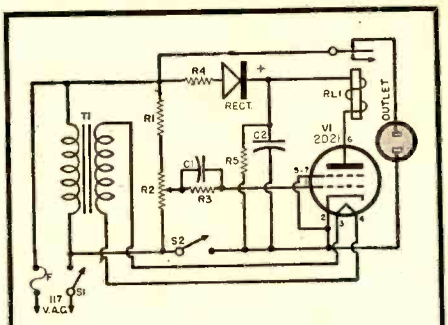
Our next point of operation should be across the *RC* network (R_3, C_1) which should indicate a resistance close to the required 15 megohms, otherwise leakage through C_1 is present.

This completes the initial testing and if all preceding measurements have been within the specified values our efforts can now be transferred to actual voltage measurements under operating conditions.

The internal resistance of the voltmeter used should be fairly high, with a minimum resistance of 1000 ohms-per-volt. All d.c. voltage measurements are to be taken with the negative test lead connected to the cathode connection of the thyratron.

Insert the tube in its socket, turn on the line switch (S_1) and allow the tube filament to warm up for at least one

(*Continued on page 124*)



R1—13,000 *ohm, 1 w. res.*
R2—10,000 *ohm, wirewound pot. (See text)*
R3—15 *megohm, 1 w. res.*
R4—100 *ohm, 1 w. res.*
R5—10,000 *ohm, 1 w. res.*
C1—1 *mfd., 600 v. oil-filled cond.*
C2—20 *mfd., 150 v. elec. cond.*
S1—*S.p.s.t. sw. (on R2)*
S2—*S.p.s.t. toggle sw.*
T1—*6.3 volt fil. trans. (See text)*
RL1—*Relay (See text)*
Rect.—*100 milliampere selenium rectifier*
F—*1 ampere, 3AG fuse*
V1—*2D21 thyratron*

Fig. 2. Circuit diagram of photo timer.

Fig. 3. Under chassis view of the compact photo timer unit.

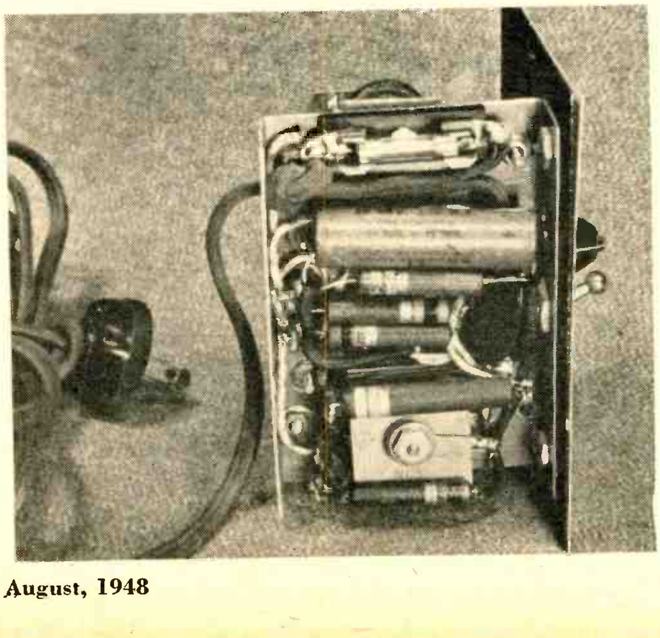
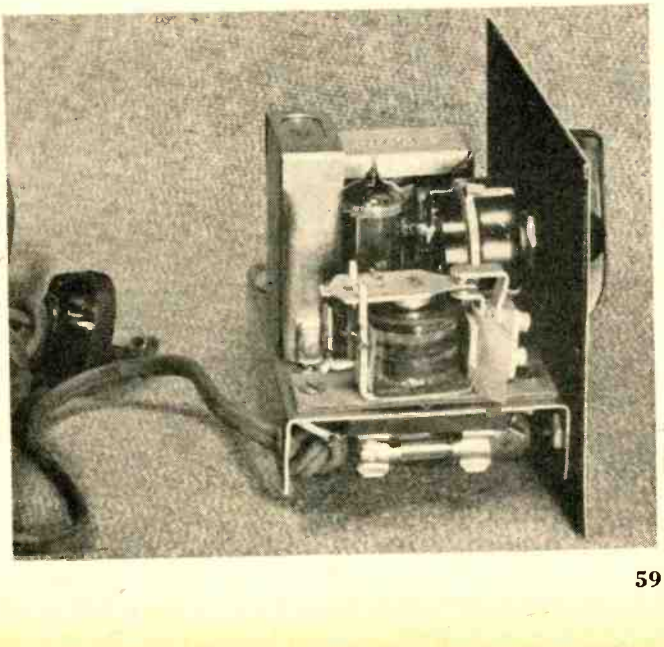
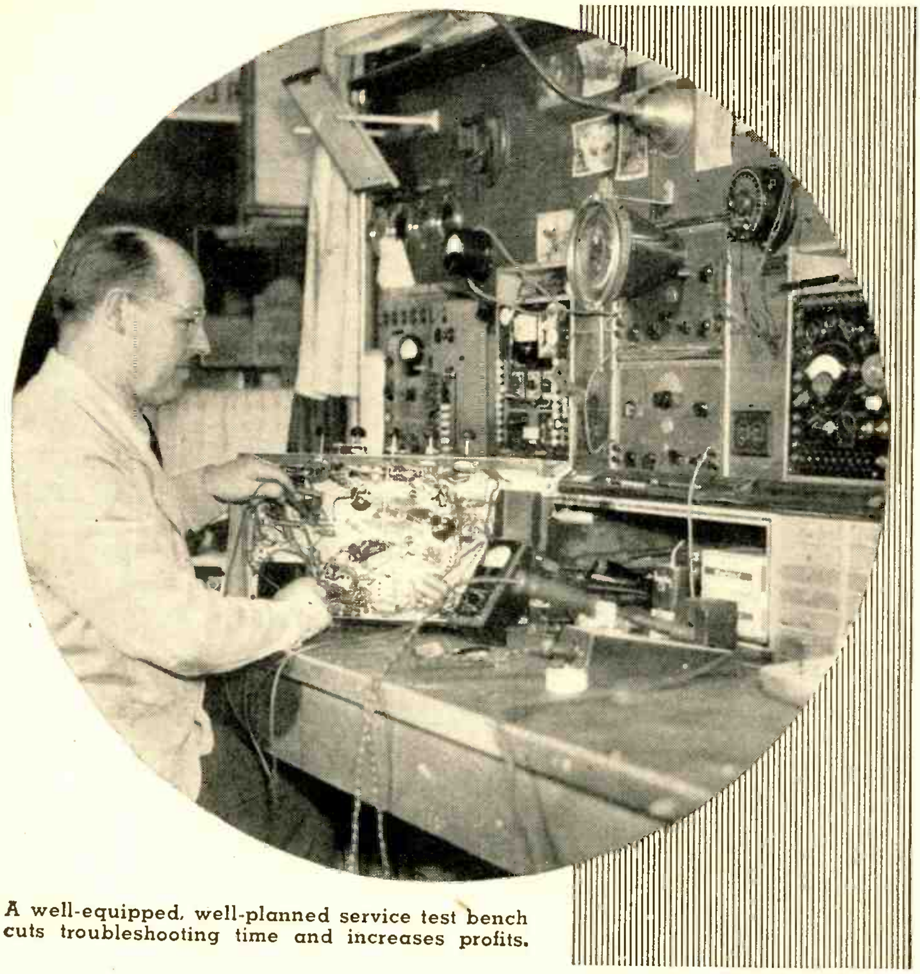


Fig. 4. Photo shows location of important above-chassis parts.





A well-equipped, well-planned service test bench cuts troubleshooting time and increases profits.

RADIO SERVICING HINTS

By FRED A. ORTH

Service more sets per day—increase your profits with these time-saving servicing hints and kinks.

PROFIT in radio servicing is dependent largely upon getting to the cause of trouble in a receiver both effectively and quickly.

The set owner little understands, and cares less, about the intricacies of modern day receivers and the time required to track down the reason or reasons why his set doesn't work, therefore it is necessary for the serviceman to locate troubles and take corrective action promptly, so that his charges may be both profitable to him and satisfactory to the customer.

Time-saving and effective procedures of systematic troubleshooting are already available from many sources. It is not, therefore, the purpose of this article to review this subject. Rather, it is our purpose merely to pass along several experiences, ideas, and methods associated with servicing and which may prove helpful. For example:

Not long ago we worked on a *General Electric* table model receiver which the owner said "makes noise like static every now and then." We tested the tubes in a tube tester, including a noise and gas test, tapped the tube shields, looked for loose connections, and so on through the usual gamut of tests.

But no noise like static.

Letting the receiver continue to operate, we returned to it later, lifted one end of the chassis, and tapped it gently on the bench. Result: "Noise like static!"

So again we tapped the tube shields, and repeated the previous tests. But no static.

To make a short story shorter, one of the tube shields had a removable top. When we had tapped the chassis against the bench, there was a downward movement sufficient to cause the top of the shield to contact the grid cap, thus causing the noise. In retrospect, the same thing apparently happened in the owner's home when someone walked heavily across the floor, or when a heavy truck passed by. However, when we had tapped the tube shield we had tapped the side of the shield, instead of the top, hence the contact and noise had not resulted.

Tape placed in the shield top licked the trouble.

Another case, which points up the importance of not relying implicitly on tubes which test *Good* in a tube tester, came to light via a 12Q7GT in a *Zenith* table model. The owner said the set would play five or ten minutes, then quit.

We proceeded to "test the tubes first." The 12Q7GT tested intermittently *"Short"* for approximately the first five seconds, but no more. We put it back in the receiver to try it again, and the set operated satisfactorily for several hours, after which we replaced the tube with a new one. The receiver has operated satisfactorily ever since. Periodically since then we have tried to get the original tube to test short, without result. But for those critical five seconds we may have yet been wondering why the lady had troubles.

While on the subject of tubes, if the dial lamp and/or 35Z5 tube in a set persists in blowing, test the 35Z5 and permanently shunt the dial lamp with a 270 ohm resistor if the lamp is a No. 40 or 47, and with an 820 ohm resistor if no pilot lamp is used.[1]

If the pilot light goes on when a receiver is turned on, then goes out, and the set contains a 50L6GT, the tube should be tested for a faulty heating element.

Replacement of metal tubes by glass tubes sometimes affects reception considerably; also, tubes removed by the owner for testing are sometimes replaced in the wrong socket, or *incorrectly* in the *right* socket. We remember finding a type 80 rectifier turned around in a *RCA-Victor* RE-45; the wafer had become brittle with age and had offered little resistance, apparently, to improper insertion of the tube prongs.

Regardless of what a tube test shows, if obscure trouble which points to imperfect tubes persists, it is well to try new oscillator and detector tubes, bearing in mind that sometimes several oscillator tubes may have to be tried to clear up trouble if this particular tube is the cause of the irregularity.

Needless to observe, electrolytics in the power pack are best tested both for leakage and capacity when replacing a rectifier tube. After testing, it is well to discharge the condenser through a resistor.

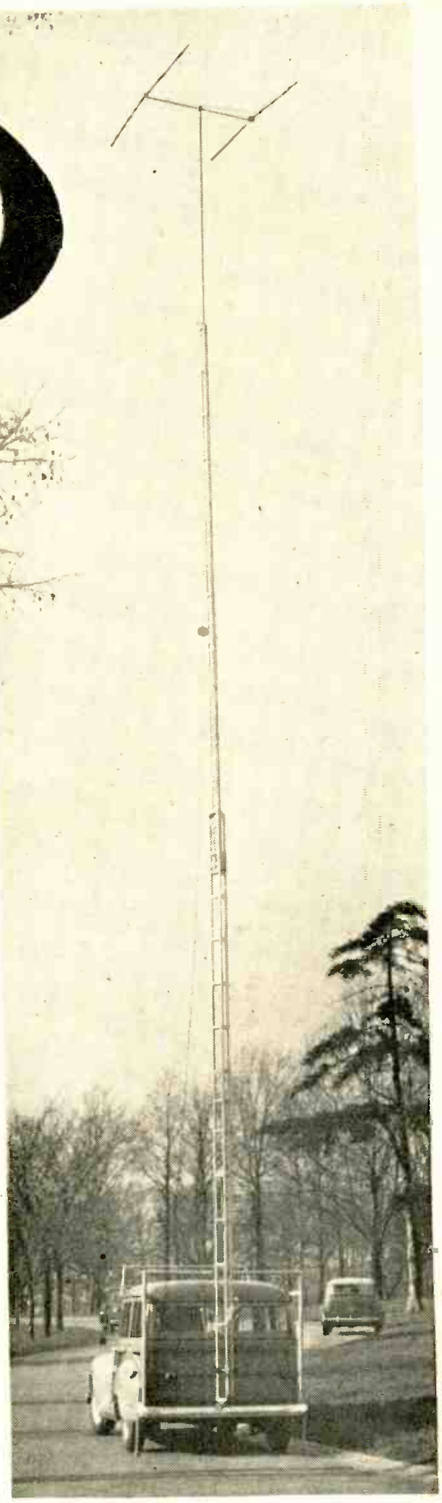
When faced with an old tube that has lost its identification numbers, place the tube in the ice box, let chill, then remove the tube and blow your breath on it. The numbers will usually show up.[2]

When removing tubes from an un-

(Continued on page 125)

New Mobile Field Strength Equipment for TV

Installation problems are easier, video sales increase—when strong-signal areas are plotted.



Mobile field strength test equipment unit used by Service Division of Philco Corporation shown in operation in Philadelphia.

★

THE *Philco Service Division* has worked out an answer to the tricky problem of determining exact areas of acceptable television picture and sound reception in a given location.

At first thought, the determination of effective picture and sound areas might seem simply a matter of drawing a circle of thirty or forty miles' radius around a transmitter site and saying that any location within the circle would receive an acceptable picture. The problem, however, is not as simple as that, for hills, valleys, large obstructions, and other factors serve to complicate matters.

As a result, the outside or "fringe" area presents itself as a ragged or broken line. Sometimes areas far outside of the line-of-sight distance from the transmitter have signal strength adequate for good reception. On the other hand, a few areas well within the radius will, because of topography or other reasons, be weak in signal strength.

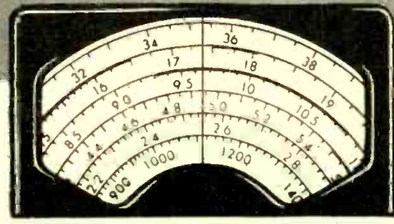
The importance of plotting these strong-signal areas cannot be overestimated. In localities where TV stations are now on the air, a strong-signal map will undoubtedly reveal areas which, although remote from the transmitter site, can receive adequate picture and sound signals. This will be valuable information at all levels of the sales organization. An accurate strong-signal survey will also help to locate the "blind spots," those areas well within maximum telecasting range which cannot receive adequate signal, and will provide an answer to service problems encountered in these areas.

In other cities where commercial telecasting is just around the corner, the strong-signal map will be equally useful. Since a transmitting station usually broadcasts test patterns for several

(Continued on page 72)

Interior view of mobile field strength test equipment station wagon. Exact areas of acceptable television picture and sound reception may be determined for any given area. Note oscilloscope in left foreground alongside of a standard Philco Model 1001 television receiver.

International SHORT-WAVE



Compiled by KENNETH R. BOORD

IT is with pleasure that we dedicate this month's *ISW Department* to short-wave radio stations in Angola, Portuguese West Africa. The following information comes to us from our South African ISW observer, Mervyn P. Laubscher:

"Radio Clube de Huilla followed up a recent letter with a bulletin of broadcasting in Angola, including a list of operating stations. A new outlet of Radio Clube de Angola is approximately 8.145, heard in South Africa at 1330-1600*, strong signals.

"Radio Clube de Benguela schedules remain the same as given recently in RADIO NEWS.

"Radio Diamang, located at Dundo in northern Angola, inland from Luanda, has a call of CR6RG, operates on 8.242 at 1400-1500; at times has been off the air as early as 1445.

"Radio Clube de Huilla, CR6RH, 9.-235, operates at 1230-1400, with 100 watts; QRA is Caixa Postal 111, Sa da Bandeira, Angola.

"Radio Clube de Huambo, located at Nova Lisboa, CR6RD, 7.152, operates 0615-6715, 1330-1430, strong signals compared to Radio Clube de Angola outlets, so possibly is 1 kw. in power, or at least 500 watts.

"Estacao Radiodifusora do Lobito, CR6AA, 7.177, is being heard around 1400 (schedule not listed).

"Radio Clube de Malange, CR6RE, schedule listed recently in RADIO NEWS.

"Radio Clube de Mocamedes, located at Mocamedes, CR6RM, 7.700, operates 1500-1600.

"Radio Clube de Angola, located at Lobito, CR6RS, 7.058, is scheduled 0600-0630, 1200-1300, 1400-1600, and has been heard signing of at 1300, R4 to R6.

"Radio Clube de Angola in sign-off gives four calls and frequencies of 31-, 37-, 41-, and ? meters."

Mr. Laubscher promises more information soon on these and any other Angola outlets heard by him.

Angola has a 1000-mile coast line stretching south from the mouth of the Congo. It is governed by a Governor General with wide powers. The Portuguese have owned it since 1575. Its area is 481,226 square miles. Capital is Luanda (Loanda). In 1936, the native population numbered 3,484,300, and there were about 59,000 Europeans living there.

(*NOTE: Unless otherwise indicated, time herein is American EST; *add* 5 hours for GCT; "news" means in the *English* language unless otherwise stated.)

Chief products are coffee, rubber, wax, sugar, oil seeds, coconuts, ivory, cattle, fish, tobacco for local use, cotton. Diamonds are mined and exported, principally to Belgium. There are large deposits of malachite copper, iron and salt, and gold has been found. Portugal supplies from 45 to 50 per-cent of the imports.

The unit of currency is the "angolar," which equals one "escudo" (average value of $0.04); a thousand are known as a "conto."

* * *

Use of English

Over the years I have had many complaints from readers that stations in *non-English-speaking* countries seldom (and some *never*) identify in the *English* language. This has been found particularly true with Latin American and some European countries.

I have done a great deal of direct contact work with overseas short-wave stations with regard to *at least occasional* identification in *English* for the benefit of *English-speaking* listeners. In some cases I have been successful—but most station managers say, "We do not have sufficient personnel."

Recently, August Balbi, Los Angeles, California, a veteran DX-er and ISW monitor, suggested that a campaign be waged by radio clubs, short-wave editors, and *listeners*, in an attempt to persuade stations to identify in *English* at least once in a while. He suggested that stations which do not have adequate personnel for this purpose might be induced to record a brief identification in *English* that could be played following normal identification in other languages used by the station.

This is really a big job, but it certainly merits the support of every listener who reports to stations which at present do not identify in *English*. A concerted effort might bring about the desired result.

Good reception reports to stations might well be accompanied by a *respectful request (never a demand!)* that the stations, whenever possible, identify in *English*.

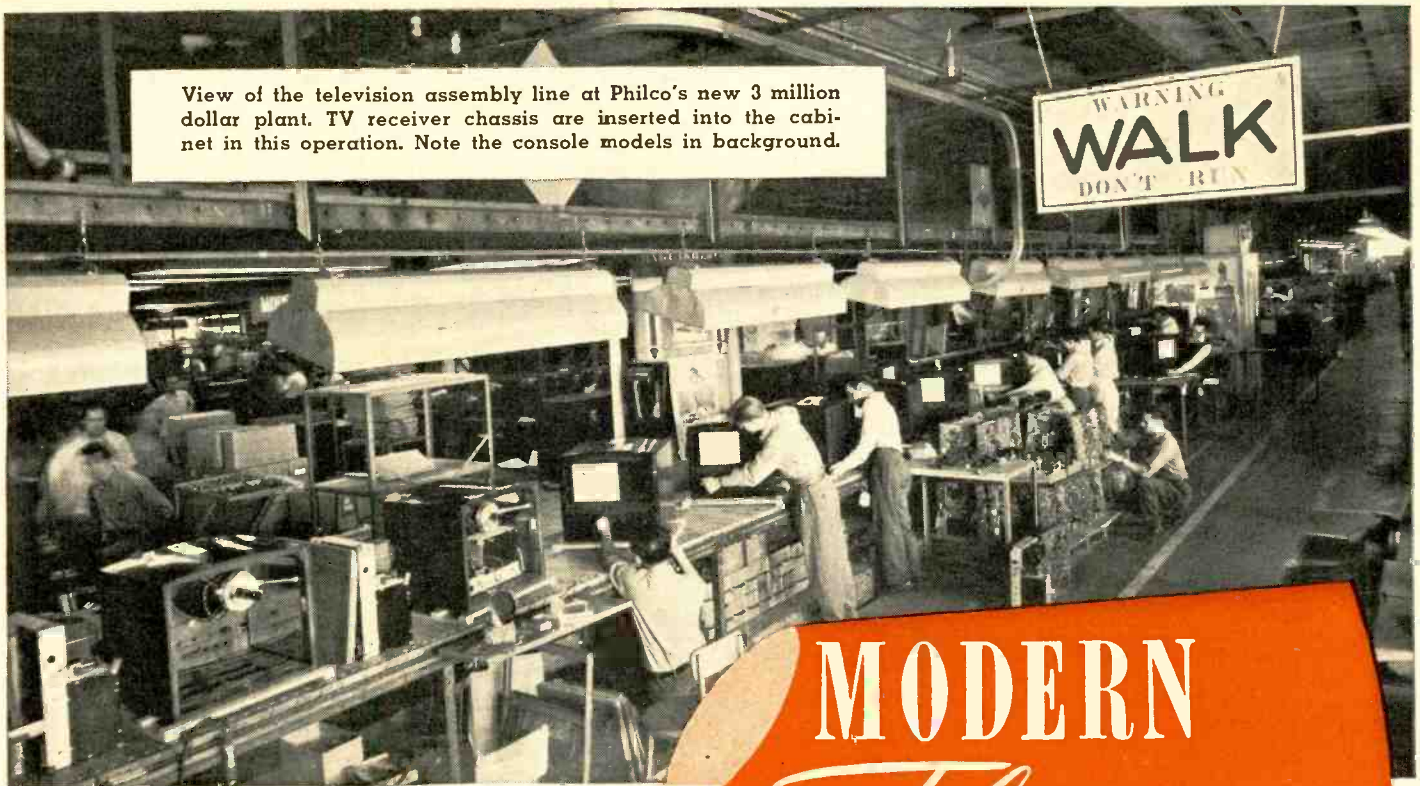
* * *

Handbook

The Summer Edition of *World Radio Handbook* (in *English*), compiled and published by O. Lund-Johansen, Copen-

(Continued on page 96)

DX-ers come young in Philadelphia! Charles S. Southall is only 14 and has been an active DX-er for less than two years during which time he has logged more than 100 countries. He is the Philadelphia representative of the International Short-Wave League (London) and is a member of ISWC, GNRS, ARRL, and the Silent QRM-ers. as well as ISW monitor for RADIO NEWS. Just to balance up his radio activities, Charles is president of his Student Council in school, edits the school paper, is chairman of United World Federalists Chapter, and has a few more "odd jobs". Equipment includes a BC-34R, a Mark II transceiver, and a Webster wire recorder.



View of the television assembly line at Philco's new 3 million dollar plant. TV receiver chassis are inserted into the cabinet in this operation. Note the console models in background.

MODERN *Television* RECEIVERS

By

MILTON S. KIVER

Part 5. Operation and alignment procedures for the sound channel in commercially-built television receivers.

ALL television receivers employ an FM sound system because of the demonstrated superiority of FM for sound transmission and reception. To convert the frequency modulated signal into its corresponding audio voltages, either Foster-Seeley or ratio detectors are used. The operation of Foster-Seeley and ratio detectors is given in detail on Page 56 in this issue, and familiarity with this explanation is assumed in what follows.

The Foster-Seeley discriminator may be shown in several ways, all being equivalent to each other. Figs. 1A and 1B illustrate two of the most common circuit arrangements. Circuits similar to these are found in *DuMont, Farnsworth, Garod, Industrial Television, Motorola* (Model VT101), *RCA, Stromberg-Carlson* and *United States Television,* receivers. A third interesting variation, shown in Fig. 2, is found in *General Electric* and *Stewart-Warner* television receivers. The secondary of the discriminator transformer contains two windings, L_2 and L_3. The bottom of L_2 and the top of L_3 are connected by a small 110 mmfd. condenser. The condenser offers negligible opposition to the high i.f. currents; therefore, as far as the signal frequencies are concerned, the two points are at the same potential. At the low audio frequencies, the impedance presented by the 110 mmfd. condenser is high, and the ends of R_1 and R_2 are effectively isolated.

A ground, connected to the left-hand side of R_2, is equivalent to the ground at one end of the same resistor, in other Foster-Seeley discriminator circuits. This is one audio output terminal, and placement of a ground connection here has absolutely no effect on the operation of the circuit. The other output terminal, as in the prior circuits, is at the opposite end of R_1. Thus, the output signal represents the difference between the audio voltages of R_1 and R_2.

A second departure from conventional design is the method of introducing the primary reference voltage into the secondary circuit. This is accomplished by C_1. C_1 transfers the voltage appearing across L_1 to R_1 and R_2 in equal measure. V_1 then, is driven by the i.f. voltages appearing across L_2 and R_2; V_2 receives the i.f. voltages from L_3 and R_1. In this respect this circuit is equivalent to that of Fig. 1A. By designing the circuit components in the manner shown in Fig. 2, *General Electric* is enabled to use a duo-diode possessing a common cathode.

In *Philco, Belmont, Admiral, Andrea* and *Motorola* (Model VT-71) receivers, the ratio detector is employed in one form or another. *Philco, Andrea,* and *Admiral* favor the balanced arrangement, all using essentially identical circuits. See Fig. 3. In the *Admiral* circuit, Fig. 3A, R_1 provides better balance and R_2 limits the peak plate current drawn by each diode section of the 6AL5. C_1 shunts i.f. voltages away from the audio output, while R_3 and C_2 comprise a de-emphasis filter to equalize the audio signal back to its original form. Fig. 3B, the *Andrea* circuit, is closely similar to Fig. 3A.

In *Philco* receivers, the ratio detector is also made to furnish a correction voltage to the oscillator control tube* whenever the r.f. oscillator drifts in frequency. How this action is achieved can be seen from the following. Between points *A* and *B*, Fig. 3C, the detected audio voltage is developed. At the center i.f. frequency, to which the ratio detector is aligned, the voltage developed between points *A* and *B* is zero. When the signal frequency swings above this value, point *A* becomes positive with respect to point *B*; when the frequency

* Kiver, Milton, S.: "Modern Television Receivers," Part 2, RADIO NEWS, May, 1948.

Table 1. A comparison of present-day television receivers. The chart below includes only those models which are on the market and which have been discussed in the articles thus far.

Manufacturer	Model No.	Picture Type: Direct	Picture Type: Proj.	Tube Size Diam.	Screen Size	Model Type: Table	Model Type: Console	Tuning Method: Continuous	Tuning Method: Selector Switch	R. F. Amp.	R.F. Osc.	Mixer	Intermediate Frequencies: Sound	Intermediate Frequencies: Video	Composite I.F. Stages	Sound I.F. System	Audio Detector: Foster Seeley	Ratio Detector: Bal.	Ratio Detector: Unbal.	Tube Type	A. F. Amplifiers
Admiral	30A14	X		10	6 x 8		X		X	6J6[6]	6J6[6]	6J6[6]	21 25	25 75	None	2-6AU6 Amplifiers— No Limiters.		X		6AL5	6SJ7, 6V6
	30A15	X		10	6 x 8		X		X	Same as Model 30A14							Same as Model 30A14				
	30A16	X		10	6 x 8		X		X	Same as Model 30A14							Same as Model 30A14				
Andrea	T-VJ12	X		12	7½x10	X			X[1]	6J6	6J6	6AG5	21 70	26 20	None	4-6BA6		X		6AL5	½ 6SQ7, 6V6
	C-VJ12	X		12	7½x10		X		X[1]	Same as Model T-VJ12						Amplifiers—	Same as Model T-VJ12				
	CO-VJ12	X		12	7½x10		X		X[1]	Same as Model T-VJ12						No Limiters.	Same as Model T-VJ12				
Belmont	21A21	X		7	5½x 4¼	X		X		6AK5	6C4	6AK5	22.25	26.75	6AH6	2-6BA6 I F No Limiters.		X		½6AT6 ½6AT6	2-6AT6, 6V6
	22A21 22AX21	X		7	5½x 4¼	X		X		6AK5	6C4	6AK5	22 25	26.75	6AH6	2-6BA6 No Limiters.		X		6AL5	6AU6, 6K6
	22AX22	X		10	6¼x 8¼		X	X		Same as Model 22A21 except for C.R T.							Same as Model 22A21 except for C.R.T.				
Crosley	307-TA (Note 13)	X		10	6¼x 8½	X			X	6J6	6J6	6J6	21 25	25 75	None	2-6BA6 I.F 1-6AU6 Limiter	X			6AL5	6AT6, 6K6
Du Mont	RA-101	X		See Note 4			X	X		6J6	6J6	6AK5	21 90	26.40	None	3-6BA6 I F 2-6AU6 Lim.	X			6AL5	2-6V6P.P., 2-6SN7
	RA-102	X		See Note 8			X	X		6J6	6J6	6AK5	21 90	26.40	None	2-6BA6 I F 1-6AU6 Lim.	X			6H6	6AT6, 6V6
	RA-103	X		12	7½x10	Note 5		X		6J6	6J6	6AK5	21 90	26.40	6AG5	1-6AU6 I.F 1-6AU6 Lim.	X			6AL5	6SJ7, 6V6
Farnsworth	GV-260	X		10	6 x 8	X			X	6BA6	½-6J6	6AG5	21 75	26 25	2-6AC7	No I F 1-6AC7 Lim	X			6H6	6J7, 6V6
Garod	3912-TVFMP	X		12	7½x10		X		X	6J6	6J6	6J6	21 25	25 75	None	2-6BA6 I F 1-6AU6 Limiter	X			6AL5	Uses Audio System Common to A.M. and F.M.
General Electric	801	X		10	6 x 8		X		X	6AU6	½-7F8	½-7F8	21 90	26 40	6AC7	1-6SG7 I.F 1-6SV7 Lim.	X			½6AQ7	½6AQ7, 6V6
	802	X		10	6 x 8		X		X	Same as Model 801							Same as Model 801				
Industrial Television Inc.	IT3R	X		See Note 3				X[7]		6J6	6J6	6AK5	21 90	26 40	None	2-6SH7 I.F 1-6AC7 Lim.	X			6H6	3-6SN7, 2-6K6
Motorola	VT71	X		7	4½x 6	X			X	½-7F8	½-7F8	½-7F8	See Note 9		Note 10	1-6AU6 Partial Lim.			X	½6S8	½6S8, 25L6
	VT101	X		10	6⅜x 8½		X		X	6AG5	½-6J6	½-6J6	21 90	26 40	6AG5	2-6BA6 I F. 1-6AU6 Lim.	X			½6S8	½6S8, 6V6
Philco	48-1000	X		10	6 x 8	X			X	6AG5	6J6	6AG5	22 10	26 60	6AG5	2-7W7 I.F No Limiter		X		6AL5	7B4, 7B5
	48-1001	X		10	6 x 8	X			X	Same as Model 48-1000							Same as Model 48-1000				
	48-1050	X		10	6 x 8		X		X	Same as Model 48-1000							Same as Model 48-1000				
	48-2500		X	5	15 x20		X		X	6AG5	6J6	6AG5	22.10	26.60	6AG5	2-7W7 I.F. No Limiter		X		6AL5	7B4, 7B5
RCA	621TS	X		7	4½x 5¼	X			X	6J6	6J6	6J6	21.25	25.75	None	1-6BA6 I F 1-6AU6 Lim.	X			6AL5	6AT6, 6K6
	630TS	X		10	6⅜x 8½	X			X	6J6	6J6	6J6	21.25	25 75	None	2-6BA6 I F 1-6AU6 Lim.	X			6AL5	6AT6, 6K6
	721TS	X		10	6⅜x 8½	X			X	6J6	6J6	6J6	21.25	25 75	None	1-6BA6 I.F 1-6AU6 Lim.	X			6AL5	6AT6, 6K6
	630TCS	X		10	6⅜x 8½		X		X	Same as Model 630TS							Same as Model 630TS				
	721TCS	X		10	6⅜x 8½		X		X	Same as Model 721TS							Same as Model 721TS				
	730TV1	X		10	6⅜x 8½		X		X	Same as Model 721TS							Same as Model 721TS				
	730TV2	X		10	6⅜x 8½		X		X	Same as Model 721TS							Same as Model 721TS				
	641TV	X		16	6⅜x 8½		X		X	6J6	6J6	6J6	21 25	25.75	None	2-6BA6 I.F 1-6AU6 Lim.	X			6AL5	6J5, 2-6F6 P.P.
	8TS30	X		10	6⅜x 8½	X			X	Same as Model 630TS							Same as Model 630TS				
	648PTK		X	5	15 x20		X		X	6J6	6J6	6J6	21.25	25.75	None	2-6BA6 I.F 1-6AU6 Lim.	X			6AL5	6J5, 2-6F6 P.P.
Steward-Warner	T-711 (Note 14)	X		10	6 x 8		X		X	6AU6	½7F8	½7F8	21.90	26.40	6AC7	1-6SG7 I.F 1-6SV7 Limiter	X			½6AQ7	½6AQ7, 6V6
	T-712	X		10	6 x 8		X		X	Same as Model T-711							Same as Model T-711				
Stromberg-Carlson (See Note 11)	TV10L Series 10	X		10	6½x 8 11/16		X		X	6AK6[12]	6C4[12]	6AK5[12]	21.60	26.10	3-6AG5	1-6AG5 I.F. 1-6AG5 Lim.	X			6H6	6SL7, 6V6
	TV10L Series 11	X		10	6½x 8 11/16		X		X	6AK6[12]	6C4[12]	6AK5[12]	21.60	26.10	3-6AG5	1-6AG5 I F. 1-6AG5 Lim.	X			6H6	6SL7, 6V6
	TV10P Series 11	X		10	6½x 8 11/16		X		X	Same as Model TV10L (Series 11)							Same as TV10L (Series 11)				
United States Television	T-502	X		10	6 x 8		X		X[2]	6AG5	6AK5	6AK5	10.7	15.2	None	2-6AC7 I.F 1-6SJ7 Lim.	X			6H6	6SC7, 2-6V6 P.P
	T-507		X	5	21 x16		X		X[2]	6AG5	6AK5	6AK5	10.7	15.2	None	2-6AC7 I.F 1-6SJ7 Lim.	X			6H6	6SC7, 2-6V6 P.P.
	T-525		X	5	25 x19		X		X[2]	Same as Model T-507							Same as Model T-507				
	T-530		X	5	30 x22½		X		X[2]	Same as Model T-507							Same as Model T-507				
	T-621		X	5	22¼x16¼		X		X[2]	Same as Model T-507							Same as Model T-507				
	T-10823	X		10	6 x 8	X			X	6J6[13]	6J6[13]	6J6[13]	21.25	25.75	None	2-6BA6 I.F. 1-6AU6 Lim.	X			6AL5	6AT6, 6K6
	T-15823	X		15	9 x12	X			X	Same as Model T-10823 except for C.R.T.							Same as Model T-507 except for C.R.T.				

[1]The Andrea receivers employ a tuner "turret" which is somewhat similar to the Philco except that all 13 channels are wired into position. The r.f., mixer, and oscillator tubes, with their circuit components, are also contained within the copperplated steel case. This reduces reradiation and protects the circuits from external fields.

[2]The r.f. tuning circuits of U.S.T. receivers closely resemble those employed in G.E. receivers. See explanation in Part 1 of this series.

[3]Industrial Television receivers are designed solely for commercial use. The picture tube is housed separately and controlled by a control unit located some distance away. Picture sizes can range from 6x8 inches for a 10-inch diameter tube to 12¾x17¼ inches for a 20-inch diameter tube.

[4]The set appears in six different style cabinets: Hampshire, Sherwood, Westminster, Revere, Plymouth, and Devonshire. Differences between models are in the size of the cathode-ray tube. The Hampshire and Westminster use a 20-inch tube; the other four models use a 15-inch diameter tube.

[5]This model receiver is available in three types of cabinets, two of which are table models and one is a console.

[6]Models 30A14, 30A15, and 30A16 employ an r.f. end section which is very similar to the RCA front end system.

[7]Industrial Television employs the "Inductuner" in an arrangement similar to that found in DuMont receivers.

[8]The set is housed in either the Clifton style cabinet, employing a 12-inch diameter cathode-ray tube (12JP4), or the Club style cabinet, employing a 15-inch tube (15AP4).

[9]For channels 1-6 video i.f. is 26.4 mc. and audio i.f. is 21.9 mc. For channels 7-13, video i.f. is 22.5 mc. and audio i.f. is 27.0.

[10]Uses Intercarrier System.

[11]Series 11 receivers have automatic frequency control of the horizontal frequency; Series 10 do not.

[12]The r.f. coils are mounted on a small bakelite strip which is then fastened to a motor driven rotating drum. Space is provided for 13 strips to cover all channels. The coils cannot be realigned but must be returned to factory if trouble develops.

[13]The r.f. stages are very similar to the RCA front end system.

[14]The front-end section of this receiver is very similar to the G.E. front-end section.

drops below the center i.f., the voltage becomes negative. In this manner, the frequency variations which constitute the FM signal are converted into equivalent audio voltages. Thus, the average voltage between points A and B is zero when the audio i.f. carrier coincides with the frequency to which the ratio detector is peaked. The audio filter network R_1,R_2, C_1 and C_2 connected to point A (actually, of course, between points A and B) will return zero voltage to the oscillator control tube.

Consider, now, what happens when the r.f. oscillator drifts in frequency. The incoming audio r.f. carrier, mixing with the altered oscillator frequency, is not reduced to the proper i.f. As a result, the balance of the ratio detector output is upset and the average voltage between points A and B will not be zero. If the oscillator frequency drift causes the audio i.f. frequencies to be higher than normal, the average voltage between A and B becomes positive. Conversely, a drift in the opposite direction produces a negative average voltage between A and B. These positive and negative voltages, fed back to the oscillator control tube, are opposite in their effect on the oscillator tuning circuit and, if properly applied, will correct the drift. C_1, C_2, R_1 and R_2 filter out the instantaneous audio variations, for it is obvious that if the oscillator frequency changes with each audio variation, no audio output at all would be obtained.

In the *Belmont* receiver, Model 21A21, two 6AT6 duo-diode triodes function as the ratio detector plus the first and second stages of audio amplification (see Fig. 4A). The output of the last i.f. amplifier is divided into two branches by the network of condensers C_1 and C_2 in conjunction with condensers C_3 and C_4. These condensers help to divide and stabilize the balance of the input voltages to the ratio detector. To maintain circuit balance, and still permit a single tuning adjustment of T_2, separate chokes L_1 and L_2 are used. Further, a connection to the junction point of L_1 and L_2 is equivalent to center-tapping T_2, which is necessary here for proper operation. If we disregard the triode sections of the two 6AT6 tubes for a moment, then we see that the circuit that results (Fig. 4B) is readily classified as a balanced ratio detector. The audio voltage variations, due to the shifting FM signals, appear across R_1.

Now, since each 6AT6 tube contains but a single cathode for both its diode and triode elements, that cathode must be incorporated, somehow, into both the ratio detector and the triode amplifier circuits. In the first audio amplifier, V_1, the audio voltage variations appearing across R_1 are also applied to its cathode. In the same circuit, the grid is put at essentially audio ground potential by C_5. Thus, the first audio amplifier stage receives its audio signal variations at the cathode, while the grid potential scarcely changes. The result, of course, is a grounded-grid amplifier. The d.c. bias is provided by the 10 megohm resistor through the contact potential between the cathode and control grid of V_1.

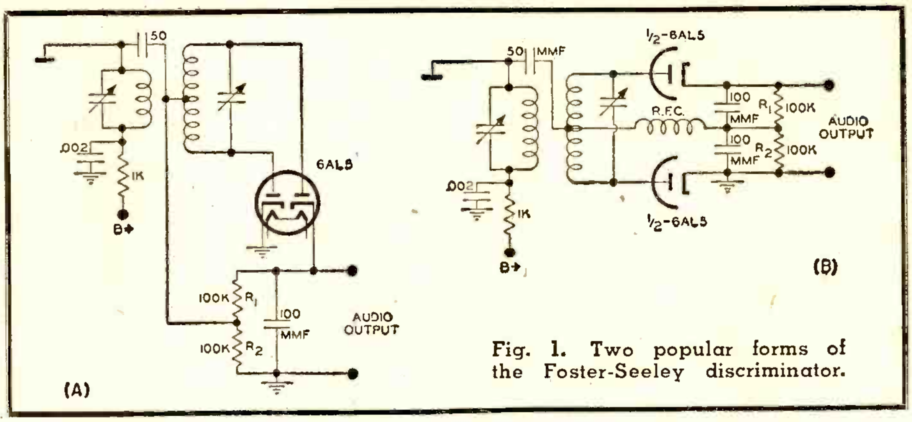


Fig. 1. Two popular forms of the Foster-Seeley discriminator.

In the output circuit of V_1, the audio voltage is coupled across a 2 megohm volume control from which the desired amount of audio voltage is transferred to the control grid of the triode section of V_2. In this instance, the amplifier is operated in the conventional manner. Condensers C_6 and C_7 maintain the grids of the audio amplifiers at the same i.f. potential as the cathodes. It will be noted that cathode current of the triode section V_1 also passes through R_1, placing a d.c. voltage in series with the diode circuit. To counterbalance this, R_2 and C_8 serve a similar purpose in the cathode circuit of V_2. Condensers C_9 and C_{10} provide coupling for the audio signal in the circuit, at the same time preventing direct current from creating noise in the volume control.

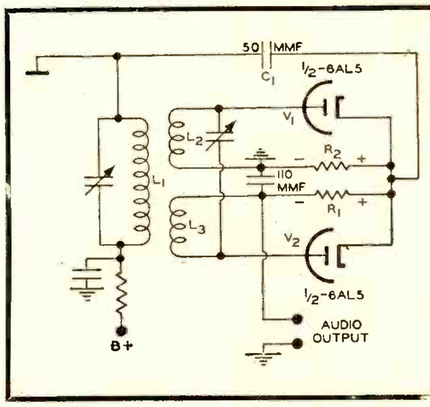
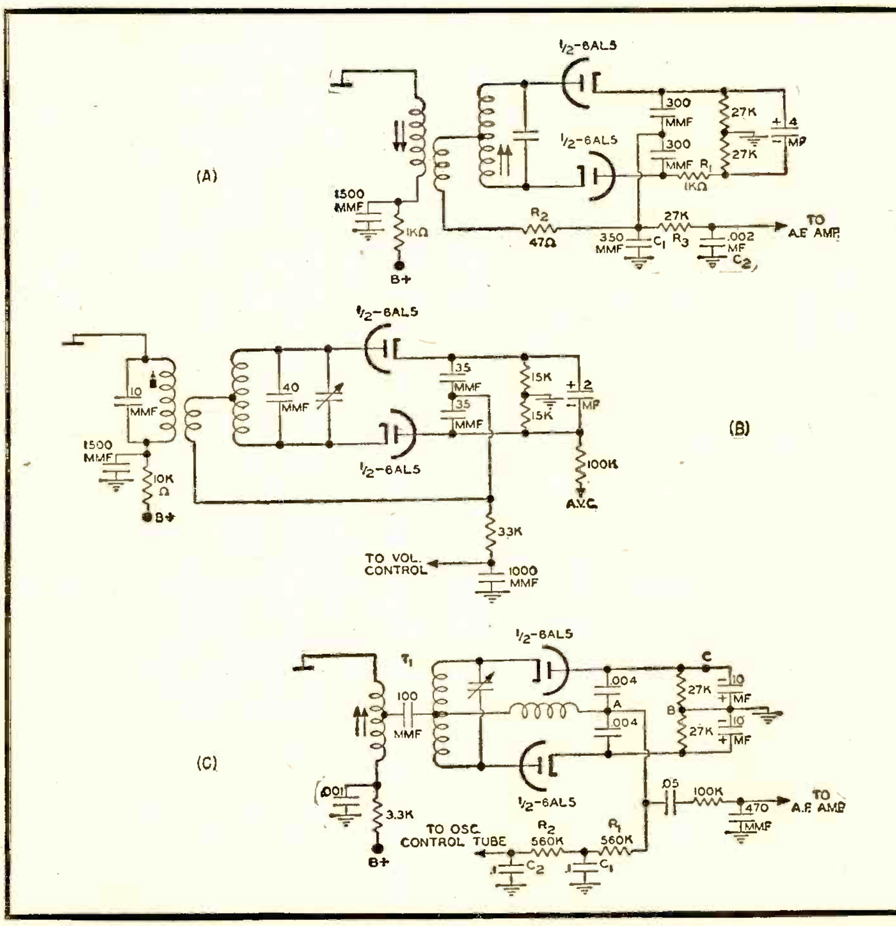


Fig. 2. A version of the Foster-Seeley discriminator used by General Electric Company and Stewart-Warner.

Fig. 3. Various forms of the balanced ratio detector as found in (A) Admiral; (B) Andrea; and (C) Philco television receivers.



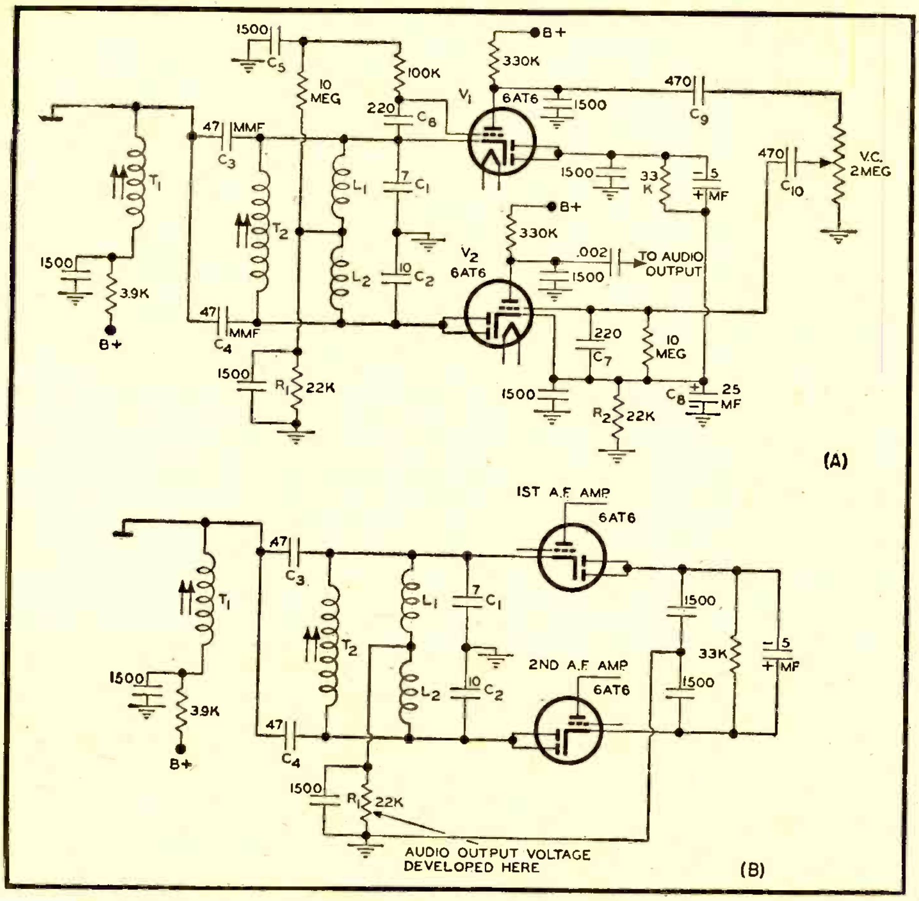


Fig. 4. (A) The actual ratio detector circuit plus two audio amplifier stages. (B) Simplified diagram to indicate the detector more clearly.

In more recent models, *Belmont* has modified its ratio detector to the form illustrated in Fig. 5. A pick-up coil, T_{1B}, provides coupling to the balanced tuned input of the ratio detector. T_{1A} is adjusted for maximum transfer at the audio i.f., whereas T_2 is adjusted for detector balance. T_2 is not inductively coupled to either T_{1A} or T_{1B}. It receives its energy through its center-tap connection to one end of T_{1B}. On the other side of the circuit, the connection between C_1 and C_2 is normally connected to ground instead of between R_1 and R_2. The shift, however, does not affect circuit operation. R_3 receives the audio voltages, arising from frequency shifts in the signal, and these are transferred to the control grid of the first audio amplifier.

The *Motorola* Model VT-71 receiver uses an unbalanced ratio detector. See Fig. 6. C_1 and R_1 form the long time constant stabilizing circuit which provides the ratio detector with much of its noise reducing qualities. C_2 and C_3 each develop voltages which vary with the frequency of the incoming signal, although at no time does the sum of their voltages exceed the average voltage across C_1 and R_1. The output audio variations are obtained from across C_3 and fed, through a volume control, to the grid of the triode amplifier section of the same tube (a 6S8).

Sound System Alignment

The sound system of a television receiver can be aligned by the sweep signal method or by the single frequency method using an AM signal generator. The more desirable method is the sweep signal method, since it reveals the full circuit response in one pattern. However, the necessary sweep generators may not be on hand; therefore, both methods will be considered in detail. The serviceman can then choose the one best suited to his equipment.

Systems Using Foster-Seeley Detectors

A. *Single Signal Method:* The equipment required for this method consists simply of a vacuum-tube voltmeter and an AM signal generator. A vacuum-tube voltmeter is preferable to an ordinary meter because it imposes negligible loading on the circuit. The AM generator should cover the i.f. range and, further, be sufficiently accurate to permit settings of plus or minus 25, 50, 75, 100, or 150 kc. about the frequency chosen. This is needed to check the bandpass response of the tuning circuits.

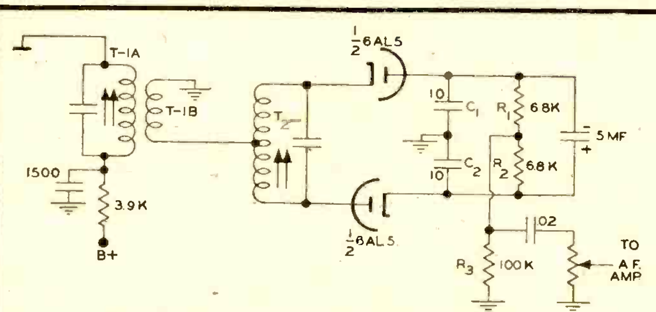


Fig. 5. A later type of ratio detector as used in some Belmont television models.

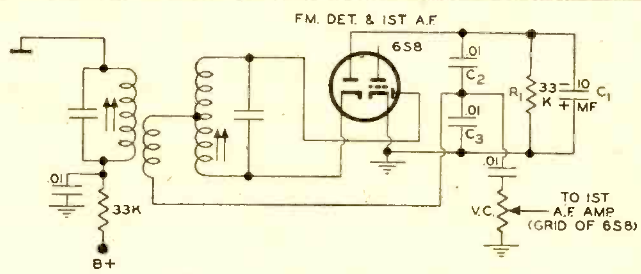


Fig. 6. In Motorola VT-71 receivers a 6S8 is utilized as a ratio detector and the first a.f. stage.

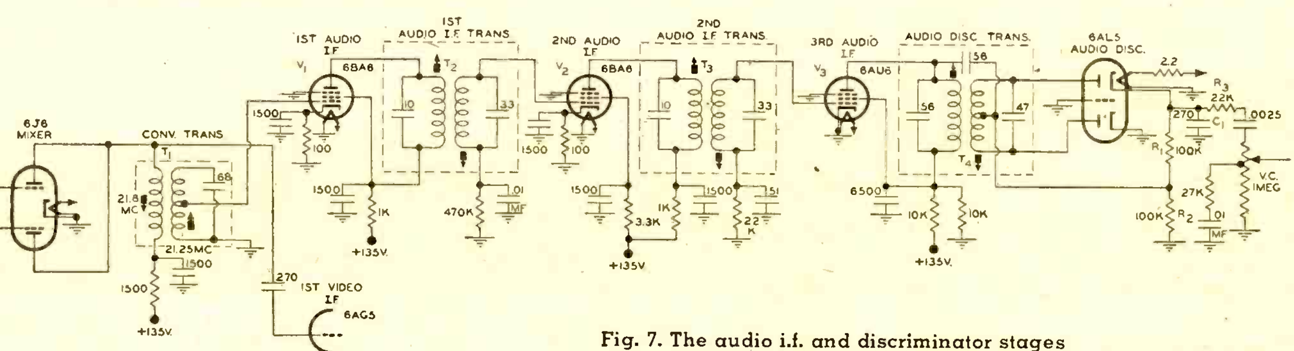


Fig. 7. The audio i.f. and discriminator stages of the RCA Model 630 TS television receiver.

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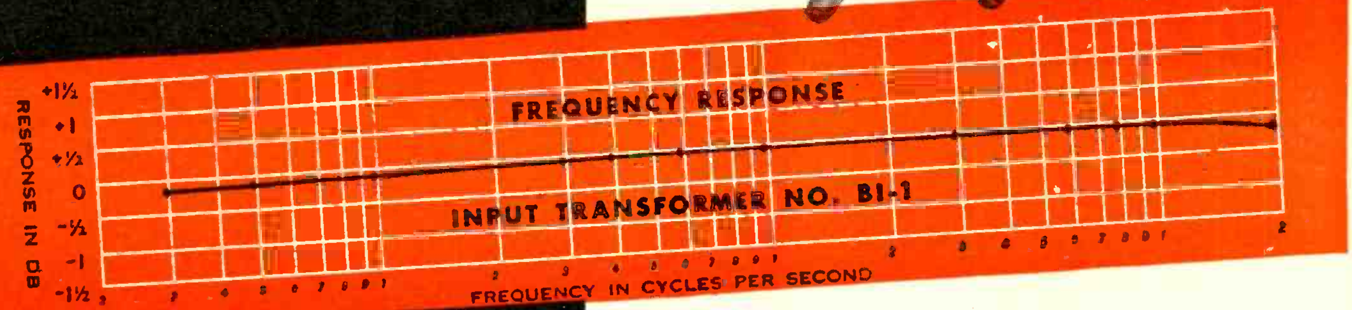

INPUT TRANSFORMERS

Catalog No.	Application	Impedance Primary—Secondary	Max. Power Level
BI-1	Line to Single or P.P. Grids..........	*Pri.—600/150 ohms CT *Sec.—50,000 ohms CT....	+20 dbm.
BI-2	Line to Single or P.P. Grids..........	*Pri.—600/150 ohms CT *Sec.—50,000 ohms CT....	+20 dbm.
BI-3	Line bridging to P.P. Grids..........	*Pri.—8,000/6,000 ohms CT *Sec.—50,000 ohms CT....	+20 dbm.
BI-4	Line to line...........	*Pri.—600/150 ohms CT *Sec.—600/150 ohms CT..	+20 dbm.
BI-5	Line to line...........	*Pri.—600/150 ohms CT *Sec.—600/150 ohms CT..	+30 dbm.
BI-6	Interstage—P.P. Plates to Single or P.P. Grids..	*Pri.—20,000 ohms CT *Sec.—50,000 ohms CT....	+20 dbm.

OUTPUT TRANSFORMERS

Catalog No.	Application	Impedance Primary—Secondary	Max. Power Level
BO-1	Single Plate to Line....	Pri.—15,000 ohms at 0 to 10 ma d-c........ *Sec.—600/150 ohms CT..	+20 dbm.
BO-2	P.P. Plates to Line.....	*Pri.—20,000 ohms CT.... *Sec.—600/150 ohms CT	+30 dbm.
BO-3	P.P. Plates to Line.....	Pri.—5,000 ohms CT..... *Sec.—600/150 ohms CT..	+40 dbm.
‡BO-4	P.P. Plates to Line.....	Pri.—7,500 ohms CT..... *Sec.—600/150 ohms CT..	+43 dbm.
BO-5	P.P. Plates to Line.....	Pri.—10,000 ohms CT.... *Sec.—600/150 ohms CT; 16/8/4 ohms......	+37 dbm.

‡Has tertiary winding to provide 15% inverse feedback.
*Split and balanced windings.

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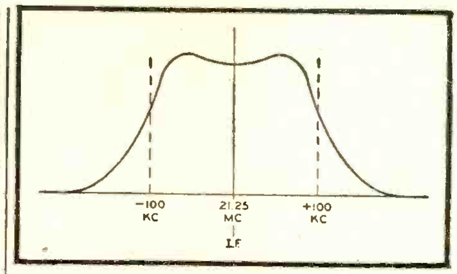


Fig. 8. Symmetrical audio i.f. response.

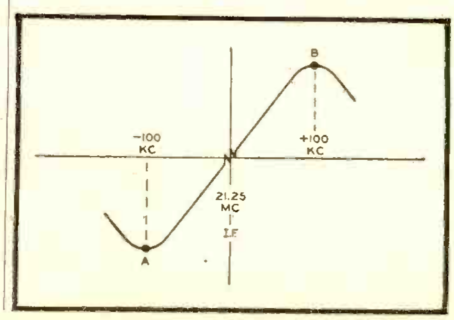
To illustrate the procedure in detail, we will use the sound system of the *RCA* Model 630 TS television receiver. The carry-over to any other system using the same type of detector will then be quite simple. (Refer back to a previous paragraph for those sets which use Foster-Seeley detectors).

Starting with the i.f. system, Fig. 7, connect the AM signal generator to the mixer grid, pin 6 (or pin 5) of the 6J6 tube. The vacuum-tube voltmeter is connected to the junction of the 22,000 ohm resistor and the 51 mmfd. condenser in the grid circuit of V_3. Note that this point is negative with respect to ground. The common lead of the meter attaches to the receiver chassis. Set the voltmeter to the lowest negative voltage scale because the alignment should be carried out using the weakest signal which will give a readable meter indication.

Set the signal generator to 21.25 mc., with the AM modulation completely off. 21.25 mc. is the sound i.f. for this receiver; in other sets, their value would be used instead. Adjust each of the iron cores of T_3 for maximum deflection of the meter. Next, adjust the primary and secondary of T_2 for maximum deflection. Reduce the signal amplitude if the meter deflection has increased to too great a value. As a final step, adjust the secondary of T_1 (the sound trap) for maximum meter deflection.

The various transformers have now been peaked, but whether or not the response is symmetrical remains to be determined. This is done as follows: Increase the generator frequency by 25 kc. Note the reading on the voltmeter. Now return the generator to 21.25 mc. and then reduce it by 25 kc. Again, note the meter reading. If the two meter readings are equal, the curve, at this frequency (21.25 mc. plus or minus 25

Fig. 9. The S-curve response pattern of an FM discriminator. The irregularities appearing at the center are produced by a marker signal generator.



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211	.69	931A	2.39
304TL	1.39	954	.49
316A	.49	955	.49
705A	2.95	957	.49
717A	1.65	958A	.49
801A	1.49	959	.49
803	8.95	1619	.49
804	8.95	1625	.49
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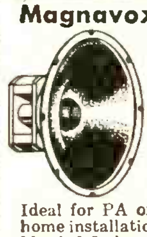
Table Model 81 for Commercial, Industrial, and Professional use. Complete, self-contained unit with built-in amplifier and speaker. Supplied with a microphone and 15-minute spool of wire. Plugs into an AC outlet, and can be carried from room to room! Voice and music are recorded with amazing fidelity, and recordings may be played back thousands of times without appreciable loss of quality—or, the recording can be "erased" and the same wire used over and over again.
Cat. No. A-15061 . . . Your Cost $114.50

Magnavox 12" PM SPEAKER



12.95

Heavy Duty 55 oz. Alnico III Magnet with 1 1/4" Pole Piece

Ideal for PA or high quality home installations. All Brand New! 6-8 ohm voice coil with dust cover. Handles over 30 watts. Superb performance at a real Bargain Price! Wt. 10 lbs. **Cat. No. S-850**

A Terrific Newark Scoop!

Smashing Reduction—McMurdo Silver RECEIVER—TRANSMITTER

Model 700 Xmitter

Cat. No. A-267 **$19.95**
Regularly $36.95

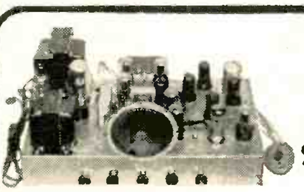
Limited Quantity! 2-band xtal-cont. phone xmitter for 144/-148 and 235/240 Mc. Compact, portable. 5 watts output on 240 Mc, more than 8 watts on 144 Mc. Complete less tubes, pwr supply, xtal, mike. Wt. 12 lbs.
Kit of 6 tubes . . . **$4.77**
Crystal (specify freq.) ea. **$3.95**

Model 800 Receiver

$19.95 **Cat. No. A-266**
Regularly $39.75

Another Great Buy! McMurdo "Atom X" UHF Rcvr, 144 to 200 Mc. Has builtin speaker. Uses 6AK5 hi-gain TRF, 9002 super-regen. detector, 6AU6 1st audio, 6AK6 power amp. Works on batts., vibra-pack, or simple AC pwr supply. Complete with 2 prs plug-in coils, less tubes and pwr supply. Wt. 10 lbs.
Kit of 5 tubes . . . **$5.37**

Big Value! IMPROVED Electro-Tech 7" TELEVISION KIT



$59.50 **Complete with 13 channel Tuner, All Parts and Step-by-Step Instructions. Less Tubes.**

It really works fine! Easy to assemble. Latest circuit refinements. 17 tubes incl. 7JP4, pre-tuned IF coils, new hi-volt trans, FM sound. Wt. 25 lbs.

Cat. No. A-19521	**$59.50**
Kit of 17 tubes incl. 7JP4	**33.97**
Cat. No. A-19523 7" cabinet	**21.00**

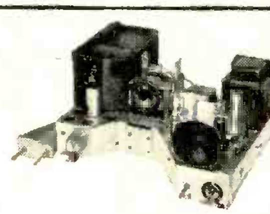
10" TELEKIT—Uses 10 BP4 tube and additional refinements. Wt. 35 lbs.

Cat. No. A-19522	**$99.50**
Kit of 19 tubes	**51.50**
Cat. No. A-19524 10" Cabinet	**23.50**

Terrific Television Buy! RCA 630TS 10" TV KIT

Complete with All Parts, Instructions, and 30 RCA Tubes (including 10-BP4.) Duplicates in every respect the famous RCA 630TS, generally accepted as best engineered TV set available!

$198.50



This Soundview 630TK kit is an exact copy of famous RCA 630TS Television set. Contains efficient RCA front end 13-channel tuner—completely factory wired and aligned with 3 RCA matched tubes, plus built-in wave trap. Complete with 30 RCA tubes (12" or 15" tube can be substituted for 10BP4 if desired). Dual controls for picture and FM sound, and for horizontal and vertical control. Kit is supplied with RCA schematic and service manual, but less wire, solder, and mtg. screws. **Cat. No. A-19752.** Shpg. wt. 85 lbs. **Your Cost $198.50. $39.70 Down—12 Months at $14.03.**
Hand Rubbed Walnut Cabinet No. **A-19753** . . . **$42.50**

DETROLA CHANGER

$12.95

Really a sensational price! Fine single post record changer, compact, fool-proof! Plays 12-10" or 10-12" records automatically without adjustment. Hi-fi xtal pickup. Removable needle. Overall 10 3/4" x 12 1/8" x 8". 6" above, 2" below mtg. bd. Hardware incl. 78 RPM. for 110 V 60 cy AC. Wt. 12 lbs.
Cat. No. S-734

VM Automatic Changer

Model 200B

$14.95

2 post changer, very low price! Wt. 16 lbs. Cat. No. S-328

TIME PAYMENTS ARRANGED

Include Postage • All Prices F.O.B. New York or Chicago • Send 20% Deposit with C.O.D. Orders

NEW YORK
Offices & Warehouse
242 W. 55th St., N.Y. 19

NEWARK ELECTRIC COMPANY, INC.

CHICAGO
323 W. Madison St.
Chicago 6, Ill.

Send Orders To 242 West 55th St. New York 19, N. Y. or 323 W. Madison St. Chicago 6, Ill.

New York City Stores: 115-17 W. 45th St. & 212 Fulton St.

kc.) is symmetrical. Follow the same procedure for frequencies plus or minus 50, 75, or 100 kc. about the i.f. value. If equal readings are obtained at each point, then the curve is symmetrical. Note that, although the two readings at each point ($\pm$25 kc., plus and minus 50 kc., etc.) should be equal, the value of the meter readings at $\pm$50 kc., for example, will be less than those obtained for plus or minus 25 kc., etc. In most circuits, the response will decrease not more than 30 per-cent of the maximum value by the time the plus or minus 100 kc. points are reached.

We are now ready to align the discriminator. Connect the generator to the control grid of V_3 and set it for a 1 volt output at 21.25 mc. Connect the vacuum tube voltmeter to the junction of R_1 and R_2. The common lead attaches to the chassis. Detune the secondary of T_4 and adjust the primary of T_4 for maximum output on the meter.

Connect the meter to the junction of R_3 and C_1. Adjust the secondary of T_4 for zero meter reading. It will be found that it is possible to produce either positive or negative readings on the meter, depending on the secondary adjustment. Obviously, to pass from a negative to a positive voltage, the voltage must go through zero. It is for this zero point that the secondary of T_4 is adjusted.

To determine whether the discriminator response is linear, leave the signal generator and meter connected as is. If it is not, it will have to be switched when the voltage polarity changes. Set the generator to a signal frequency which is 25 kc. above 21.25 mc. Note the meter reading. Shift the frequency to 25 kc. below 21.25 mc. An equal and oppositely-phased reading will be obtained if the discriminator characteristic is linear. Unequal readings indicate the need for readjustment of the primary and secondary cores of T_4. Follow the same procedure for frequencies which are plus or minus 50, 75, and 100 kc. about 21.25 mc. Equal readings should again be obtained for frequencies which are equidistant from 21.25 mc. Deviations from this indicate non-linearity and the need for readjustment of T_4.

B. *Sweep Signal Method:* The instruments required to carry out a visual alignment include:

1. An oscilloscope
2. A sweep signal generator covering the i.f. frequencies and possessing an adjustable sweeping range from 1 to 10 mc.
3. An AM signal generator to provide marker signals.

An outlet is generally provided on FM sweep generators to permit a portion of the modulating voltage to be tapped off and applied as a synchronizing voltage to the terminals labeled "External Sync" on the oscilloscope front panel. In this manner we synchronize the sweep of the oscilloscope with the modulating voltage of the signal generator and obtain a stationary pattern on the scope screen.

Synchronization, however, is required only when the internal saw-tooth deflection voltage of the scope is swinging the beam across the screen. When the frequencies of the sweep generator are shifted back and forth in a sinusoidal manner, the FM signal generator furnishes the deflecting voltage and no additional synchronizing voltage is needed.

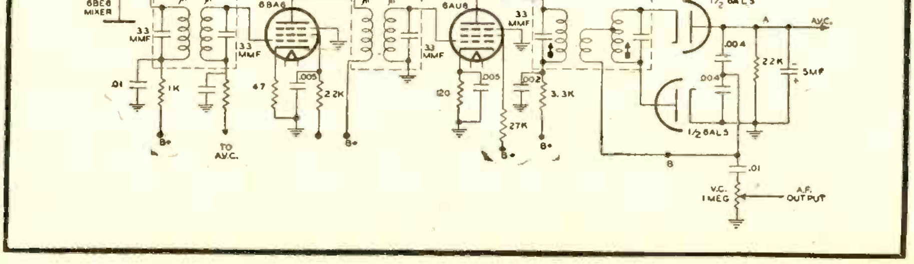
To visually align the i.f. system, the vertical input terminals of the oscilloscope are connected across the grid-leak resistor in the grid circuit of the limiter. The sweep generator is placed between grid and ground of the mixer tube. The primary and secondary windings of each i.f. transformer are then adjusted until the desired bandpass response curve is obtained on the screen. If double peaking (over-coupling) is used, care must be exercised to adjust each stage for the symmetrical curve of Fig. 8. The peaks must be equally distant from the center. With single peaking, the midpoint of the peak should occur directly at the carrier point. The level of the input signal is kept as low as possible in order to drive the limiter beyond saturation. When this happens the curve flattens out.

To determine the frequencies of various points on the visible response curve, connect the AM signal generator in parallel with the sweep generator. Set the AM generator to whichever frequency it is desired to identify and note where the wiggle or pip appears on the pattern.

To align the discriminator input transformer visually, connect the output leads of the sweep generator between grid and ground of the limiter tube just preceding the discriminator. Attach a wire from the "Vertical Input" post of the scope to the junction of R_3 and C_1 of Fig. 7. The other end of the discriminator load, ground, is connected to the ground terminal of the scope.

(Continued on page 164)

Fig. 10. An audio i.f. system feeding an unbalanced ratio detector.



SLASHED PRICES DOWN
"Q 5'er"
Here is a little unit that covers 200 to 400 KC, has 135 KC I.F.—complete with tubes —has a tuned stage of R.F.—it is a natural for the aircraft beacon frequencies—The tube line up is: 2-25L6; 1-6SQ7; 1-6SK7; 1-6SA7; 1-6K7. This set is perfect for Rand's article "The Man's Q 5'er"
Special $4.95
SELSYN MOTORS
110 V 60 CYCLE INPUT
No. S for indicating direction of your beam or actually driving it. Made in two popular sizes. Type 11-5 are heavy duty brass motors which will drive.....$12.95 per pair
No. S2 Type I—Light duty for use as indicators $9.95 per pair
SYNCHRO—DIFFERENTIAL
Model #1943—C78249-CAL-11280 Bendix Aviation 115 v.—60 cy. 6" length to end of shaft x 4¼" diameter $9.95
PLATE TRANSFORMER 600 V.
Primary 220 or 110 V. 50/60 Cy. Sec. 612-0-612 V. @ 300 ma—also has 585 V. taps.
While they last....... $9.95
PLATE TRANSFORMER
Primary 220 or 110 V., 50/60 Cy. Sec. 2050 CT @ 1.0 amps. Used in a bridge circuit, this transformer will deliver 2000 V. DC @ 487 ma. $17.95
PLATE TRANSFORMER
220 Volt Primary 50/60 Cy—1220 V. CT @ 570 ma—This is a rugged transformer designed to take it. $12.50
POWER TRANSFORMER
700 Volts DC transformer—Pri. 117.5 Volts —60 Cycles.
Sec. #1—6.3 V. @ 1.2 amps.
Sec. #2—725-0-725 V. @ 60 ma.
Sec. #3—5 V. @ 3 amps.
$2.95
630 T.S. POWER TRANSFORMER
This transformer designed for heavy duty television service.
Primary 115 Volts 60 Cy.
Sec. #1—325-0-325 V. @ 400 ma.
Sec. #2—5 V. 3 amps.
Sec. #3—12.6 C. CT. @ 10 amps.
Sec. #4—6.3 V. @ 7 amps.
List Price $40.00
YOUR COST $18.25
SMALL POWER TRANSFORMER
Primary 115 Volts, 60 Cy.
Sec. #1—750 V. CT @ 80 ma.
Sec. #2—6.3 V. @ 5 amps.
$2.95
KITS!
TUBE KITS
Complete set of tubes for SCR-522..$17.95
Complete set of tubes for BC-348....$7.95
Complete set of tubes for BC-312....$7.95
Specify Model Numbers
BC-348 Owners
Converter for Broadcast Band
Convert that BC-348 without any alteration in your circuit. Our special converter takes power from receiver. Just tune your set to 450 kc. and forget it. All tuning is done on a converted panel covering 550 to 1600 kc.—double conversion means High Sensitivity. Excellent Fidelity and Higher Selectivity—complete basic kit with schematic and full instructions—less chassis dial and tuning knobs. Terrific Buy at $6.50
Model 200-EA. 5-ELEMENT 2 METER BEAM KIT. Folded di-pole driven element. All aluminum construction. Feed with low impedance coaxial cable.
Amateur net price $8.40
DO YOU OWN AN SCR-522?
We have a complete power supply, including a separate voltage regulated bias supply chassis and schematic—all in kit form. This kit will supply all voltage necessary for operation of the set. All parts guaranteed. Complete at the amazingly low price of.. $14.95
IT'S SENSATIONAL!
Hottest Item Out! Make your SCR-522 Receiver operate on 144 to 148 MC with ONE DIAL control, in less than 1 hour!
Parts and instructions.......... $3.00
No. C 3002
Butterfly Condenser
This cond. has the tank circuit built in—just plug in a tube. (Designed for W.E. 368-AS). Operates from 200 to 1000 mcs. Can be used with any high frequency triode. . $1.98
MODULATION TRANSFORMER
Designed for the famous ARC 3 transmitter—will match 6L6 modulators to 832, 829B or 807. Come early—going fast....... $3.25
No. M4214
Dynamic Mike
Has push to talk switch designed for the famous Mark II Transmitter, but can be used anywhere — A wonderful value — Black Bakelite Frame.
Complete with 8 ft. rubber cord and PL55 plug. $1.75
Conversion Manual 1948 Surplus Radio
Here is the latest manual on conversion of surplus equipment. Complete articles including schematics "before & after" on such units as the BC 221, 342, 312, 348, 412, 645, 946, SCR 274, 522, TBY Transceiver, PE 103A, BC 1068A/1161. Electronic Surplus Index, Cross Index of A/N Vac. Tubes and many others.
ONLY $2.50
No. BM 601
Beam Rotating Motor
3 R.P.M. with built in reduction gears — weather proof-Reversible-AC or DC. This motor will drive any type of array—small, compact and strong. Requires 30 volts which can be obtained by the simple use of a lamp bulb in series with the line. A wonderful value at.... $12.95
BRAND NEW HF 100
A perfect tube for Class A amplifiers or Class B modulators—Can be run at maximum of 1750 volts, 150 ma each up to 30 mc. Will deliver conservatively 110 watts output on phone or 350 watts of Audio.
A Wonderful Value at $4.95
PE 94
28 VOLT DYNAMOTOR
Designed for 522—delivers:
300 Volts @ 250 ma DC
150 Volts bias
12 Volts @ 10 amps DC
$8.75
TRANSTAT
Input 115 volts 60 cy. Output 90 to 130 volts @17.5 amps. Here is the answer to that low line voltage.
Very few left. $24.95
400 Cycle TRANSTAT
110 V. 400 cy input—90 to 135 V. output @ 10 amps. Can be used on low voltage 60 cyc for controlling Filament voltage.
$14.50
No. C-641
R.F. UNITS FROM THE BC-312
Contains six coils which cover from 1500 KC to 18 Mc. Has a ceramic band switch to change from any coil. Each coil is tuned with an air padder. Build your own receiver or signal generator with this assembly. A marvelous Buy at.... $1.98
20% DEPOSIT WITH ORDERS UNLESS RATED
NIAGARA RADIO SUPPLY CORP.
160 GREENWICH STREET NEW YORK 6, N. Y.
ALL PRICES F. O. B. N.Y.C.

Field Strength Equipment

(Continued from page 61)

weeks before telecasting commercially, in this preliminary period a strong-signal map can be made which will be of value in concentrating television sales efforts in the areas where good picture and sound reception is assured. From the point of view of service, the signal-strength map will provide an excellent preview of the service problems which are likely to come up so that preventive measures can be set up immediately.

The *Philco Service Division* has hit upon the use of mobile signal strength test units as an answer to the problem. The first of these units is now on a survey of several Midwestern television cities and other similar units are being planned. The unit consists of a production model station wagon. Special brackets are mounted on top and these brackets support a telescoped aluminum mast carried horizontally. In a matter of seconds, a dipole and reflector can be attached and the mast swung into a vertical position. The thirty-foot extension is raised by means of a crank and the rotatable antenna, now fifty feet in the air, is ready for use.

A standard production model 48-1001 receiver is cushion-mounted in the car. Test equipment also includes a 5 inch oscilloscope for measuring video level at the second detector of the receiver and an a.c. voltmeter for measurement of line voltage.

In the near future a *Philco* mobile radio transmitter and receiver, Model MV-27, will be installed in the unit. This will probably operate on *Bell Telephone* Channel 11. Constant contact with the test crew can thus be maintained and the itinerary of the unit kept flexible.

An accurate signal-strength survey of any area requires time. New television stations are coming on the air at such a rapid rate that more mobile test units will soon be necessary. —30—

TV PRODUCTION UP

TELEVISION receiver production continued to climb during April and reached a new weekly average of more than 11,500 sets although the month's output fell below March because the latter covered five work weeks as against four in April, according to the Radio Manufacturers Association.

April's production of 46,339 television receivers by RMA member-companies brought the total postwar output up to 350,000 units as of April 30. April's weekly TV set manufacturing rate was 28 per-cent higher than the weekly average for the first quarter of 1948.

Radio set production, including FM-AM receivers, indicated a seasonal decline during April totaling 1,182,473. FM-AM sets reported for the month numbered 90,635 to bring the postwar total to nearly 2 million receivers.

Portables and auto sets continued to be turned out at a high level, but table models showed the sharpest seasonal drop. —30—

"YOU CAN'T BEAT KEN-RAD TUBES!"

"You can't beat Ken-Rad tubes—I found that out long ago!

"Ever since 1935, when I started in business, I've been using Ken-Rad tubes.

"And believe me, they hold up—never let me down!

"I found Ken-Rad tubes dependable. So I sold them to my customers. They like them, too. I never receive a complaint.

"In fact, I think a good part of the big repeat business I do is the result of Ken-Rad tubes.

"Quality pays off!"

JOHN F. BERANICH, 4439 West Madison St., Chicago, Ill., does a big business servicing radios, and like thousands of other servicemen he uses Ken-Rad tubes. He likes their dependable quality!

"HERE'S WHY YOU CAN'T BEAT KEN-RAD TUBES!"

"From start to finish, Ken-Rad tubes undergo strictest inspections and tests.

"I know, because I help test them!

"They're made to stand up, satisfy customers, increase your business.

"You can depend on Ken-Rad tubes because they're tested for noise, microphonics, static, life, shorts, appearance, gas, air and hum.

"Your customers can depend on Ken-Rad tubes because they're built, throughout, to the highest standards of quality, stamina, and endurance."

WALTER DOWNING, Foreman, Raw Materials Inspection Department, is in charge of comprehensive testing of all materials used in making Ken-Rad tubes. Here cathode sleeves are being tested for breaking strength.

178-GA9-8850

KEN-RAD *Radio Tubes*

PRODUCT OF GENERAL ELECTRIC COMPANY

Schenectady 5, New York

The Serviceman's Tube

Follow the "ARROW" to TOP VALUES!

COMMAND SET
SCR-274 MEDIUM FREQUENCY

Excellent condition **$34.95**

Complete installation with 2 transmitters, 3 receivers, racks, tubes, crystals control box and plugs.

BLOWER MOTOR

24V, small portable with fan, ideal for defroster or ventilator unit, 17,000 RPM, BRAND NEW **$1.95**

THE LAZIEST Q-5'er

FL-8-A, used when flying radio range. RANGE-VOICE-BOTH switch selects 1020 pass ONLY, or voice freq. minus 1020 cps, or by-passes filter completely. Put in series with hi-impedance headset when listening to 1 kc MCW.. **$1.95**

AUTOMATIC FREQUENCY CONTROL UNIT

Western Electric type used for controlling frequency for teletype and telephone work, complete with 3—6SJ7 and 2—6H6 tubes. Complete unit, brand new in original box... **$4.95**

BC-604 FM 35 WATT TRANSMITTER

A-1 condition, complete with tubes, 10 channel push buttons, less crystals and power supply, 19.6-27.6 Mc **$10.95**

BC-788 FOR 420 MC

Complete with tubes. Excellent cond. Complete transmitter-receiver. 14 tubes including 3-6J6; 9-6AG5; 1-6L6; 1-5Y3. Six wide band IF stages. Has 98.356 KC crystal. Details on page 53 of "QST", Nov. 1947. ONLY.. **$10.95**

FILTER CHOKES—All Fully Enclosed

8.7 H. @ 145 MA. DC., 125 ohms DC. Res. 4 MTG. Studs, each **59c**

100 mi 10H 59c

APN-1 RADIO ALTIMETER

Complete 420 MC transmitter-receiver unit, complete with all plugs, indicators. BRAND NEW **$34.50**

AN/PRS-1 MINE DETECTOR—BRAND NEW

.................................$9.50

BC-929-A

Contains power supply 110 V. 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes. Each $17.95; Used, ea..............$14.95

R-78/APS-15

Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes. Each **$39.50**

COMPASS RECEIVER MN-26

Remote control commercial type navigational receiver. Indicates direction of any desired transmitting station. 3 bands—frequency range: 150 Kc to 1500 Kc; has 12—6 V. type tubes. Brand new, original cost $600. Now **$24.95**

Accessories for Above:

Loop MN-20	$9.25
MN-28 Control Box	7.25
MN-52 Loop Control Unit	4.45
Loop Transmission cable—168" long	9.95
MC-124 Flexible Shaft	2.45
IN-40 Left-right Indicator	9.95
Set of 3 plugs	4.60
MN-40 Navigators Indicator	12.95

T-17B HAND MIKE

BRAND NEW . . . perfect carbon hand mikes, light wt., 200 ohms, single button, press to talk switch, 5 ft. rubber cord, plug, dust cover. ONLY **89c**

COMMAND RECEIVERS and TRANSMITTERS

(274N Series)—Complete with Tubes

	NEW
BC-454A; 3 to 6 MC (Receivers)	$5.95
BC-458; 5.3 to 7 MC	5.95
BC457; 4 to 5.3 MC	5.95
T-20/ARC-5 same Freq. BC-457	5.95
BC-456 MODULATOR. Brand New	2.95

RECEIVER

Low impedance, magnetic type receiver, ideal unit for pillow receiver or small microphone, NEW **39c**

HS-33 (Red plug), low impedance, Used, almost like new. With rubber cushions 8000 ohms or 200 ohms.................. **95c**

AN18/APT-10

Pre-amplifier Model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch, brand new in original cartons.

Each **$1.95** 3 for **$5.00**

BRAND NEW SCR-625 MINE DETECTORS

Used by Army to detect buried metallic mines. New, complete in original packing container. Worth many times this low price of **$39.95**

F.O.B. Shipping Point

ALTIMETER TRANSCEIVER RT-7/APN-1

Frequency 418-462 Mc FM, with 14 tubes: 3—12SJ7; 4—12SH7; 2—12H6; 1—VR150; 2—955; 2—9004; 27 V. Dynamotor, used in working condition **$7.95**

RECEIVER-POWER SUPPLY UNIT

For the APN-4 indicator; complete with 16 tubes; 110 V. 400 cycles. BRAND NEW **$10.95**

MONTHLY SPECIALS
SCR-283

40-80 METER XMITTER

New equipment: Transmitter-Modulator and coil sets to cover 2.5-7.7 mc, transmitter tubes 2 No. 10 special and 2 No. 45 special, receiver (less the receiver coil sets), receiver tubes 1—37, 1—38, 4—39/44, shock mounts, dynamotor, antenna switching relay, receiver control box, transmitter control box, charts, dials, and instruction book. What a sweet buy! Only.............. **$9.95**

SMALL PORTABLE MOTORS

No. 1—Universal type .24 volts DC shunt with two leads, 1½" diameter by 2½" long with ¼" shaft, ¾" long. New. Ea.... **$1.49**

No. 2—Delco motor .24 volts DC shunt type. 4 leads. 6000 R.P.M. 1½" diameter by 2½" long. ¼" shaft one inch long. NEW. Ea **$1.49**

No. 3—Pincor motor. 24 volts DC shunt type. 4 leads. 5000 R.P.M. 1½" diameter by 2½" long. ¼" shaft, ¾" long. NEW. Ea. **$1.49**

Above motors are ideal for small hand-driven portable applications. Set of 3 .... **$3.95**

REMOTE CONTROL BOX

BC-450—Triple receiver control box, can be modified to a FT-260 local control for command receivers, NEW **$1.95**

RADIO RECEIVER

Designed to receive A-N beam signals, 24-28 VDC 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier, 28D7, output amplifier, 195 to 420 kc. 4" high x 4" wide x 6⅝" long—wt. 3 lbs., 4 oz. BRAND NEW in original carton........ **$5.95**

ANTENNA THERMO-COUPLE METER

BC-442; 0-10 amps, with extra relay and 50 MMFD 5000 Volt condenser . . . used with command transmitters. BRAND NEW...... **$1.95**

ARB AIRCRAFT RADIO RECEIVER

The ARB is a six tube, four band, superheterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles. Used......... **$15.95**

R-89/ARN-5A

Glide path receiver. Crystal control of local oscillator, 332-335 mc, complete with relays, 7—6AJ5, 1—12SR7, 2—12SN7, 1—28D7, and 3 crystals: 6497 kc, 6522 kc, 6547 kc. 90-cycle band-pass and 150-cycle band-pass filters, excellent for making an intermodulation checker. Beautiful cabinet and chassis as foundation for many interesting experimental and construction projects. Broad pass band on 20.7 mc IF's ideal for television. Schematic furnished.

Used, excellent, Only................. **$6.45**

New $12.95

BC-733-D

Localizer receiver of the blind landing system. Companion to the glide path receiver. Also contains 90 and 150 cycle band-pass filters. 108.3 to 110.3 mc. by relay selection of crystals in the local oscillator. Wide pass-band on 6.9 mc IF's ideal for FM. Has a wonderful AVC system using rectified output of an RF oscillator as power supply for 100 volt DC bias. With relays, crystals, and 10 tubes: 3—717A, 2—12SG7, 1—12SQ7, 1—12A6, 1—12-AH7, 2—12SR7. Schematic furnished!

Condition: Used, excellent, only........ **$3.95**

New $9.95

VEEDER-ROOT METER AND CASE

Counts up to 1000. Each **59c**

HAND-TYPE MICROPHONE RS-38

Carbon type, with PL-68 plug, brand new...$1.95

Used 1.00

BC-645 TRANSMITTER-RECEIVER

BRAND NEW . . . 15 tubes interrogator-transmitter designed for airborne use, 435 to 500MC frequency range. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band: 420-450mc; fixed and mobile: 450-460mc; citizens radio band: 460-470mc; television experimental: 470-500mc; complete with all tubes, including WE Doorknob tube. Size 10½x13½x4¾". Net wt. only 25 lbs. Your cost........only **$9.95**

DYNAMOTOR FOR ABOVE Model PE-101-C $2.75

RADIO PARTS

100 Resistors ⅛ to 1 watt	**95c**
Electrolytic condensers 50-30, 150 Volt ....10 for	**$2.89**
½ Meg. Volume Controls 1" shaft with switch. 10 for	**$3.00**
½ Meg. Volume Controls 1" shaft without switch. 10 for	**1.95**
Crystal Pick-up, new light wt. ....each	**1.79**

400 CYCLE AUTOSYN MOTOR

Ideal for indicating direction of antenna systems—BRAND NEW...........each **$2.95**

All shipments F.O.B. Chicago or Los Angeles. 20% Deposit required on all orders. Minimum order accepted $5.00.

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1712-14 South Michigan Avenue
Chicago 5, Illinois

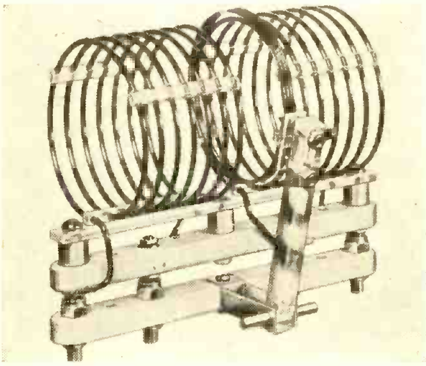
North Side Branch
1802 North Humboldt Blvd.
Chicago

West Coast Branch: 1260 South Alvarado, Los Angeles, Calif.

What's New in Radio

NEW INDUCTOR LINE

E. F. Johnson Co. of Waseca, Minnesota is now offering a new and comprehensive line of inductors and swinging link assemblies designed for the ham.



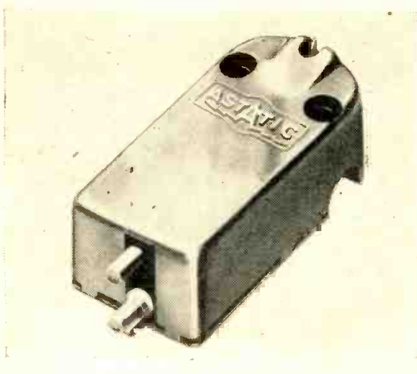
These new air-wound inductors are sturdily supported on polystyrene and come in 150, 500, and 1000 watt ratings. The coils are spaced to fit conventional jack and plug assemblies in their respective ratings. Also available in all power sizes is the company's complete line of semi-fixed link inductors.

The company, *E. F. Johnson Co.*, Waseca, Minnesota, will supply complete information on the line if you will ask for it.

ASTATIC PICKUP CARTRIDGE

Incorporating a new manufacturing principle, *The Astatic Corporation* is introducing the "Magneto-Induction Pickup Cartridge" which eliminates the need for delicately spaced air gaps.

The new pickup cartridge is available in two models, the Model MI-1 in a standard housing, and the Model MI-2 with a Mumetal housing. The Model MI-2 is said to provide increased shielding effect for maximum reduction of hum. The physical dimensions of these



cartridges are such that they may be employed with a majority of present-day standard pickup and transcription arms.

Velocity response of the pickup is given as flat to 12,000 cycles. The output is 100 millivolts. Needle pressure is one ounce and the unit has an impedance of 7500 ohms at 1000 c.p.s. and 110,000 ohms at 10,000 c.p.s.

Complete data on these pickup cartridges is available from *The Astatic Corporation*, Conneaut, Ohio.

"RANGE-MASTER"

Bradshaw Instruments Co. of Brooklyn has announced the availability of the new Model 10-F "Range-Master."

The new test unit provides direct reading on all of its 25 ranges. A three-inch meter, either round or square, has specially designed scales to provide maximum readability.

The "Range-Master" weighs approximately 6½ pounds and measures 8¾ by 7¼ by 4 inches. It is housed in a sturdy polished oak carrying case with a slip-joint hinged cover and handy compartment for tools and test leads.

Additional information on the Model 10-F is available on request. Write to *Bradshaw Instruments Co.*, 348 Livingston St., Brooklyn 17, New York.

AMPLIFIER KIT

The new 10576 amplifier kit just introduced by *Altec Lansing Corporation* will permit hams, hobbyists, and experimenters to build the company's A-328B unit for themselves.

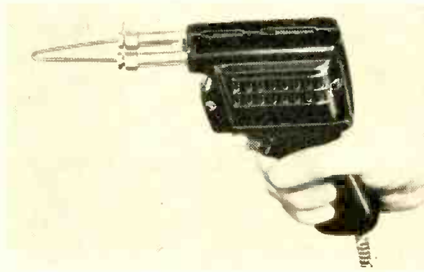
The kit consists of five elements, and includes the punched chassis and the special transformers and coil used in the amplifier. All other components, condensers, resistors, controls, etc., are standard parts, stocked by most distributors. The kit includes a TL-217B output transformer, TL-608 power transformer, a TA-325 low pass equalizer choke, a 10513 punched chassis, and a 10514 circuit diagram.

The kit will be available through regular jobber-distributor channels and further information on the unit may be secured from *Altec Lansing Corporation*, 250 West 57th Street, New York 19, New York.

220 VOLT SOLDERING GUN

The Weller Mfg. Co. of Easton, Pennsylvania has introduced two new soldering gun models.

Designed for use on 110 or 220 volts



at 50 or 60 cycles, these models are intended to meet the requirements of export customers. The 220 volt gun can be used wherever 115 volt, 60 cycle current is not available, but 220 v. current is.

Designated the ES-110 and ES-220, the new models provide single heat at 100 watts with a 4 inch reach from housing to tip. The five second heating, prefocused spotlight, and "Flexitip" of the regular *Weller* models are also features of these new units.

Further details on the ES-110 and ES-220 will be furnished by *The Weller Mfg. Co.*, Easton, Pennsylvania upon request.

D.C.-A.C. INVERTERS

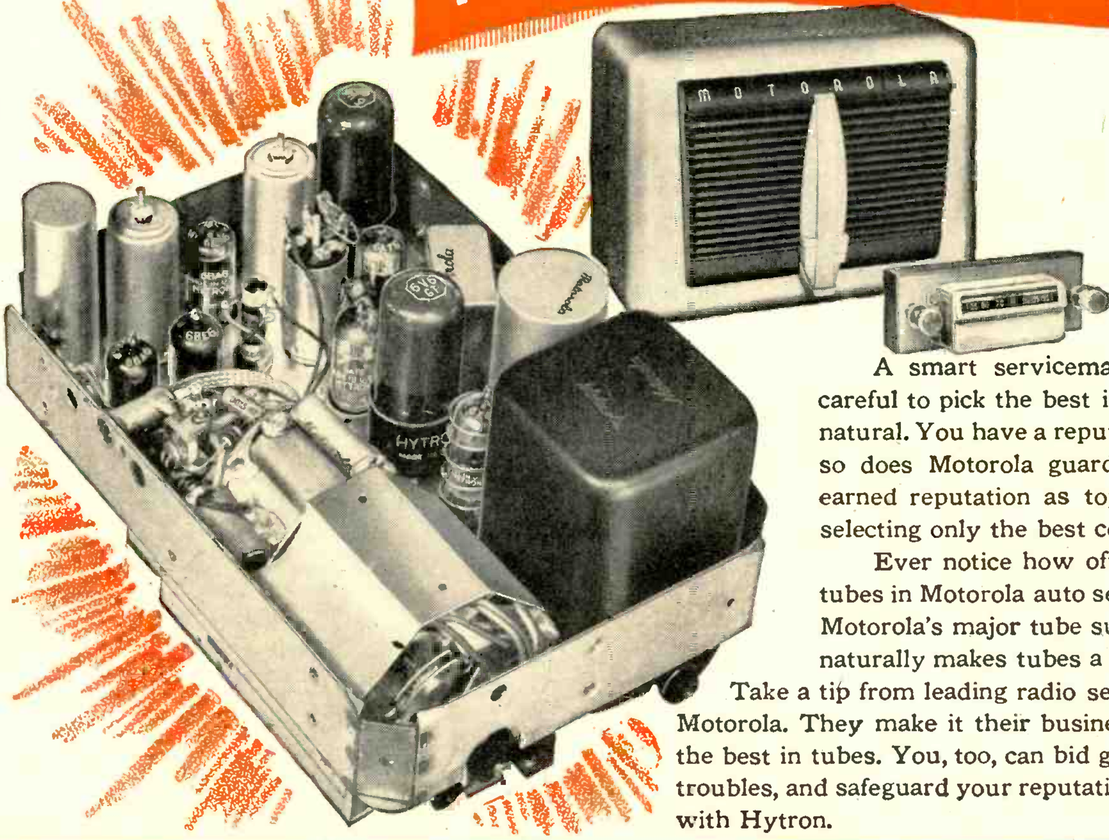
A complete new line of d.c.-a.c. inverters has been announced by *American Television & Radio Co.* of St. Paul.

Operating on d.c. input voltages ranging from 6 volts d.c. to 220 volts d.c.,

these units deliver an output of 110 volt, 60 cycle a.c. at output capacities ranging from 75 watts to 500 watts.

These inverters are specially designed for operating a.c. radios, p.a. systems,

TUBES ARE KNOWN BY THE COMPANY THEY KEEP



A smart serviceman, you are mighty careful to pick the best in tubes. That's only natural. You have a reputation to protect. Just so does Motorola guard jealously its well-earned reputation as tops in auto radio by selecting only the best components.

Ever notice how often you find Hytron tubes in Motorola auto sets? To rate as one of Motorola's major tube suppliers, Hytron just naturally makes tubes a lot better than good. Take a tip from leading radio set manufacturers like Motorola. They make it their business to know and use the best in tubes. You, too, can bid goodbye to your tube troubles, and safeguard your reputation by "going steady" with Hytron.

SERVICEMEN—Win These Monthly Prizes!

FIRST PRIZE, JULY
Hickok 156A Indicating Traceometer.

FIRST PRIZE, AUG.
McMurdo Silver 900A "Vomax," 904 C/R Tester, and 905A "Sparx."

FIRST PRIZE, SEPT.
Jackson 641 Universal Signal Generator.

FIRST PRIZE, OCT.
Weston 769 H-F Electronic Analyzer.

Want one of these deluxe first prizes? Perhaps a $200 U. S. Savings Bond grand prize? Or one of four $50 and four $25 U. S. Savings Bond second and third prizes? Try your hand at any or all of Hytron's monthly contests exclusively for radio servicemen. It's easy. Here's how. Get entry blank with complete details from your Hytron jobber, or write us. Describe your proposal for a simple, economical shop tool like the Hytron Tube Tapper or Miniature Pin Straighteners. Mail entry to Hytron Contest Editor. Then hold your breath. The finger of the judges may point at you.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

NEW 9-PIN
Miniature Pin Straightener

Only 49¢ at Hytron jobbers

television receivers, amplifiers, a.c. motors, and electrical appliances from d.c. voltage sources.

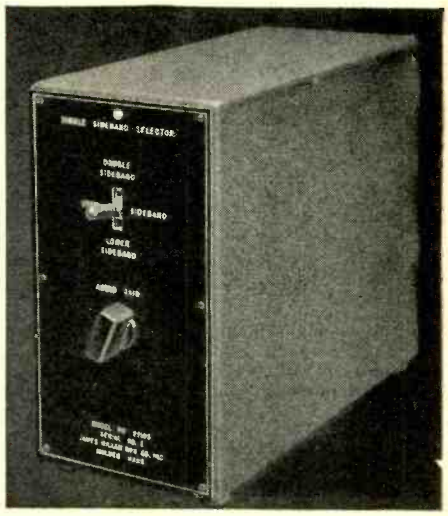
Featured in the line is an automatic switching unit for use as an auxiliary unit with 32 volt and 110 volt d.c. input inverters, permitting the automatic start and stop of these units as the load is turned on and off.

Complete descriptive literature covering the line is available free of charge from *American Television & Radio Co.*, 300 East Fourth Street, St. Paul 1, Minnesota.

SIDEBAND SELECTOR

James Millen Manufacturing Co., Inc. of Malden, Massachusetts, is currently marketing the No. 92105 Single Sideband Selector for use with amateur and commercial communications receivers.

Selectable single sideband reception provides many of the advantages of single sideband reception on all signals



without limiting its use to signals solely from transmitters with suppressed carrier, and thus requiring carrier reinsertion at the receiver.

The circuit of the No. 92105 utilizes two crystals, four tubes complete with their own power supply, r.f. and a.f. gain controls, and a telephone type lever switch for shifting between upper and lower sidebands.

The unit is readily connected to standard communications receivers without circuit alterations, and without in any way affecting the normal performance of the receiver.

Full details on the new unit are obtainable on request from *James Millen Manufacturing Co., Inc.*, 150 Exchange Street, Malden 48, Massachusetts.

BROOKS' FM TUNER

Brooks Electronic Laboratories of Waltham, Massachusetts is now merchandising the Model FMT-10 FM tuner which covers the frequency range from 87 to 109 mc.

(*Continued on page 108*)

MONEY BACK GUARANTEE — We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check on the design, calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

THE NEW MODEL 670

SUPER METER

A Combination VOLT-OHM- MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts. OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000. D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. RESISTANCE: 0 to 500/100,000 ohms, 0 to 10 Megohms. CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics). REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms. INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries. DECIBELS: −10 to +18, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, Crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3". **28.40 net**

THE NEW MODEL 770—AN ACCURATE POCKET-SIZE

VOLT OHM MILLIAMMETER

(Sensitivity: 1000 ohms per volt)

FEATURES:

Compact-measures 3⅛" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

Specifications: 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts.
6 D.C. VOLTAGE RANGES: 0-7½/15/75/150/750/1500 volts.
4 D.C. CURRENT RANGES: 0-1½/15/150 Ma. 0-1½ Amps.
2 RESISTANCE RANGES: 0-500 ohms. 0-1 Megohm.

The Model 770 comes complete with self contained batteries, test leads and all operating instructions .... **13.90 net**

THE NEW MODEL 450

TUBE TESTER

Speedy operation—assured by the newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS:

• Tests all tubes up to 117 volts. • Tests shorts and leakages up to 3 Megohms in all tubes. • Tests both plates in rectifiers. • New type line voltage adjuster. • Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes. • Noise Test defects microphonic tubes or noise due to faulty elements and loose internal connections. • Uses a 4½" square rugged meter. • Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—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. **39.50 net**

THE NEW MODEL 777

20,000 OHMS PER VOLT!!

TUBE & SET TESTER

TUBE TESTER SPECIFICATIONS:

• Tests all tubes including New Miniatures, etc. Also Pilot Lights. • Tests by the well-established emission method for tube quality, directly read on the scale of the meter. • New type line voltage.

V.O.M. SPECIFICATIONS:

• D.C. VOLTS: (at 20,000 Ohms Per Volt), 0 to 7.5/15/75/150/750/1,500 Volts. • A.C. VOLTS: (At 10,000 Ohms Per Volt), 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 Amperes. • RESISTANCE: 0 to 5,000/50,000/500,000 Ohms 0 to 50 Megohms.

Model 777 operates on 90-120 volts 60 cycles A.C. Housed in beautiful hand-rubbed cabinet. Complete with test leads, tubes, charts and detailed operating instructions. Size 13" x 12½" x 6". **59.95 net**

THE MODEL S-35—A POWERFUL

REFLEX PROJECTOR

COMPLETE WITH BUILT-IN DRIVER UNIT CONSERVATIVELY RATED AT 35 WATTS—WILL EASILY HANDLE UP TO 55 WATTS WITHOUT BLASTING.

Heavy gauge aluminum in the main trumpet section completely eliminates blasting and blaring. New plastic diaphragm overcomes the resonant peaks of the old type; also it is absolutely impervious to atmospheric changes whereas the old type was subject to atmospheric corrosion. We are enabled to guarantee the unit for one year.

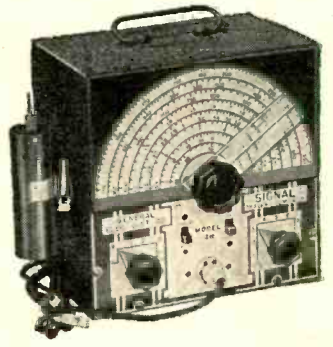
SPECIFICATIONS:

POWER (CONSERVATIVE)— 35 WATTS; AIR COLUMN—3½ FT.; DISPERSION—80°; POWER (PEAK)—55 WATTS; BELL DIAMETER—15"; IMPEDANCE—8 ohms; FREQUENCY RANGE—130 to 5000 C.P.S. PROJECTION—½ mile; FINISH—Attractive two tone crystalline.

The Model S-35 Comes Complete with Built-in Driver Unit, ONLY **28.50 Net**

THE MODEL 88—A *COMBINATION*

SIGNAL GENERATOR and SIGNAL TRACER



SIGNAL GENERATOR SPECIFICATIONS:

• Frequency Range: 150 Kilocycles to 50 Megacycles. • The R. F. Signal Frequency is kept completely constant at all out-put levels. • Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. • R.F. obtainable separately or modulated by Audio Frequency.

SIGNAL TRACER SPECIFICATIONS:

• Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.

The Model 88 comes complete with all test leads and operating instructions. ONLY **28.85 net**

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO.

Dept. RN8, 98 PARK PLACE NEW YORK 7, N. Y.

TUBES! R·H·S TUBES!

SPECIALS OF THE MONTH

SENSATIONAL TUBE SALE!

XMITTING—RECEIVING—CATHODE RAY—RECTIFIER—SPECIAL PURPOSE

BRAND NEW TUBES—STANDARD BRANDS ONLY

1B24	$4.95
1B25A	4.95
1B26	15.95
1B27	4.95
1B29	4.95
1B32	4.95
1B56	8.00
1N21	.59
1N23	.59
1P22	11.50
1P24	2.00
1S21	1.95
2AP1	2.95
2B22	5.35
2C21	.98
2C22	.39
2C26A	.75
2C34	.59
2C40	1.98
2C43	7.50
2C44	1.75
2C46	7.50
2D21	1.69
2D29	1.39
2E22	1.50
2E24	4.37
2E25	3.95
2E26	3.29
2E30	2.25
2J21A	14.95
2J22	24.95
2J26	14.95
2J31	24.95
2J32	24.95
2J34	24.95
2J38	37.50
2J39	34.95
2J40	34.95
2J42	34.95
2J49	34.95
2J51	34.95
2JB51	4.95
2J53	25.00
2J54	25.00
2K25	24.95
2K28	24.95
3AP1	2.95
3B22	4.95
3B23	4.95
3B24	1.95
3B25	.98
3B26	5.95
3BP1	2.95
3C21	5.95
3C22	2.95
3C23	4.95
3C24	.69
3C30	1.50
3CP1	3.00
3BP1	3.95
3EP1	3.95
3D21A	3.00
3E29	4.95
3GP1	4.95
4-65A	14.50
4-125A	27.50
4-250A	37.50
4A1	1.98
4AP10	6.95
4B24	4.95
4C35	19.95
4C27	8.95
4J28	34.95
4J29	34.95
5AP1	4.95
5AP4	5.95
5BP1	1.95
5BP4	4.95
5CP1	3.95
5CP7	13.95
5D21	29.95
5FP7	3.95
5GP1	9.95
5JP1	11.95
5J29	29.50
5J30	29.50
5LP1	11.95
5TP4	20.00
6AF6G	.88
6C21	24.95
6D4	1.95
6J4	3.95
6Q5G	1.25
7BP7	4.95
7EP4	17.95

7GP4	$19.40
9GP7	15.00
9JP1	3.95
9JP2	3.95
9LP7	4.95
9MP7	14.95
10BP4	34.95
10CP4A	42.20
10FP4	54.50
10HP4	49.50
10Y	.69
10 Spec.	.69
12DP7	14.95
12GP7	14.95
12JP4	60.00
15AP4	125.00
15E	1.50
15R	1.50
20AP4	270.00
23D4	.49
45 Spec.	.49
75TL	3.95
100TH	12.95
100TS	3.00
102F	4.00
114A	.69
114B	1.25
120	5.95
121A	2.65
203B	10.95
203R	5.95
204A	49.95
205B	4.50
211	.98
215A	3.00
217C	7.50
221A	2.95
222A	120.00
227A	3.95
241B	80.00
242C	5.95
249C	3.49
250R	7.95
250TH	19.50
250TL	19.50
252A	4.95
259A	4.95
274A	1.25
274B	1.25
301A	4.95
304TH	7.95
304TL	1.98
305A	12.95
307A	6.25
310	4.95
311A	1.98
316A	.89
322A	120.00
327A	4.95
331A	4.95
350/A/B	2.95
353A	4.95
368AS	9.95
371A	2.95
371B	2.95
388A	7.95
393A	7.95
394A	4.50
417A	24.95
434A	3.95
446A	1.95
450TH	24.95
503	195.00
527	12.95
531	49.50
575A	14.95
632A	9.95
701A	4.95
702A	3.95
703A	4.95
704A	1.98
705A	2.95
706BY	24.95
706CY	24.95
707A/B	24.95
708A	7.95
709A	9.95
713A	1.65
714AY	14.95
715A/B	19.95
715C	29.50
717A	1.65
720CY	34.95
721A/B	4.35
723AB	5.95

724A/B	$4.95
725A	24.95
726A	23.50
800	2.25
801A	.98
802	2.95
803	8.95
804	9.95
805	4.95
806	17.50
807	1.25
808	2.95
809	2.50
810	7.95
811	2.25
812	2.95
812H	6.90
813	7.95
814	4.95
815	2.50
816	1.19
822	11.95
826	.79
827R	99.50
828	6.95
829/A/B	7.95
829B/3E29	4.95
830B	5.25
832/A	3.95
833A	39.50
836	1.15
837	2.50
838	3.95
841	.69
843	.69
845	4.95
845W	5.95
851	98.00
852	14.95
860	3.00
861	49.95
864	.69
865	.98
866A	.89
868	1.95
869B	75.00
872A	2.50
874	2.49
876	.98
878	2.49
879	.89
884	.98
889	.98
891	110.00
892R	200.00
902P1	7.95
905	11.95
920	2.95
923	.98
931A	4.95
950	1.06
953B	4.95
954	.75
955	.75
956	.75
957	.75
958A	.75
959	.75
991	.69
1000 Spec.	24.95
1000T	75.00
1611	.99
1613	.75
1614	1.75
1616	1.39
1619	.75
1621	1.98
1622	1.75
1624	1.75
1625	.49
1626	.49
1627	7.95
1629	.69
1630	7.50
1636	5.95
1638	.98
1641	.79
1642	.98
1654	1.98
1665	.98
1851	1.25
1852	1.06
1853	1.06
1963	.95
2050	.98
2051	.98
2140	20.00
5514	4.95
5516	5.95
5562	10.00
7192	.39
8005	4.95
8011	2.95
8012	4.95
8013	2.95
8016	1.89
8020	3.95
8027	7.95
C5B	12.95
C6A	9.95

C6J	$12.95
6EQ72	1.95
CK1005	.39
CK1006	.69
EF50	.79
EL3C	4.95
EL225	1.95
F123A	12.95
F127A	22.50
F660	150.00
FG81A	6.95
FG105	19.95
FG238B	160.00
GL146	11.00
GL605	250.00
GL697	150.00
HF100	3.95
HF200	17.95
HY24	1.50
HY69	2.49
HY75	1.25
HY114B	1.25
HY115	1.25
HY31Z	5.50
HY615	1.25
HYE1148	.48
HY1251Z	5.50
HY1269	5.50
KC4	105.00
KU676	22.00
ML100	105.00
ML101	150.00
ML502	300.00
MR4	90.00
QK59	49.50
QK60	49.50
QK61	59.50
QK62	59.50
REL21	4.25
RK12	1.95
RK21	3.95
RK22	4.95
RK25	2.95
RK33	.98
RK34	.59
RK59	3.95
RK60	.79
RK69	49.50
RK72	1.95
RK73	3.95
RX120	10.00
T20	1.95
TZ40	2.95
UX6653	3.95
V700	6.95
VR75	.98
VR78	.75
VR90	.75
VR91	1.49
VR92	.75
VR105	.75
VR150	.98
VT127A	3.00
VU111	1.19
WL460	14.95
WL468	14.95
WL532A	4.95
WL562	150.00
WL616	105.00
WL619	49.50
Z225	1.95
OY4	.99
OZ4	.99
OZ4G	.99
1A3	.81
1A4P	1.54
1A5GT	.67
1A6	1.20
1A7GT	.81
1B3/8016	1.89
1B4P	1.54
1B5/25S	1.20
1C5GT	.81
1C6	1.20
1C7G	1.20
1D5GP	1.54
1D7G	1.20
1D8GT	1.54
1E5GP	1.62
1E7G	1.54
1F4	.99
1F5G	.99
1F6	1.54
1F7G	1.54
1G4GT	.99
1G5G	.99
1G6GT	.99
1H4G	.81
1H5GT	.67
1H6G	1.20
1J5G	1.20
1J6G	1.20
1J6GT	1.20
1L4	.81
1LA4	1.20
1LA6	1.20
1LB4	1.20
1LC5	1.20
1LC6	1.20

1LD5	$1.20
1LE3	1.20
1LH4	1.20
1LN5	1.20
1N5GT	.81
1P5GT	.99
1Q5GT	.99
1R4/1294	1.20
1R5	.81
1S4	.99
1S5	.99
1T4	.81
1T5GT	.99
1U4	.81
1U5	.99
1V	.81
2A3	1.20
2A4G	1.54
2A5	.81
2A6	.99
2A7	.99
2B7	.99
2E5	.99
3B7/1291	1.54
3D6/1299	1.54
3LF4	1.20
3Q4	.81
3Q5GT	.99
3S4	.81
3V4	.81
5T4	1.54
5U4G	.62
5V4G	.99
5W4	.99
5W4GT	.62
5X4G	.67
5Y3GT	.39
5Y4G	.57
5Y4GT	.57
5Z3	.67
5Z4	.99
6A3	1.20
6A4/LA	1.20
6A6	.99
6A7	.81
6A8	.81
6A8G	.81
6A8GT	.81
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6J5GT	.62
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6SF5GT	.81
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6SG7	.81
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6SH7GT	.81
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6SJ7GT	.67
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7A6	.81
7A7	.81
7A8	.81
7B4	.81
7B5	.81
7B6	.81
7B7	.81
7B8	.81
7C5	.81
7C6	.81
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12SA7GT	.81
12SC7	.81

12SF5	$.67
12SF5GT	.67
12SF7	.81
12SG7	.81
12SH7	.81
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14B8	.99
14C7	.99
14E6	.81
14F7	.99
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14J7	1.20
14N7	1.20
14Q7	.99
14R7	.99
15	1.20
19	1.20
24A	.81
25A6	1.20
25L6	1.20
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25Z6GT	.62
26	.67
27	.62
30	.81
31	.99
32	1.20
32L7GT	1.54
33	1.20
34	1.20
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35A5	.81
35B5	.81
35L6GT	.67
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35Y4	.99
35Z3	.81
35Z4GT	.57
35Z5GT	.52
36	.99
37	.67
38	.81
39/44	.99
41	.67
42	.67
43	.67
45	.67
45Z3	.67
45Z5GT	.67
46	.99
47	.99
49	.99
50	1.62
50A5	.99
50B5	.81
50L6GT	.67
50Y6GT	.67
53	.99
55	.81
56	.67
57	.81
58	.81
59	1.20
70L7GT	1.62
71A	.81
75	.67
76	.67
77	.67
78	.67
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81	1.54
82	.99
83	.99
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Code Oscillator

By PAUL M. CORNELL, W8EFW

Neither transformers nor batteries are needed in constructing this two-tone code practice oscillator.

THE accompanying diagram and photos show a simple neon bulb audio oscillator circuit which will deliver satisfactory headphone volume and key easily for code practice. Two tones, a high frequency and a low frequency, are available at the click of a switch. Earphones and key are in "cold" circuits and will not cause shock.

By using the postwar selenium rectifier, the problem of providing filament voltage for a tube rectifier has been eliminated. The low ohm (50-100 ohm) resistor keeps the selenium rectifier from running too warm.

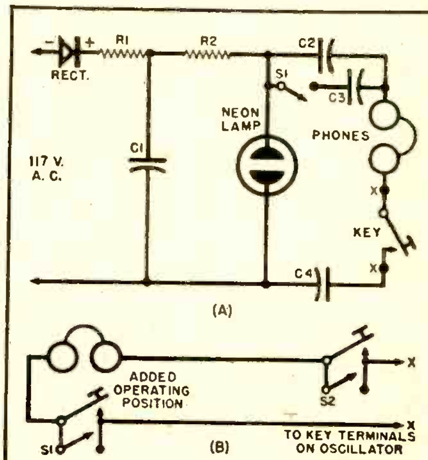
Almost any value of filter condenser, from 1 μfd. up, can be used. Ours happened to be a 5 μfd., 200 volt d.c. unit. The 200 volt d.c. working voltage is the lowest voltage rating filter condenser that can be used, however.

The oscillator circuit itself requires at least 3 megohms as a series resistor. Tests showed that a lower value of resistance caused a loss of oscillations. Some slight tone change occurs as the resistance increases, and one hears a lower frequency tone when a resistor of higher ohmage is used.

The answer to varying tone, however, was found in the coupling condensers (C_2, C_3) run from the positive side of the neon bulb to the phone/key circuit. A .00025 μfd. condenser produced a very high frequency whistle, while a .01 μfd. condenser caused a low frequency tone in the earphones. As a compromise, a .001 μfd. unit (C_3) was selected for the low frequency tone, and a 100 μμfd. condenser (C_2) for the high frequency whistle.

A variation of the capacity of the negative voltage coupling condenser (C_4) will produce some change in tone but it is not as effective as varying the value of the positive coupling condensers (C_2, C_3).

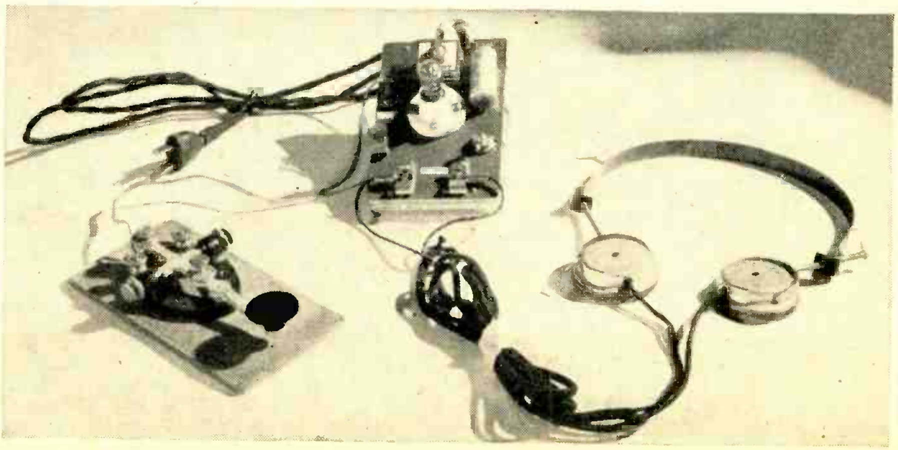
This unit uses a ¼ watt standard neon bulb, but a regular 1 watt size works fine, too. A previous unit which was built into an old *McElroy* code

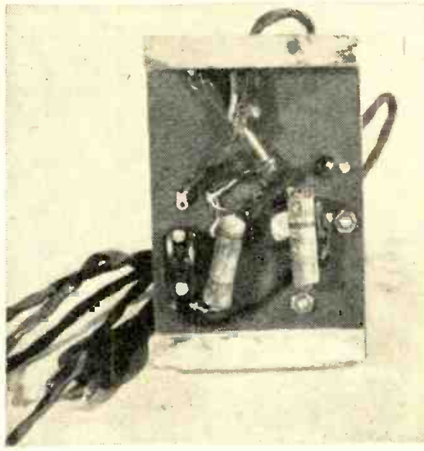


R_1—50 to 100 ohm, 1 w. res.
R_2—4 megohm, ½ w. res.
C_1—1 to 8 μfd., 200 v. elec. cond.
C_2—100 μμfd. mica cond.
C_3, C_4—.001 μfd., 200 v. cond.
S_1, S_2—S.p.s.t. toggle sw.
1—75 ma. selenium rectifier
1—Key
1—¼ w. neon lamp
1—Headphone set

Wiring diagram for code oscillator.

Top view shows construction of oscillator and connections for key and headset.





Under chassis view.

practice case, replacing the 117N7 tube unit, used the common night-light variety of neon bulb and worked very well. However some trouble may be experienced with nightlights, as they don't all seem to be good oscillators. The neon bulbs incorporated in this unit are used as is, without removing the resistor in the base.

Reversing the position of the key and phones may cause a carryover background oscillation. If this occurs it may be necessary to connect the key first, from positive coupling condensers to phones.

Additional keys and phones can be added in series as shown, using the usual telegraph circuit arrangement. The key switch at the receiving station must be closed while the other station's key is being used. If a carry-over tone is noted in the phones, reverse the line connections to the other key and phones.

Requiring few parts and small space, a unit of this type should prove ideal for code practice work.

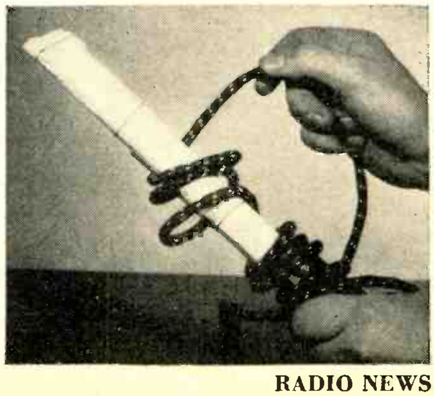
—30—

ASBESTOS HOLDER

A HOLDER for the soldering iron may be easily assembled from a sheet of asbestos and some fine wire.

A cylinder of asbestos is made with the one end folded back and held in place with the wire. A turn or two of wire is placed near the other end of the asbestos and in the middle.

By using this holder the iron may be replaced in the service kit without waiting for it to cool. . . . . . . H.L.



New Developments in D. C. AMPLIFIERS

By DON M. WHERRY, WODEX

A general understanding of d.c. amplifiers and their applications should be of value to the serviceman.

IT IS commonly known in the electronic engineering field that uses for d.c. amplifiers are almost too numerous to mention but for some obscure reason the experimenter and amateur seem to be almost unaware of their existence. The layman may ask, "What good are they?" or "What do they do?" To answer the last question first it can be said that a d.c. amplifier occupies the same place in the d.c. field as the a.c. amplifier does in its field. The other question will be answered by the reader after his perusal of this article.

In designing a d.c. amplifier the choice of tubes is the most important single item, even more important than in a.c. work. The two characteristics to choose are sharp cut-off and high gain. No attempt will be made to go into the mathematics or characteristic curves as reasons for such requirements as the importance of these two items will be clear after a study of the diagrams and explanations.

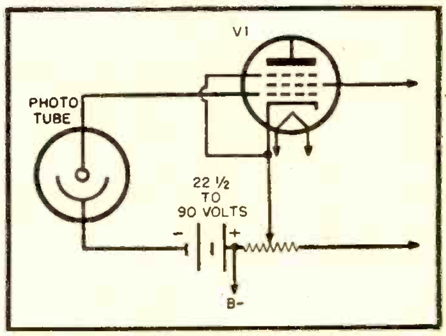
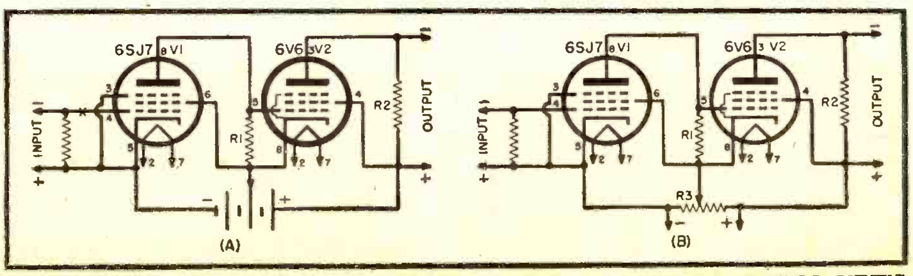


Fig. 1. Phototube input to d.c. amplifier.

Fig. 2A shows a simple, two-stage d.c. amplifier, the principal point of difference from the a.c. type being the absence of condensers. The addition of bypass condensers may improve the performance in some cases, however. It can be seen from the diagram that at no-voltage input the first tube is without bias of any sort. For this reason the plate voltage should be kept at a value sufficiently low to keep the plate dissipation within the rated value. Bias could be added in series with the grid return resistor but such biasing is not advisable unless it is in the form of a battery inserted between the grid and the resistor on the grid side of the input. Cathode bias, in the form of a cathode resistor, should be avoided as a general rule as it operates in opposition to the voltage to be measured. Input polarity must be observed under these conditions as the input tube already is drawing maximum current and a plus voltage applied to the grid will have little or no effect. If it is impossible to isolate the minus input voltage from, say, a common ground with the amplifier itself, it will be necessary to add the bias battery as mentioned. In this event care should be taken that the tube is not biased beyond cut-off because it will then be necessary to apply an equal amount of positive voltage at the input to overcome the "beyond cut-off" portion of the bias before any output will be developed across the plate load resistor, R_2. Assuming the circuit is as shown in Fig. 2A it can be seen that with no input V_1 draws maximum current causing a large voltage drop across its plate load resistor, R_1. This unit also serves as the grid return resistor for V_2 as its

Fig. 2. (A) Two-stage d.c. amplifier. (B) Addition of voltage divider in "B" circuit.



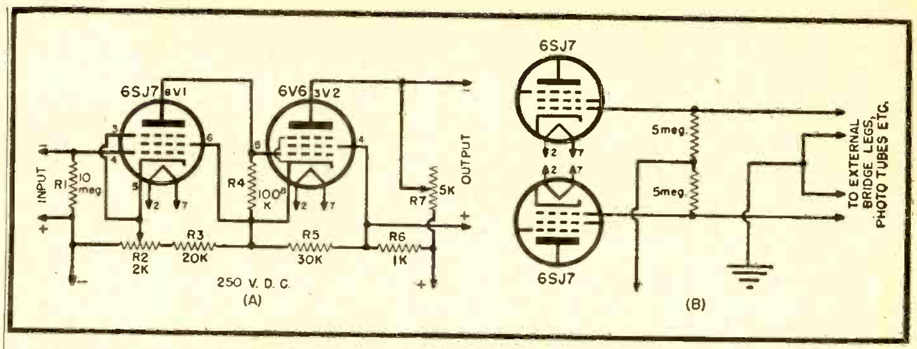


Fig. 3. (A) Practical circuit using the basic d.c. amplifier circuit. (B) Extremely sensitive temperature indicator using thermocouples in a bridge circuit. Other devices, such as phototubes, may also be used for the two bridge legs.

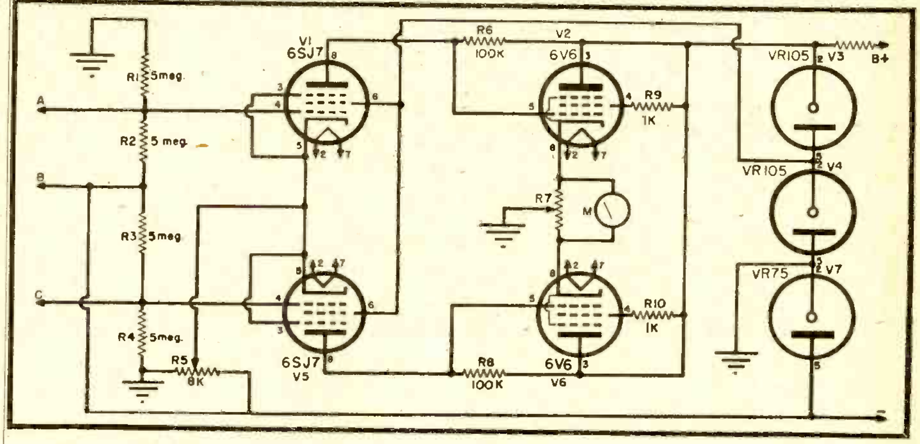
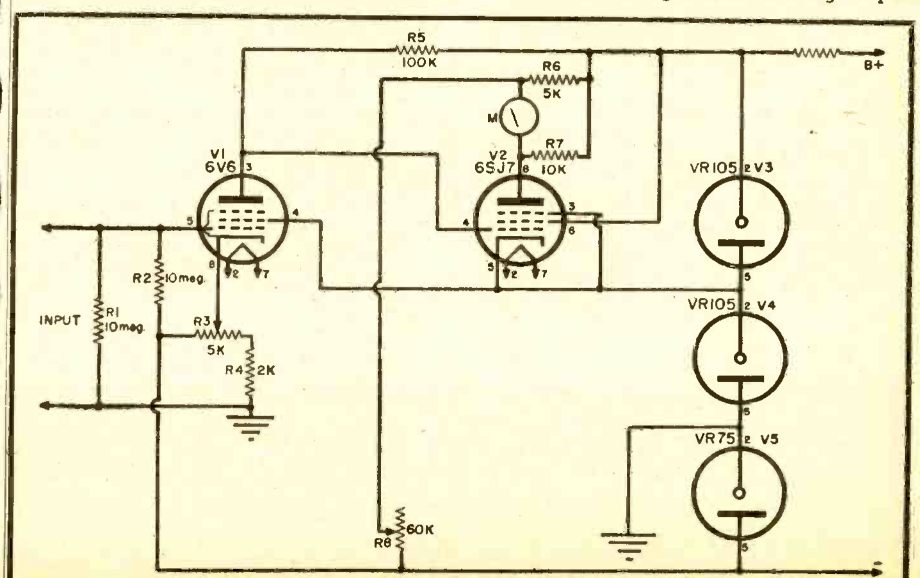


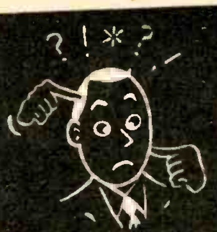
Fig. 4. Push-pull circuit for increased stability and low impedance output. With leads A, B, and C brought out, both plus and minus voltages can be read with a left-hand zero-reading meter. An external bridge input can be connected to A and C, in which case, R_1 and R_4 can be omitted, B left open, and the center of the external legs grounded as shown in Fig. 3B.

cathode connects to the "B plus" end of R_1. It follows that with no input to V_1 the grid of V_2 is biased heavily by the large drop across R_1 and no current flows through its plate load resistor, R_2, and consequently no output is obtained. This load resistor is used when a high impedance voltage-operated device is used for the output but when a current-operated device is used the resistor may be omitted.

While this is the basic circuit for a two-stage d.c. amplifier there are several things which make it undesirable in actual practice, chief of which is lack of any adjustments. As was mentioned, no input means V_2 may be biased far beyond cut-off in which case some def-

Fig. 5. Voltage regulation is used to prevent line voltage changes from altering output.





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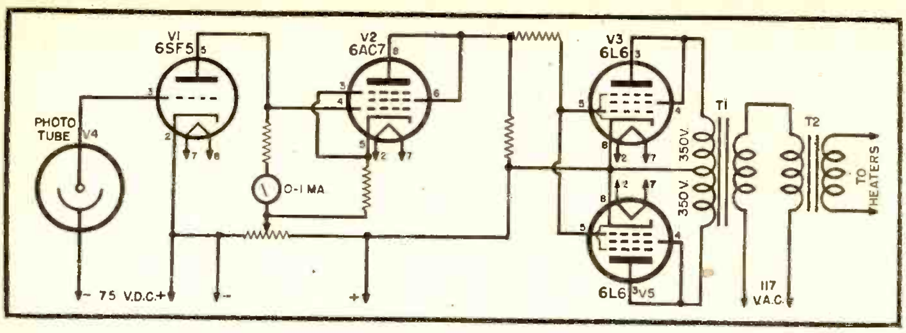

Fig. 6. This amplifier uses a light to control a heater voltage. A very small light variation changes the load on T_1 secondary which reflects a higher, or lower, impedance in series with the heater transformer primary (T_2). This is the basic control circuit for a Dew Point Indicator, developed by the author.

inite input voltage must be applied *before any output is available.* This situation is remedied in actual practice by the addition of a variable resistor across the "B" voltage as shown in Fig. 2B. This resistance is then varied until the drop across R_1 is exactly equal to the cut-off voltage of V_2 thereby giving no output but allowing the output to rise at once with the applied input.

A practical circuit using the basic d.c. amplifier is shown in Fig. 3A in which R_2 is a slider resistor which is used to set the bias on V_1 for the required current flow to place the grid of V_2 at just slightly on the positive side of cut-off. This will allow a small current flow through V_2 and consequently a small output. This output is cancelled out by the proper adjustment of R_1 which allows a current to flow through the output in opposition to the tube current. This is a simple zero-adjustment that can be applied to a great many instruments. As previously mentioned if a high impedance voltage-operated device is used on the output, a plate load resistor should be added across the output terminals. However an extremely sensitive voltmeter can be made by using a 1 milliampere meter across the output terminals of this amplifier. Also if a phototube is used for the input (Fig. 1) and a meter or sensitive relay for the output an instrument of almost unbelievable sensitivity to light can be obtained. Additional stages may be added for increased sensitivity if desired but it must be noted that no input becomes maximum output and vice versa through each tube. For this reason your amplifier probably will need an even number of stages. The sensitivity of four stages would be more than necessary and difficult to handle. For that reason two are usually used. Also d.c. amplifiers are much more susceptible to line voltage fluctuations than a.c. types because instead of simply having a slight effect on the gain as is the case with a.c. units any fluctuation is directly read on the output as a change in reading. Where the output device is a relay or some such piece of apparatus small output changes may be inconsequential except in cases of extreme sensitivity, but where the output is fed into a recording meter, for example, changes other than input cannot be tolerated.

For this reason the circuit for a recording meter (Fig. 5) was developed.

A brief explanation of this circuit is as follows. At "nc input" the grid of V_1 is approximately 37 volts negative with

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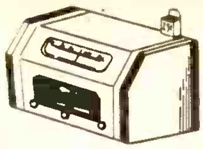

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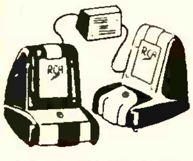

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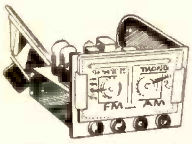

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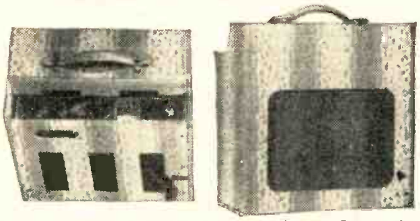
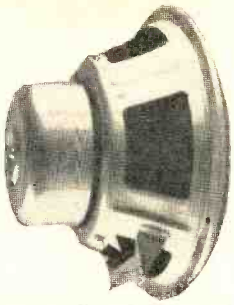
$59.50 VALUE MUSICAL AMPLIFIER WHILE THEY LAST $24.95



8 watt musical amplifier. 4 tube AC type. Inputs for crystal or dynamic mike and phono or instrument pickup. 2 gain controls and tone control. Has heavy duty built-in 8" speaker. Attractive leatherette covered case. Made by a large manufacture to sell at $59.95. Brand new, fully guaranteed. For 110 volt AC operation. Our scoop price, $24.95. Stock No. XR-3. Contact instrument pick-up, $6.95 extra. Deluxe instrument pick-up; with volume control, $8.95 extra. Crystal mike and desk stand $4.95 extra. Shipping weight, 20 lbs.

3-TUBE MUSICAL AMP. $19.95

In same deluxe case as the model XR-3 shown above. Has same features except it is designed for instrument pickup only. No input for mike. Stock No. XR-22. Net $19.95.



★ SALE ★ "COAXIAL" 12" PM SPEAKER

$12.95

Two for $25.00

Designed by one of America's finest speaker builders for FM high fidelity radios; selling in the $500.00 bracket a 12 in. Alnico 5 PM with 4 in. built in tweeter. The high pass filter is built in. Just hook to any 8 ohm voice coil winding on the output transformer. Will take 18 watts. This speaker should sell for $35.00. Stock No. 4-12X. Weight 8 lbs. Net $12.95

12" COAXIAL P.M. SPEAKER $9.95

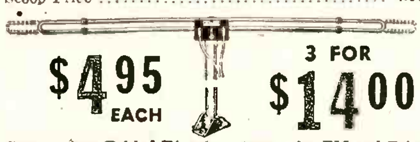
Model 12-RN. Our leading value in a 12 inch Coaxial Alnico V. P.M. speaker. Has the same electrical features and is equal in every respect to the model 4-12X speaker described above, except is shipped less the pot cover and is cadmium plated instead of opalescent grey finish. A scoop at only $9.95. Two for $19.00. Weight 12 lbs.

15 inch Juke box type PM speaker with 1½ inch 8 ohm voice coil and 21½ oz. alnico V. magnet. Will take 30 watts of audio. Model M-2 net $19.95 two for $38.00.

12 25 watt alnico V. PM speaker with 1¼ inch 8 ohm voice coil and 12.1 oz. alnico V. magnet. Model 2K1 net $9.95.

SAVE ON FIELD SPEAKERS

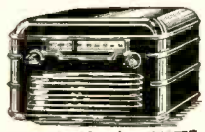
4 in. Dynamic. 450 ohm field.................$1.89
5 in. Dynamic. 450 ohm field................. 1.89
5 in. Dynamic. 1000 ohm field................. 1.89
8 in. 2 ohm field for heavy duty auto radio use 2.95
8 in. Dynamic. 1000 ohm field................. 2.95
12 in. Dynamic. 1000 ohm field................. 4.95
12 in. RCA 450 Reg. 10.00 net 1¼" Voice Coil Scoop Price 4.95



$4.95 EACH — **3 FOR $14.00**

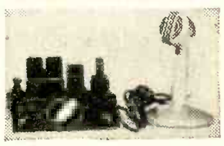
Super value. Folded Di-pole antenna, for FM and Television. Complete with 60 feet of twin 300 ohm line and 4 low-loss stand-off insulators. This folded di-pole covers frequencies 42 through 108 megacycles. Trombone action makes exact tuning to any one weak station. Furnished with adjustable mounting bracket. Has 5 foot mast. Made for Stromberg-Carlson. Stock No. Mt-300—Net $4.95. Weight 4 lbs. Individually packed.

4 TUBE RADIO KIT $6.95



4 tube AC-DC, TRF radio kit. Ideal for students and beginners. Every part furnished to build this kit, including tubes, diagram and photos. Has Alnico V PM speaker and tubes 12SK7, 12SJ7, 50B5 and 35W4. Plastic cabinet with slide rule dial. Receives broadcast 550 to 1600 KC. This is the easiest type of radio to build. Kit Model TF-4 Net $6.95. Weight 6 lbs.

1948 MODEL—MIKE-BROADCASTER ONLY $7.95



Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2-35L6, 12SJ7 and 35Z5 tubes. Priced with tubes and connecting instructions. Wired and tested. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

Brand New

ELECTRONIC MEGAPHONE SCOOP PRICE $39.95

Only 109 of these Brand New Electronic Megaphones to sell. You may see these listed at a lower price, but ours are new and guaranteed to work. Amplifier straps on shoulder, then just hold megaphone and speak into mike, mounted on rear of projector. Pull switch to turn on dry battery operated amplifier.

ORDER 100 RADIO TUBES $35.00

Individually Cartoned — Full Replacement — Branded HYVAC — You Pick the Types from List Below — 39c EACH — 100 for $35.00

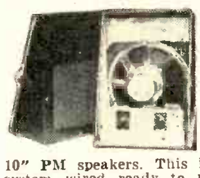
117P7GT	6Q7 GT	1S5
32L7GT	6V6 GT	3Q4
12A8GT	6X5 GT	3S4
12K7 GT	6SA7 GT	1B4
25Z6 GT	6SD7 GT	12K8
6A7	6SK7 GT	12A6
47	6SN7 GT	12SF7
12F5 GT	6SQ7 GT	6F5
6S8 GT	25L6 GT	6J5
6P5 GT	7017 GT	6SJ7
3V4	117L7 GT	12SJ7
6C5	117Z3	6AJ5
12SA7 GT	12AT6	6SF5
12SK7 GT	12BA6	6BA6
12SQ7 GT	12BE6	6BE6
35L6 GT	35W4	6AT6
35Z5 GT	35B5	6X4
50L6 GT	50B5	6BJ6
6K7 GT	1T4	6AK5
6A8 GT	1L4	6BH6
5Y3 GT	1U4	80
6K6 GT	1R5	

75% OF ALL THE TUBES YOU USE 49c EACH

Guaranteed Standard Brands Cartoned and Uncartoned

12AH7	6K7	6SL7	12SG7	12SQ7
27	9001	6SN7	12SH7	12SR7
26	9002	6SG7	12SJ7	50L6
78	9003	6SR7	12SA7	12SK7
76	1625	6V6 GT	12SL7	25L6 GT
3S4	6SA7	6X5 GT	12SC7	35L6 GT
5U4G	6SC7	6AB7	1T4	35Z5 GT
5Y3G	6SF7	12AT6	1R5	35W4
6AC7	6SQ7	12BA6	1S5	50B5
6C5	6SH7	12BE6	6R7	
6H6	6SJ7	12H6	6L7	
6J5	6SK7	12J5 GT	7Z4	

59c each 1½ Volt Octal—1N5 GT, 1H5 GT, 1A7 GT, 1A5 GT. 69c each Loctal Tubes—50A5, 35A5, 7A7, 7B7, 7E7, 7F7, 7N7, 7C5, 7Y4, 0Z4, 35Y4, 14A7, 14B6, 14Q7, 7E5. 79c each 1½ Volt Loctal Tubes— 1LN5, 1LC6, 1LH4, 1LD5.

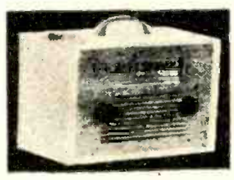


PORTABLE P.A. $39.95

18 watt complete portable public address system. Has inputs for a crystal or dynamic mike and phono pickup. Has push-pull 7C5 tubes in output. Attractive leatherette covered split type case. Priced complete with two 10" PM speakers. This is a complete public address system wired ready to play. Stock No. RC-18. Net $39.95. Priced complete with crystal mike and desk stand.

Amplifier chassis only with tubes, less speaker, case and mike; in kit form. Diagram furnished. Stock No. AC-18 Net $10.95. AC-18 amplifier wired and tested. Net $14.95.

PORTABLE KIT, $10.95



- 4-Tube Broadcast Superhet
- Priced Complete with Batteries
- Dynamic Speaker
- Slide Rule Dial

PERSONAL PORTABLE KIT MODEL K-PX. Small size leatherette covered case 9x5½x5. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with avc. Has 3 inch Alnico five PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1S5, 1T4 and 3S4. Not AC DC, but straight battery operated. Has 2 gang cond. Everyone should have one of these personal portables. Everything furnished. Kit K-PX ....Net $10.95

3-Way Portable Kit $16.95. 4 tube plus disc rectifier. 300 hour battery pack included. Beautifully built portable case. Operates on 110 volts AC or self contained battery. Receives broadcast 550 to 1650 KC. All parts including tubes are furnished. Uses disc rectifier, 1R5, 1T4, 1S5 and 3S4. Leatherette cabinet. Model 3-ZA Net $16.95.

20-WATT UTILITY AMP. KIT, $17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—6SN7, 6J5, 2—6L6GA, 5Z3. Kit Model 20-LX......Net $17.95

INTER COM KITS $7.95

Inter-com kit. All parts furnished to build a small two-way call system (Master and one sub-station speaker). Has 3" speaker and tubes 70L7 and 12SL7. Has separate 3" speaker for sub-station. Ready punched chassis. Everything complete, less cabinet. Diagrams and photo furnished. Kit TB-3. Net Price $7.95.

McGEE RADIO COMPANY

WRITE FOR CATALOG *Prices F.O.B. K.C.*

SEND 25% DEPOSIT—BALANCE C. O. D. 1225 McGEE ST., KANSAS CITY, MISSOURI

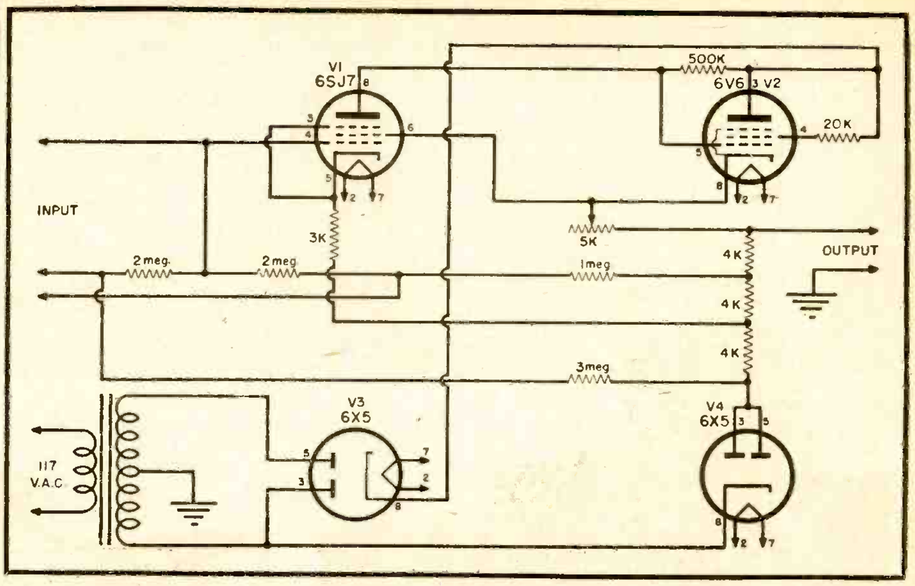


Fig. 7. Another interesting variation of the basic d.c. amplifier unit.

respect to ground while the cathode voltage is adjusted by R_3 to a point just negative enough with respect to the grid to allow a sufficiently large current through the tube and plate load resistance, R_5, to give the necessary voltage drop to bias V_2 to normal class A condition. Under these conditions R_8 is adjusted to cancel out the plate current of V_2 through the output device giving zero output. As a negative voltage is applied to the grid of V_1 the grid moves towards cut-off causing V_2 grid to go less negative. This, in turn, allows the plate current to overcome the bleeder current through R_8 and R_6 thereby giving an output. This circuit is desirable because it possesses good stability and can measure both positive and negative voltages—if a center-reading zero meter is used.

If even more stability, coupled with a good low impedance output is desired this circuit may be modified into a push-pull type as shown in Fig. 4. The operation of this circuit is almost identical to Fig. 5 with the exception of the output which is connected across R_7, the cathode resistor which is common to both tubes. This circuit is particularly well adapted to phototube work where very high sensitivity and good stability is desired.

A temperature indicator of extreme sensitivity can be constructed by using two thermocouples made from #40 constantan and iron wire and connected in the bridge circuit shown in Fig. 3B. One couple should be mounted in a bath of mercury or water in order to hold steady at room temperature and the measurements made with the other. Two strain gauges may be used to measure the amount of flexing of anything from your beam antenna support to a bridge girder. In fact, the uses to which this d.c. amplifier may be applied are only limited by the inventiveness and ingenuity of the experimenter or amateur.

You have perhaps read that d.c. amplifiers are inherently unstable. This is unquestionably true and if the experimenter goes into multi-stage or unstabilized amplifiers of very high sensitivity he possibly will encounter some grief. However, when one carefully constructs an amplifier according to Fig. 4 in which the voltages are stabilized and push-pull is used to further minimize voltage fluctuations the instability simmers down to that caused by thermal agitation and changes in the "mu" of tubes which should cause little concern.

It is now apparent why tubes having a high amplification factor and a sharp cut-off should be used. The high amplification factor is required in order to obtain the high plate current change with given grid change and the sharp cut-off is needed because in many cases the tubes are operated at exactly cut-off condition.

All in all the d.c. amplifier is an interesting and instructive piece of equipment and one can go from the basic units described here into an endless chain of developments. See Figs. 6 and 7 for interesting variations and applications. Get your junk box out and let your imagination run. —30—

MOTOROLA SALES CONTEST

MOTOROLA, Inc. has announced a $50,000 prize contest for their distributor's salesmen to stimulate the sale of the company's auto radios.

In addition to the $50,000 worth of merchandise offered to salesmen, the company is awarding $1,000 to the distributors whose salesmen top the list. The company is awarding 1948 Chevrolets, cash, chests of silverware, home appliances, home furnishings, luggage, cameras, and baby strollers as prizes.

The contest which started May 27th will close August 31st. —30—

"Television and FM Servicing"

Practical On-the-Job Training Program for the Better Serviceman Who Wants Greater Earnings and Security In This Expanding Field

THIS basic CREI Servicing Course paves the way to greater earnings for you. Since 1927 thousands of professional radiomen have enrolled for our home study courses in Practical Radio Engineering. Now, for the first time, we introduce a Practical Servicing Course. You do not have to be, or want to be, an engineer to benefit from this course. It is written for *you* — the average good serviceman! It's not too elementary for the experienced. It's not "over the head" of those who have limited experience—if they have real ambition and natural ability.

CREI developed this course at the request of several large industrial organizations. The urgent need of capable, trained servicemen is one of the big problems of the industry. Hundreds of thousands of Television Receivers will be marketed in 1948. In years to come millions more will flow into American homes. With Television comes FM receivers and circuits. This new field demands a tremendous increase in the number of properly trained television and FM technicians to install and service this equipment.

CREI EQUIPS YOU TO INSTALL AND SERVICE ALL TYPES OF TELEVISION AND FM RECEIVERS

Now . . . with the help of this new CREI streamlined Service course you can move ahead to unlimited opportunities in your chosen field. CREI has again taken the lead by offering a course so entirely new that for the first time in our twenty-one year history we can offer a down-to-earth course of training for servicemen. In offering this course at a popular price, CREI is enabling thousands of the "top third" now engaged in service work to enter the ultimate profitable field of television and FM installation and service.

This can be your big year! Don't waste another day. CREI has the answer to your future security in this new servicing course. Write today for complete information. The cost is *popular*. The terms are *easy*. The information is *free*. Write today.

Radio Service Division of

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Gentlemen:
Please send me complete details of your new home study course in Television and FM Servicing. I am attaching a brief resume of my experience, education and present position.

NAME ____________________

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CITY ____________ ZONE ____ STATE ____________

☐ I AM ENTITLED TO TRAINING UNDER G. I. BILL.

International Short-Wave
(Continued from page 62)

hagen, Denmark, is now available for $1.25, postpaid, from Ben E. Wilbur, 32 Whittlesey Avenue, East Orange, New Jersey, USA.

* * *

DX Sessions

The weekly DX sessions from Stockholm, Sweden, are scheduled this summer on Saturdays at 0245, SBP, 11.705, SBT, 15.155; at 1000, SBT, 15.155, SDB-2, 10.780, and at 2000, SBT, 15.155, SDB-2, 10.780. Reports are requested to DX Editor, The Swedish Broadcasting Service, Stockholm 7, Sweden. Programs are compiled by Arne Skoog, who heads up the International League of Short-Wave Editors.

The weekly DX program from *Radio Australia* is currently scheduled on Sunday at 0025, VLA5, 15.320, VLC9, 17.-840, VLB5, 21.540, VLG11, 15.210; at 0827, VLB, 9.540, VLC7, 11.810, and at 0902, VLB3, 11.760, VLC6, 9.615, and VLA6, 15.200. These broadcasts are compiled by Graham Hutchins on behalf of the Australian Radio DX Club.

* * *

UN Broadcasts

Relays by United States and Canadian stations from the United Nations, Lake Success, New York, are at present being made possible through the cooperation of the Department of State (USA), the Canadian Broadcasting Coropration, and the World Wide Broadcasting Foundation (Boston, Mass., USA), which have placed transmitting facilities at the disposal of the United Nations. The UN transmitter at Geneva, Switzerland, is still experimenting, trying to find best frequencies for its purposes. European listeners have recently reported it at 0900-1000 on 6.672 and 9.655, sometimes with *English* at 0930-0945, and in French at 0945-1000; also on 17.770 at 0500; reports are desired to Radio des Nations Unies at Geneve, Suisse (Switzerland).

(Incidentally, it is reported that one of the World Wide Broadcasting Foundation outlets in Boston will increase power to 250 kw. this autumn, and that it is likely this powerful transmitter will be used for UN relays.)

The Radio Division, United Nations, Lake Success, N. Y., USA, is anxious to establish contact with as many listeners as possible and will gladly acknowledge all communications, I am informed. Letters from all parts of the world have already been received and have provided valuable information about the reception of UN broadcasts and about local listening conditions. Schedules may be obtained from the address just given.

* * *

Club Notes

England—Due to ill-health, W. E. H. Harris, BSWL 2325, who has been writing "Broadcast Survey" for *Short Wave Review*, house organ of the British Short Wave League, London, has been compelled to give up this work. He will be replaced shortly.

U.S.A.—New officers of the Grand

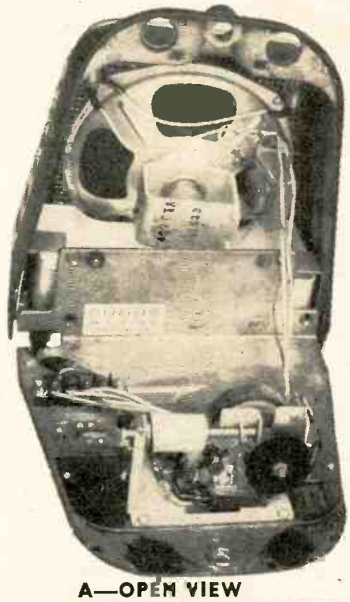
A—CLOSED VIEW

REMOTE CONTROLLED COIN INSERT AND SPEAKER BOX

Made by Solotone Corp., Los Angeles.
24 Volt operated, fused.
Size of base 5½"x8"x10" high.
Weight 11 lbs.
Front grill is sloping, illuminated by two pilot lights.
PM speaker 6" size with matching transformer, screen and felt protective grills.
Will accept 5c or 10c coins.
Each 5c coin gives equivalent of two phonograph records.
Has Haydon Mfg. Co. timer.
Lock installed in top, (with key.)
Coin box readily removable, size 3½"x 7¼"x1¾" deep.
Finished in attractive blue crackle metal, red plastic with chrome plated grill.
Easily mounted on a wall or a flat base.
This unit could be used to house coin operated radio.

Original cost and selling price of this unit was several times our price.

Brand new **$4.75**



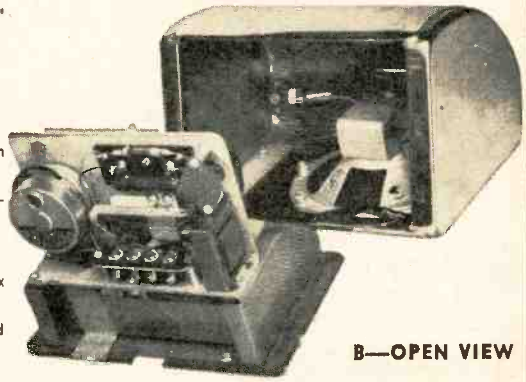
A—OPEN VIEW

B—CLOSED VIEW

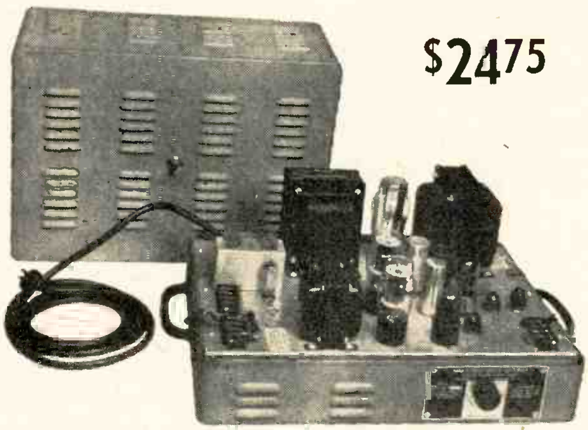
REMOTE CONTROLLED COIN INSERT AND SPEAKER BOX

Made by Personal Music Corp, Newark, N. J.
Model F.
24 Volt operated, fused.
Weight 6½ lbs.
Size 4¾"x7½"x5½" high.
Sloping front.
PM Speaker 5" size.
Has 2 Pilot Lights for illumination.
Finished in chrome metal and grill with red plastic.
Accepts 1 to 6 nickels.
Each 5c coin gives about two phono records of music
Should be mounted on a flat base.
Has Haydon Mfg. Co. timer.
Lock installed in top, (with key.)
Easily removable coin box, size 6"x3½"x 1½"
Requires 4 wires from power unit.
A beautiful piece of equipment that could be built to house coin operated radio.
Worth several times our asking price.

Price brand new **$4.95**



B—OPEN VIEW



$24.75

MASTER POWER SUPPLY UNIT FOR MEASURED MUSIC SYSTEM

Made by Personal Music Corp., Newark, N. J.
Model F.
110 V 60 cycle, input 300 Watts, fused.
15 Watt output.
Has high-low AC input line switch.
Tube lineup: 2D21, 6AL5, 6SJ7, 6SN7, 2-6L6G's, 5U4G.
Size 11½"x17½"x10".
Chassis size 11½"x17½"x2½".
Has Vernier volume, master volume, treble and bass controls.
Gray crackle finish.
Well ventilated.
External handles for carrying it.
Lock installed in top, (with key.)
Built for continuous night and day service.
Originally sold for several times our asking price.

Price brand new, $24.75

$24.75

ADAPTER-AMPLIFIER

Made by Solotone Corp., Los Angeles.
Model 2.
115 Volts, 60 cycles, fused.
125 Watts input.
15 Watts output.
Tube lineup: 6J5, 6SL7, 2-6L6G's, 5U4G.
Crystal, magnetic or 600 ohm line inputs.
Individual volume, treble and bass controls.
15 ohm output.
Size 10½"x15½"x8½" high.
Weight 30 lbs.
Chassis size 10½"x15½"x3¼" high.
Has meter to determine number of plays.
Has 24 V AC output for the remote speaker boxes, fused.
Toggle switch turns remote speaker boxes off and on.
Black crackle finish.
Well ventilated.
Built for continuous night and day service.
Originally sold for several times our asking price.

Price brand new $24.75

TERMS: CASH WITH ORDER

AMERICAN SURPLUS PRODUCTS CO.

537 N. CAPITOL AVE.
INDIANAPOLIS, IND.

National Radio Society are Edward F. Shirley, president; Walter Downes, first vice-president; Charles Eaton, second vice-president, and J. I. Vaught, secretary. New QRA of this group is P.O. Box 52, Cassadaga, New York. Mr. Shirley succeeds George H. Jacobs, founder of the club and its president the past nine years. Mr. Jacobs will act as a personal aide to the new club president.

Carl Beck has resigned as short-wave editor for the Universal Radio DX Club, and has been replaced by Donald C. Gross, Route 1, Box 175, Port Orchard, Washington. Ralph Kastner, amateur editor, also recently resigned and the new amateur editor is Don Martinez. 1469 26th Avenue, San Francisco 22, California; Martinez will be assisted by associate CQ-DX editor, James M. Moore, 1130 Guerrero Street, Apt. 4, San Francisco, California. Headquarters of this club are at 7507 Holly Street, Oakland 3, California.

* * *

AIR Schedules

Schedules just in via airmail from Delhi list these summer schedules for All India Radio:

Delhi—VUD2, 10 kw., 7.290, 2100-2300 (to 2330 on days of educational broadcasts); 9.630, 0200-0400; 9.630, 0630-0800; 4.960, 0815-1230. VUD3, 5 kw., 9.670, 2040-2245; 17.760. 0200-0400; 17.760, 0715-0745; 9.670, 0800-0830; 15.-290, 0845-1130; 9.620, 1200-1245. VUD4, 10 kw., 11.850, 2040-2245, 0200-0400, 0715-0830, 0845-1230. VUD5, 100 kw., 15.190, 2040-2200; 15.190, 2215-0145; 15.190, 0215-0315; 15.90, 0430-0800; 9.590, 0830-1100; 9.590, 1115-1230; 7.-290, 1730-1825. VUD7, 100 kw., 15.160, 2040-2145, 2215-0230, 0315-0345, 0500-0945,1000-1100, 1115-1230. VUD8, 7.5 kw., 21.510, 2215-0230, 0500-0830, 0900-1110, 1115-1230. VUD9, 7.5 kw., 15.350, 2215-0230, 0340-0400, 0430-0830, 0900-1110, 1115-1230. VUD10, 20 kw., 9.630, 2040-2100; 17.830, 2215-0230; 21.510, 0315-0345; 17.830, 0430-0700; 7.290, 0800-0930. VUD11, 20 kw., 11.760, 2040-2200; 15.290, 2215-0030; 15.290, 0130-0145; 15.290, 0200-0400; 15.290, 0500-0700; 15.290, 0715-0745; 15.290, 0800-0830; 9.630, 0900-1110; 7.210, 1200-1245.

Bombay—VUB2, 7.2470, 10 kw., 2100-2300; 9.550, 0130-0400; 7.240, 0550-0845; 4.880, 0900-1230.

Calcutta—VUC2, 10 kw., 7.210, 2000-2200; 9.530, 0200-0430; 9.530, 0630-0800; 4.840, 0815-1230.

Madras—VUM2, 10 kw., 7.260, 2030-2230; 9.590, 0200-0430; 9.590, 0530-0630; 7.260, 0700-1030; 4.920, 1045-1200.

English periods from Delhi (*usually news*) are scheduled at 2130, 15.19, 15.16, 11.85, 11.76, 9.67, 7.29; 2230, 21.51, 17.83, 15.35, 15.25, 15.19, 15.16; 0030, 21.51, 17.83, 15.35, 15.19, 15.16; 0130, 21.51, 17.83, 15.35, 15.29, 15.19, 15.16; 0300, 17.76, 15.29, 15.19, 11.85, 9.63; (including program summary), 21.51, 15.35, 15.29, 15.16; 0630, 21.51, 17.83, 15.35, 15.19, 0730, 17.76, 15.35, 15.19, 15.16; 0930, 21.51, 15.35, 15.16, 9.59; 1030, 21.51, 15.35, 15.29, 15.16, 11.85, 9.63, 9.59, 4.96; 1100 (replayed from BBC, London), 21.51, 15.35, 15.29, 9.63. The *English* news periods are normally

relayed *also* by Madras, Calcutta, and Bombay (*see their schedules already given*).

* * *

Last Minute Tips

TAQ, 15.195, is being used extensively now by Ankara, Turkey; heard well in Eastern North America daily 2100-2117 (*no English*), and at other times, fine level. (Kary, Pa., Fuller, Rhode Island) Reported heard well in Britain.

At last report, the *four new* 100-kw. stations being built in Spain have not been completed as yet. (Dobeson, England)

The manager of *Radio Monte-Carlo*, Monaco, advises that by this time a *second* short-wave transmitter should be on the air from that location, operating in either the 31- or 25-meter band. Schedule of the 6.035 (49.71 m.) outlet, 25 kw., is 0130-0300, 0600-0800, 1300-1715.

Swedes report call-sign of *Radio Dakar* on about 15.614 is FZK9, heard to around 17.00. Foerster, Illinois, reports this station to 1805 closedown.

Belgrade's 6.107 outlet now has news at 1230 as well as at 1530. (Pearce, England)

In Sweden, VLR2, 6.150, Australia, is heard with news 1500; VLH4, 11.880, and VLG6, 15.240, are in parallel with news 1545. (Ohrwall)

For the summer, Norway has replaced 6.185 with 15.170 in the daily overseas beam (some *English*), 2000-2100; 15.170 is a good signal; 11.735 (100 kw.) is usually excellent, but the other parallel outlet (9.610) is "squeezed" badly by Rio de Janeiro's ZYC8. (Kary, Pa., Stark, Texas)

Rabat, 9.082, French Morocco, has news in French 1730, closes 1800.

Kary, Pa., has received a verification from PGGF, the liner *Nieuw Amsterdam*, 17.633; when signal was picked up by Kary, the liner was just north of Haiti en route from Curacao to Hoboken (N. J.), trip having started in Rio de Janeiro harbor; transmitter is KSV/CL of Dutch manufacture from the N.S.F. factory at Hilversum; power 500 watts; antenna is single vertical; telephone transmitter uses suppressed grid modulation, the first to be used aboard ship, the chief radio operator informed Kary. Incidentally, that operator is really an "old-timer" in radio, having begun as a wireless operator at sea in 1915 with the old spark-gap transmitters!

Bucharest, Roumania, outlets on 6.210, 9.52, 11.90, are in parallel for *English* period at 1500-1530. (Pearce, England) The 6.210 frequency may vary slightly at times.

Radio Australia reports that a United Nations amateur station at Lake Success, N. Y., has been set up under the callsign of K2UN, and will be used by UN personnel. Will utilize the 10-, 20-, 40-, and 80-meter bands. When first reported was on 20 meters.

Rangoon, Burma, is broadcasting *English* periods daily at 2015-2030, 0115-0145 on 9.540, and at 0915-1015 on 6.-025, news 1000. (Cushen, New Zealand) Frequency in the 49-m. band appears to be 6.035. (Dilg, Calif.)

JKF2, 4.910, Tokyo, has been heard opening at 1400; JVW, 15.225, JVW3,

15.325, are scheduled now 0300-0900. (Radio Australia)

Radio SEAC, Colombo, Ceylon, has been heard widely this summer on 15.230 in special broadcasts; was a good signal here in West Virginia when relaying BBC's descriptions of cricket matches played in Nottingham (England); was beamed to Australia around 0600-0800 and later. *SEAC's* 15.120 has been heard fair to good here this summer at 0600 when relaying BBC news from London; also in the Sunday beam to Britain 1230-1430; for this beam announces 9.825 in parallel to British Isles, and 9.520, 6.075, and 3.393 to India, Pakistan, and East Asia; however, at times seems to use 17.730 instead of (announced) 9.825. In the daily program, I note that at 0600 they announce *only* 15.120; Australians report the use of 17.730, 15.120, 9.520, 6.075, 3.393 at 0530.

Warsaw III, 6.215, is scheduled 0930-2000, according to *Radio Australia*, with news at 1430 (if not heard then, try at 1530); on Wednesdays at 1510 has 15 minutes in Esperanto; is reported on 11.710 at 0500-0600.

Radio Nacional de Espana, Madrid, 9.368, 40 kw., is scheduled in French 1300; German 1330; Italian 1345; Portuguese 1400; Russian 1420; *English* 1500; Arabic 1530; Spanish 1535-1600. (Dobeson, England)

Finland's OIX4, 15.190, is heard with weak signal in England with news 0715. (Harrison)

Tetuan, 6.067, Spanish Morocco, often relays programs from Madrid with identification as latter; should not be mistaken for Spain; signals erratic in England. (Harrison)

FIQA, 6.059, *Radio Tananariva*, Madagascar, is heard in Sweden with weak signal; news in French 1245. (Ohrwall) Frequency may be as high as 6.063.

Moscow's 7.200, 6.160, and 6.020 outlets have *English* at 1730; sometimes appear off these frequencies slightly. (Harrison, England)

Rome's 9.630 outlet is heard in Sweden with *English* program at around 1450. (Ohrwall) The 11.810 outlet is heard at 1600 to South Africa, mostly in Italian, but with *English* announcements. (Harrison, England)

Radio Monte-Carlo, 6.035, Monaco, has French news 1330. (Ohrwall, Sweden)

Prague on 11.760 has news at 1245-1300; at 1445 and 1645 on 9.553. (Pearce, England)

Radio Luxembourg, 15.350, is heard at 1145 with sponsored program in French; either closes down or fades out around 0700. (Pearce, England)

TAP, 9.465, Ankara, Turkey, now has news daily 1145; *Postbag* on Sundays is at 1530 now; *English* to England at 1530 on Mondays, Thursday. (Pearce, England)

Brazzaville's 16-meter outlet, which had been off the air for some time, appears to be on daily now at 0500-0745 (Sundays 0400-0745) on 17.837, in parallel with 15.595. (Swedish DX Broadcast)

Helsinki's 9.500 outlet is heard in England at 0715 with news for North America (weekdays only). (Pearce) The 15.190 channel parallels.

Jaffa, Palestine, on 6.790,, still has Arabic at 1330, signs off 1400. (Pearce, England)

Apparently, the *Danish Brigade Radio*, 6.225, Germany, is now on Summer Time, as has been heard signing *off* 1400; schedule now appears 0600-0700, 0900-1100, 1300-1400. (Pearce, England) Location is given as Aurich, a town about 120 km. northwest of Bremen. (Holmberg, Sweden)

Current schedules of *Radio Makassar*, Celebes, 9.550, 5.030, 10 kw., appear to be weekdays 2200-0130, 0400-1000, 1730-1930; Sundays 1900-0130, 0400-1000. QRA is Radio Makassar, Strandweg Zuid, Makassar, Celebes. (Swedish DX Broadcast)

Radio Indoesia, Batavia, Java, is heard in England on 19.345 and 17.630 with *English* for Europe 1200-1230; latter then signs on to Middle East in Arabic. (Pearce)

International Red Cross, Geneva, Switzerland, has been heard by Pearce, England, on Saturdays at 1230 in French, and *English;* also Sundays 0245. Frequency is 6.345.

Kernan, Massachusetts, reports ZM2AP, 7.700, Apia, Western Samoa, Mondays, Wednesdays, Fridays, Saturdays 0115-0300; fades out rapidly.

ZYB8, 11.765, Sao Paulo, Brazil, is heard in Chicago at 2000. (Domzalski)

Rome appears to be using 15.120 again now to North America evenings

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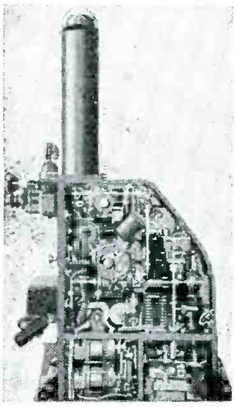

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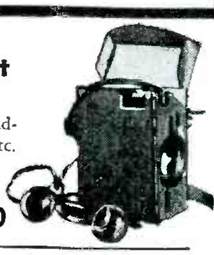

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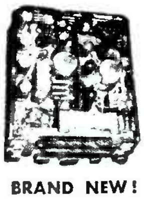

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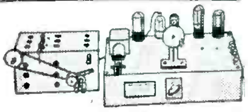

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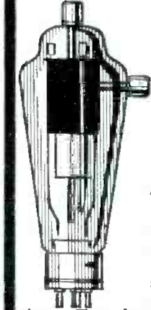

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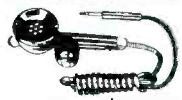

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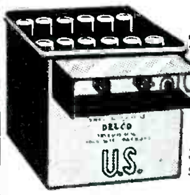

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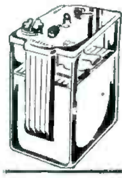

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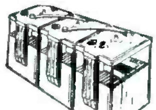

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Made by Willard, for above storage batteries. 1 qt. sufficient for two 2-volt cells. Hermetically sealed. SPECIAL. per qt. bot. **$1.25**

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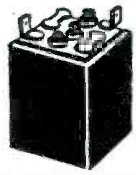

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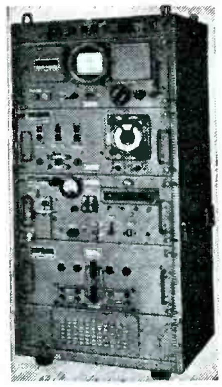


Bargain opportunity of a lifetime! This I.F.F. equipment originally cost about $20,000 . . . now buy it for a tiny fraction of cost! Easily converted for Television. Complete assembly consists of Control unit with 5" C.R. Tube, transmitter and receiver assembly (157 to 185 Mc). Indicator unit, and Power Supply (450 watts), operating on 110 volts, 60 cycles AC. All assembled, ready to operate. 62 Tubes included: 8—6V6GT, 9—6SL7GT, 14—6SN7GT, 1—5CP1, 2—9006, 1—6Y6G, 2—6E5, 1—100TH, 2—6J5, 2—2C26, 1—3E29, 1—6H6, 7—6AG5, 3—6AK5, 1—6C4, 3—2X2, 1—6X5GT, 3—5U4GT. Overall size 55" high, 28" wide, 20½" deep. Shpg. weight 855 lbs. Your cost, complete, BRAND NEW, in original packing . . . **$195.00** to at least 1950; news at 1915. (Goffs, Ohio)

Lisbon on 11.030 has a broadcast for Portuguese listeners abroad 1600-1700; now heard here instead of previously-used 11.845; also heard earlier, signing *off* at 1530. (Pearce, England)

ZQI, Kingston, Jamaica, B.W.I., is scheduled on 4.95 at 1600-1730, on 3.48, 1930-2200; news 2000. (Southall, Pa.)

Radio Ankara has informed Southall, Pa., that the *new* 100-kw. transmitter of *Radio Istanbul* should be testing around the end of August; no frequencies were given; the station will be "dedicated to preserving the world peace," and will be the most powerful station in that part of the world, it was stated. Watch for this one in the popular short-wave broadcast bands.

Recently, KZRC, 6.135, "The Voice of Cebu," Philippines, has been coming through again in Texas around 0630. (Stark)

Hagganah Radio, "Palestine Calling," is reported on 13.89 at 0400-0420, 1700-1720, 1800-1820, with announcements in *English;* mostly in Hebrew. (Short Wave News, London)

Kure, 6.105, Japan, now operates 1643-0730. (Dilg, Calif.) Relays *Radio Australia.*

YHN, 10.851, Indonesian Broadcasting System, Djokjakarta, has *English* 1200-1300; on occasions is heard with weak signal (also in *English*) at 1730. (Pearce, England) Latter beam is for U.S. and is scheduled to around 1930; is seldom reported as audible in U.S.

M. I. Dada, Port Louis, Mauritius, informs Southall, Pa., "We have one broadcasting station, operating in the 220-meter band, thrice daily, at 2200-2245, 0315-0350, 1000-1230. Recently, the Mauritius Broadcasting Station has carried out tests in the 42-meter band. They were not found satisfactory. *Further tests will be carried* out next winter." Was reported heard in England in winter on 7.295, during tests.

Vatican Radio is scheduled in *English* at 0900 on 9.66, 15.095; at 1315, 9.66, 5.969. (Southall, Pa.)

HLKA, 7.933, Seoul, Korea, is heard in England some days from 1615; chimes and call at 1630, then talk in Eastern language; usually deteriorates badly and has much CWQRM. (Pearce) Not heard lately mornings in California; the 2.510 outlet is still heard there, however. (Dilg) It is possible this station has moved from 7.933 to a higher frequency for the summer for its morning transmission.

CR7BJ, 9.654V, Mozambique, is a good signal when signing on daily 0000 (Saturdays may not sign on until around 0200); signs on with "rooster and/or cuckoo calls" and chimes. (Southall, Pa.)

ISWC, London, reports that an airmail letter just in from the Government of Pakistan says that the short-wave transmitters of the Pakistan Broadcasting Service are not likely to be on the air for some months yet.

A Dutch DX-er has received word from Batavia, Dutch East Indies, that *Radio Batavia* (which, incidentally, now announces "Radio Indonesia") is "desperately" seeking reception reports—to Regeerings Voorlichtings Dienst, Koningslein 12, Batavia, Java, D.E.I.; schedules were listed PLD6, 17.630, PLA2, 19.345, and YDC, 15.145, 1100-1130 (Dutch); and PLF2, 19.345, *English* from 1200. (ISWC)

PCJ's 21.480 outlet is *only* 15 kw., and *not* 100 kw., as first reported; a 100 kw.

The Square Post of the American Legion in Chicago is sponsoring a project which other civic minded groups may wish to adopt. The Post is collecting table model radios to be reconditioned for distribution to Veterans' Hospitals. Fred A. Orth is in charge of repairing the radios and to date he has put 48 sets in working order of the 61 that were donated as a result of a small item in community paper.

station will probably be on the air from Hilversum by the latter part of next year (1949). (ISWC)

ISMC, London, reports *United Nations Radio*, Geneva, Switzerland, 6.670, 18.450, daily, except Sundays, at 1300.

Peddle, Newfoundland, sends us these tips—CSX2, 4.845, Ponta Delgada, Azores, 1800-1900; Algiers, 9.570, 1330-1830; OLR5B, 15.320, Prague, 1500-1545; PJC2, 2.315, Willemsted, Curacao, oft at 2130; Damascus, 12.00, Syria, 1215-1345 sign-off.

Brazzaville's 17.840 outlet has been heard in Texas with news 1545. (Stark)

Bucharest, 6.210V, Roumania, has news in German 1400. *Radio Belgrade*, 6.107, Yugoslavia, has news in *English* 1530. *Radio Renascenca*, CSWD, 6.155, Lisbon, Portugal, is heard in Sweden to 1730. (Ohrwall)

Radio Bissau, Portuguese Guinea, has informed Starry, Pa., via airmail, that new schedule on 7.948 is 1630-1900. However, Kary, Pa., recently heard CQM-4 signing *off* at 1800 as usual. Usually has had CWQRM and "ham" phone QRM.

PJA-19, Aruba (city of Orenjestad), 19.460, has been heard in Pa. at 0845-0906, calling WKF, New York, with traffic; goes into scrambled telephony after contact has been established; strong signal but carrier suffers from bad hum, is considerably over-modulated. (Kary)

Prague, Czechoslovakia, appears to have "decided that its 11.840 outlet is OLR4R;" for some time this station announced as OLR5A although it has always been officially listed as OLR4A. (Worris, N.Y.)

The Salzburg, Austria, outlet on 7.220 has news 0115. (Harrison, England)

PRL-5, 11.950 (measured), Brazil, is good in Pa. evenings, generally in parallel with PRL-7, 11.720; news in Portuguese 1740. (Kary)

According to Gutter, Chicago, Moscow now radiates in *English* 0900-0930, news to about 0910; on 15.440; at 0930-1000 closedown, uses German. Is possible the whole hour is beamed to American Zone of Germany. Can anyone confirm?

Widely reported with good to fair signals is Teheran, 15.100, Iran, with news 0715; may have gone on earlier schedule by this time, in which case news would be one hour earlier (0615).

A station on 17.825 afternoons to around 1700 is believed to be Oslo. (Stark, Texas) I have heard this outlet here in West Virginia around 1200-1300 or later, good level.

LSM-3, Buenos Aires (actually location is Hurlingham), Argentina, has been heard in Pa. at 1830, calling Cuba, extremely strong signals. (Kary)

T. Fridriksson, an official of the Reykjavik, Iceland, station, informs me: "The only regular short-wave broadcast from Iceland at present is over TFJ on 12.175 (24.64 m.), previously on 12.235 (24.52 m.). Transmission is *only* on Sundays at 1115-1145, and consists of home news, talk, and Icelandic music. All speech is Icelandic. These transmissions are intended primarily for Icelanders in other countries and others who understand the Icelandic language. TFJ is operated by the Iceland State Telephone and Telegraph Administration, but is used occasionally by the Iceland State Broadcasting Service for special broadcasts, in addition to the weekly transmission on Sunday." Has been heard weakly in Pennsylvania by Kary and Southall. Was heard late in winter by Anderson, California; station verified his report. Probably beams on Scandinavia and thus will be difficult to pick up in U.S. Kary reports bad teletype QRM.

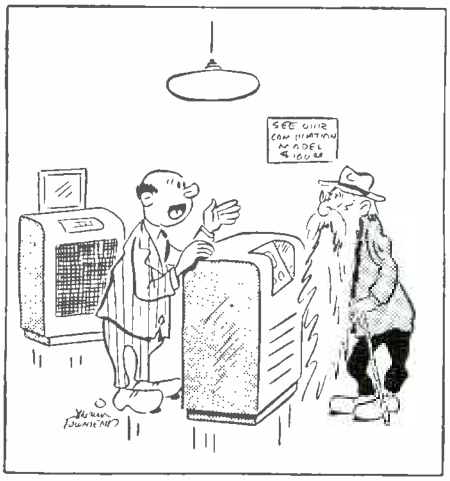
PSF, measured 14.690, with PSH, 10.220, in parallel, heard in Pennsylvania to usual 1800 sign-off with Brazilian National Anthem, "Ouviram do Ipiranga." PSF is slightly weaker than PSH, but is by far the clearer channel; programs consist of various press releases from the Brazilian government—such as "Noticias Federal," "Noticias de Capital," and "Noticias de Interior." All Portuguese. (Kary)

OTC-2, Leopoldville, Belgian Congo, was recently measured by Kary, Pa., at 9.767.77, indicating a drift back to assigned frequency of 9.767 (which is announced); some weeks ago was reported in East as being as high as 9.770 at times.

Radio Brazzaville's 15.595 outlet has news 0715-0730; sign-off varies, but is usually around 0750, with "La Marseillaise;" considerable fade has been noted; the 17.840 (measured 17.836.66) outlet has QRM in form of heterodyne from *Radio Eireann* at 1230-1300; the 17.840 channel signs off 1346; the 21.000 channel has been measured 21.004, and is heard to 1215 sign-off, is weak and suffers frequent complete fade-outs; has QRM from CW station OLU, identity unknown. (Kary, Pa.)

The Chief of Foreign Liaison, *Radio Polskie,* Warsaw, Poland, has notified Kary, Pa., that the "alleged" Polish outlet on 9.530 is not an "official Polish station; it may be an amateur one from Poland as well as from another country; the Polish short-wave station is Warsaw III, operating on 6.215." It is doubtful that this is an amateur station, however. Listeners "Down Under" reported hearing this outlet announce "Radio

(Continued on page 117)



"I usually guarantee this set to last a lifetime, but in your case it would be running it down."

What's New in Radio

(Continued from page 78)

Available in either kit form or completely wired, the new tuner features an i.f. bandwidth of 150 kc. at 6 db. down, high gain miniature tubes throughout, input impedance to match the standard 300 ohm line, an 8 inch slide rule dial with linear tuning, and a self-contained power supply.

The unit measures 8 inches by 10 inches by 6¾ inches, a size suitable for most custom installations.

A data sheet covering the Model FMT-10 will be forwarded to those requesting it from *Brooks Electronic Laboratories*, 32 Kendall Park, Waltham, Massachusetts.

MOBILE TRANSMITTER

Standard Transformer Corporation of Chicago has announced the availability of its new *Stancor* Model ST-203-A mobile transmitter unit.

This compact radio transmitter has been designed primarily for mobile operation but may also be used for fixed station service should the owner so desire. A special mounting arrangement makes the ST-203-A quickly transferable from car to fixed location.

Power is obtained from a dynamotor or vibrator supply for mobile work or from an a.c. supply at a fixed location. Features include 27.5 watt amplifier plate power input, AM radio-telephony, two crystal-controlled frequencies, coverage of the 10 and 11 meter bands, and press-to-talk operation.

The circuit lineup consists of a 6V6 harmonic oscillator working from 7 mc.

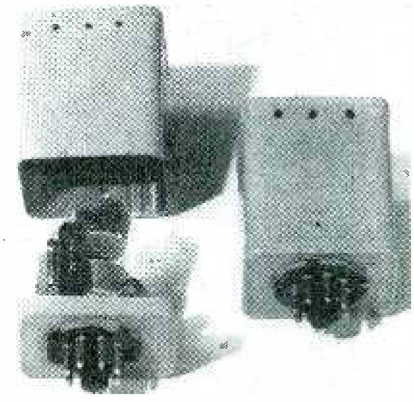
crystals, a 2E26 class C amplifier, a 6J5 grounded-grid speech amplifier, and a push-pull 6V6 class A-1 modulator.

The transmitter is finished in silver-gray hammertone with gray plastic control knobs and brushed metal carrying handle. The unit measures 8⅝ by 7⅜ by 6¾ inches and weighs only 9¼ pounds. It is available either completely wired or in kit form.

A data sheet covering the transmitter is available on request. Write Department E, *Standard Transformer Corporation*, Elston, Kedzie, and Addison Streets, Chicago 18, Illinois.

COLLINS AMPLIFIER

A new amplifier for use in the pickup amplifier-equalizer stage with the new *General Electric* variable reluctance, *Pickering*, or other types of magnetic pickup



cartridges has been introduced by *Collins Audio Products Co., Inc.* as the 1-A amplifier.

The unit consists of a small metal shield can with an octal plug base measuring 1¾ by 2½ inches in which is wired the complete equalizing circuit including the vacuum tube. It gives the proper frequency response curve to exactly complement the bass characteristic curve of the cartridges.

The entire unit plugs into a tube socket which can be easily installed on the amplifier or radio chassis. It is then wired right into the circuit between the phono input connection on the chassis and the grid of the input tube. It is only necessary to provide filament, ground, and "B" voltages to the designated terminals.

Collins Audio Products Co., Inc., P.O. Box 368, Westfield, New Jersey will supply full details on request.

NEW V-O-M

The Triplett Electrical Instrument Co. of Bluffton, Ohio is now marketing the new Model 630 Volt-Ohm-Mil-Ammeter.

The new test instrument features an enclosed molded switch which is said to permanently retain its contact alignment, wide range scales, large sensitive meter, and precision resistors.

There are six d.c. voltage ranges from 0 to 6000 at 20,000 ohms/volt. Six a.c. ranges cover voltages to 6000 at 5000 ohms/volt. Five d.c. current ranges from 0-60 microamperes to 0-12 amperes, resistance ranges to 100 megohms, decibels from -30 to + 70 db., and output ranges, provide a complete volt-ohm-milliampere analysis of the equipment under test.

Write to *The Triplett Electrical Instrument Co.*, Bluffton, Ohio for full details on the Model 630.

—30—

A SIMPLE DEVICE FOR MAKING RECORDING EASIER

By SILVIO A. LANZA
Physicist

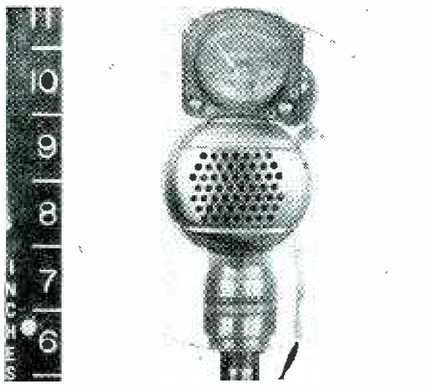
Volume level indicator mounted on microphone makes monitoring while recording practical.

THE writer has been doing recording for some time and has been extremely interested in it from many angles. One of the most common difficulties encountered in recording is the necessity for having a monitoring operator at the recorder to control the recording level. If the person whose voice is being recorded must watch the horizontal vollume indicator meter (which is invariably set up in the recorder case) the operation becomes very awkward and uncomfortable. If the person recording is reading an article it is necessary for him to hold his manuscript in line with his eyes while attempting to watch the volume indicator which is usually remotely located.

The situation whereby the person recording does his own monitoring is the most practical. Once the optimum setting of the recorder amplifier gain control is determined, it should be used.

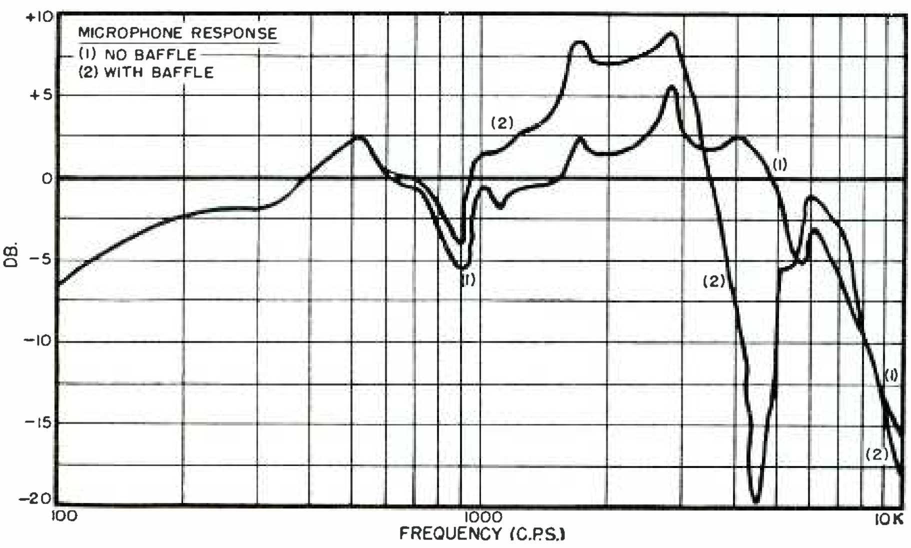
The microphone with a transparent lucite baffle built around it is shown in the photograph. It is a simple disc, one eighth inch thick with a two inch rim around it. The center hole is cut so as to make a tight fit around the microphone and eliminate the necessity for clamps. Mounted behind the baffle, and attached to it, is a volume indicator meter. This is connected by a twisted pair of flexible leads to the output of the recorder amplifier.

In actual operation we have the following set-up. With the speaker's eyes ten inches to one foot from the meter for proper eye focus, the mouth is at an ideal distance from the microphone grid and on the axis of the microphone diaphragm, when noting relative positions of eyes and mouth. When the speaker talks into the microphone his eyes are in line with the volume indicator meter. He knows at all times the output level of the recording amplifier and may control his voice accordingly. With the transparent baffle he may bring his reading material in the same plane as the baffle, even directly behind



Note baffle extending out from microphone. Meter is placed behind baffle.

Curves show response characteristics of microphone with and without baffle.



it, because the lucite of which it is constructed will not obstruct vision and will be in substantially the same focal plane as the volume indicator, thereby relieving the eye of adapting itself for different reading distances (of meter and reading material.) The result is that the reader does not feel awkward and talks along the axis of the microphone while watching the volume indicator and reading matter simultaneously.

If a small volume indicator meter is not obtainable it is a simple matter to use a small d.c. meter and connect a small germanium crystal rectifier in series with it, after which it may be calibrated by using proper series resistances.

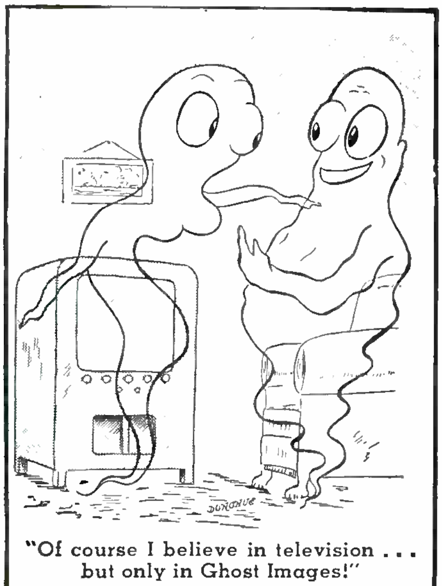
A pair of frequency response curves obtained on the writer's microphone both with and without the baffle are shown on page 109. In comparing the two curves it will be noticed that when the baffle is used the microphone output begins to increase at 600 cycles-per-second until it reaches a maximum increase of 5.7 db. at 1700 cycles-per-second and 5.5 db. at 2000 cycles-per-second when it begins to drop off gradually to 3300 cycles-per-second where the curves cross. The output, using the baffle, then drops off rapidly showing much lower sensitivity than when the baffle is not used.

The area between 600 and 3300 cycles-per-second is the area that contributes most to intelligibility of speech and it is a very great advantage to have the increased sensitivity in this neighberhood and the decreased, unwanted sensitivity beyond.

Certain recorders are extremely sensitive below 1000 cycles-per-second and the resulting recordings are "boomy" and unnatural. The increased response at the higher frequencies serves to equalize this unwanted condition.

The baffle is attached to the microphone in such a way that when the microphone is not being used to record speech it is an easy matter to slip the baffle off.

—30—



"Of course I believe in television . . . but only in Ghost Images!"

Spot Radio News

(*Continued from page 14*)

on a three-hour schedule between 7 a.m. and midnight. Either system can be used on an unlimited basis between midnight and 7 a.m.

Faxcasting progress will be watched closely by not only broadcasters, but those in the advertising, sales, sports, financial, and general business world, where facsimile will eventually become a *must* service.

THE EXTENSIVE PACIFIC COAST TV plans of CBS were revealed recently during a special field hearing of FCC in San Francisco.

William B. Lodge, director of engineering for CBS, testified that CBS plans to spend $685,000 for a television transmitter on San Bruno Ridge, south of San Francisco, and for the conversion of two standard broadcast studios, now leased to KQW, into a 52 x 43 foot fully-equipped TV studio in the Palace Hotel Building in downtown San Francisco.

Discussing CBS's experience in telecasting, Adrian Murphy, vice president of the network, said that Columbia had spent $9,000,000 in television experiments, programming and telecasting, with 5000 hours of black and white telecasts recorded. According to Mr. Murphy, WCBS-TV now has 271 full-time employees and is telecasting about 25 hours a week.

SOME SIGNIFICANT TV COST DATA was also disclosed during a meeting of the American Television Society in New York City. F. M. Flynn, general manager of WPIX, the *New York Daily News* TV station which went on the air a few weeks ago, said that equipment alone cost about $600,000, while over $500,000 had been spent for studio construction. Payroll costs are hitting the $800,000-a-year point he declared. These figures seem to make TV a big business project and not one for the little fellow.

In another TV-cost talk, Harold A. Anderson of the *Austin Company*, builders of studios and station facilities, predicted that around $18,000,000 will be spent this year for transmitters, studios, and accessories. In 1951, expenditures may go as high as $50,000,000, he added.

TV seems to be becoming quite a healthy business.

DISTINGUISHED ACHIEVEMENT awards have been won by two electronic specialists of the Bureau of Standards in Washington; Dr. Robert D. Huntoon, assistant chief of the Atomic Physics Division and Dr. A. V. Astin, assistant chief of the Electronics Division.

Dr. Huntoon received his award from the Washington Academy of Sciences for his research in . . . "the advancement of electronics and its application to other sciences and to modern ordnance." Joining the Bureau in 1941, Dr. Huntoon assisted in the early develop-

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1N21	.59
1N23	.59
1P22	11.50
1P24	2.00
1S21	1.95
2AP1	2.95
2B22	5.35
2C21	.98
2C22	.39
2C26A	.75
2C34	.59
2C40	1.98
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2C44	1.75
2C46	7.50
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2D29	1.39
2E22	1.50
2E24	4.37
2E25	3.95
2E26	3.29
2E30	2.25
2J21A	14.95
2J22	24.95
2J26	14.95
2J31	24.95
2J32	24.95
2J34	24.95
2J38	37.50
2J39	34.95
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2J42	34.95
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2J51	34.95
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2J54	25.00
2K25	24.95
2K28	24.95
3AP1	2.95
3B22	4.95
3B23	4.95
3B24	1.95
3B25	.98
3B26	5.95
3BP1	2.95
3C21	5.95
3C22	2.95
3C23	4.95
3C24	.69
3C30	1.50
3CP1	3.00
3BP1	3.95
3EP1	3.95
3D21A	3.00
3E29	4.95
3GP1	4.95
4-65A	14.50
4-125A	27.50
4-250A	37.50
4A1	1.98
4AP10	6.95
4B24	4.95
4C35	19.95
4E27	8.95
4J28	34.95
4J29	34.95
5AP1	4.95
5AP4	5.95
5BP1	1.95
5BP4	4.95
5CP1	3.95
5CP7	13.95
5D21	29.95
5FP7	3.95
5GP1	9.95
5JP1	11.95
5J29	29.50
5J30	29.50
5LP1	11.95
5TP4	20.00
6AF6G	.88
6C21	24.95
6D4	1.95
6J4	3.95
6Q5G	1.25
7BP7	4.95
7EP4	17.95
7GP4	19.40
9GP7	15.00
9JP1	3.95
9JP2	3.95
9LP7	4.95
9MP7	14.95
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10CP4A	42.20
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10 Spec.	.69
12DP7	14.95
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15E	1.50
15R	1.50
20AP4	270.00
23D4	.49
45 Spec.	.49
75TL	3.95
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114A	.69
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204A	49.95
205B	4.50
211	.98
215A	3.00
217C	7.50
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222A	120.00
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241B	90.00
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249C	3.49
250R	7.95
250TH	19.50
250TL	19.50
252A	4.95
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274B	1.25
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305A	12.95
307A	6.25
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316A	.89
322A	120.00
327A	4.95
331A	4.95
350/A/B	2.95
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368AS	9.95
371A	2.95
371B	2.95
388A	7.95
393A	7.95
394A	4.50
417A	24.95
434A	3.95
446A	1.95
450TH	24.95
503	195.00
527	12.95
531	49.50
575A	14.95
632A	9.95
701A	4.95
702A	3.95
703A	4.95
704A	1.98
705A	2.95
706BY	24.95
706CY	24.95
707A/B	24.95
708A	7.95
709A	9.95
713A	1.65
714AY	14.95
715A/B	19.95
715C	29.50
717A	1.65
720CY	34.95
721A/B	4.35
723AB	5.95
724A/B	4.95
725A	24.95
726A	23.50
800	2.25
801A	.98
802	2.95
803	8.95
804	9.95
805	4.95
806	17.50
807	1.25
808	2.95
809	2.50
810	7.95
811	2.25
812	2.95
812H	6.90
813	7.95
814	4.95
815	2.50
816	1.19
822	11.95
826	.79
827R	99.50
828	6.95
829/A/B	7.95
829B/3E29	4.95
830B	5.25
832/A	3.95
833A	39.50
836	1.15
837	2.50
838	3.95
841	.69
843	.69
845	4.95
845W	5.95
851	98.00
852	14.95
860	3.00
861	49.95
864	.69
865	.98
866A	.89
868	1.95
869B	75.00
872A	2.50
874	2.49
876	.98
878	2.49
879	.89
884	.98
889	.98
891	110.00
892R	200.00
902P1	7.95
905	11.95
920	2.95
923	.98
931A	4.95
950	1.06
953B	4.95
954	.75
955	.75
956	.75
957	.75
958A	.75
959	.75
991	.69
1000 Spec.	24.95
1000T	75.00
1611	.99
1613	.75
1614	1.75
1616	1.39
1619	.75
1621	1.98
1622	1.75
1624	1.75
1625	.49
1626	.49
1627	7.95
1629	.69
1630	7.50
1636	5.95
1638	.98
1641	.79
1642	.98
1654	1.98
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1852	1.06
1853	1.06
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VR92	.75
VR105	.75
VR150	.98
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WL468	14.95
WL532A	4.95
WL562	150.00
WL616	105.00
WL619	49.50
Z225	1.95
OA2	1.69
OA3/VR75	.98
OA4G	1.06
OB2	2.05
OB3/VR90	.75
OC3/VR105	.75
OD3/VR150	.75
00	.50
OY4	.88
OZ4	.88
OZ4G	.88
01A	.50
1A3	.72
1A4	1.28
1A4P	1.28
1A5GT	.88
1A6	1.06
1A7GT	.72
1AB5	1.06
1B3GT	1.56
1B4	1.28
1B5/25S	1.06
1B7GT	1.06
1C5GT	.72
1C6	1.06
1C7G	1.06
1C8	.88
1D5G	1.28
1D5GP	1.28
1D7G	1.06
1D8GT	1.28
1E5GT	1.56
1E7GT	1.56
1F4	.88
1F5G	.88
1F6	1.28
1F7G	1.28
1G4GT	.88
1G6GT	.88
1H4G	.72
1H5GT	.60
1H6G	1.06
1H6GT	1.06
1J6GT	1.06
1L4	.72
1LA4	1.06
1LA6	1.06
1LB4	1.06
1LC5	1.06
1LC6	1.06
1LD5	1.06
1LE3	1.06
1LG5	1.06
1LH4	1.06
1LN5	1.06
1N5GT	.72
1P5GT	.88
1Q5GT	.88
1R4	.88
1R5	.72
1S4	.88
1S5	.66
1T4	.72
1T5GT	.88
1U4	.72
1U5	.66
1V	.72
1V5	.88
1W5	.88
2A3	1.06
2A4G	1.28
2A5	.72
2A6	.88
2A7	2.20
2B7	.88
2E5	.88
2V36	1.10
2X2A	.69
3A4	.72
3A5	1.29
3A8GT	1.92
3B7	1.06
3C6/XXB	1.28
3D6	.89
3E6	1.06
SLF4	1.06
3Q4	.72
3Q5GT	.88
3S4	.72
3V4	.72
5AZ4	.42
5R4GY	1.03
5T4	1.28
5U4G	.53
5V4G	.88
5W4	.88
5W4GT	.60
5X4G	.60
5Y3G	.50
5Y3GT	.38
5Y4G	.50
5Z3	.60
5Z4	.88
6A3	1.06
6A6	.88
6A7	.72
6A8	.72
6A8G	.72
6A8GT	.72
6AB5/6N5	.88
6AB7/1853	1.06
6AC5GT	1.06
6AC7/1852	1.06
6AD7G	1.06
6AG5	.96
6AG7	1.06
6AH6	1.42
6AJ5	.99
6AK5	.99
6AK6	.88
6AL5	.72
6AL7GT	1.06
6AQ6	.66
6AQ7GT	.88
6AR5	.66
6AT6	.54
6AU6	.72
6AV6	.54
6B4G	1.06
6B5	1.56
6B6G	.72
6B7	1.06
6B8	1.06
6B8G	1.06
6BA6	.66
6BE6	.66
6BG6G	1.92
6GH6	.93
6BJ6	.72
6C4	.60
6C5	.60
6C5GT	.60
6C6	.72
6C8G	1.06
6D6	.60
6D8G	1.06
6E5	.72
6F5	.60
6F5GT	.60
6F6	.72
6F6G	.60
6F6GT	.60
6F7	1.06
6F8G	1.06
6G6G	.88
6H6	.60
6H6GT	.60
6J5	.54
6J5Gt	.54
6J6	1.06
6J7	.72
6J7G	.72
6J7GT	.72
6J8G	1.06
6K5GT	.88
6K6GT	.54
6K7	.60
6K7G	.60
6K7GT	.60
6K8	.88
6K8G	1.06
6K8GT	.88
6L5G	.88
6L6	1.28
6L6G	1.06
6L6GA	1.06
6L7	.88
6L7G	1.06
6N6G	1.28
6N7	.88
6N7GT	.88
6P5GT	.88
6Q6G/6T7G	1.06
6Q7	.72
6Q7G	.60
6Q7GT	.60
6R7	.88
6R7GT	.88
6S7	
6S7G	.88
6S8GT	.96
6SA7	.60
6SA7GT	.60
6SB7Y	.88
6SC7	.72
6SD7GT	.96
6SF5	.60
6SF5GT	.72
6SF7	.72
6SG7	.72
6SH7	.72
6SJ7	.60
6SJ7GT	.60
6SK7	.60
6SK7GT	.60
6SL7GT	.88
6SN7GT	.80
6SQ7	.54
6SQ7GT	.54
6SR7	.60
6SR7GT	.60
6SS7	.66
6ST7	.88
6SV7	.88
6U5/6G5	.72
6U6GT	.72
6U7G	.60
6V6	1.06
6V6GT	.72
6W7G	.88
6X4	.54
6X5	.88
6X5GT	.54
6Y6G	.88
6Z7G	1.28
6ZY5G	.72
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	1.06
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.06
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7A7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7V7	1.06
7W7	1.06
7X7/XXFM	1.06
7Y4	.72
7Z4	.72
10	1.56
12A6	.89
12A6GT	1.06
12A7	1.06
12A8GT	.72
12AH7GT	.88
12AL5	.72
12AT6	.54
12AT7	1.06
12AU6	.72
12AU7	.88
12AW6	.96
12BA6	.66
12BE6	.66
12C8	.89
12F5GT	.60
12H6	.60
12J5GT	.54
12J7G	.72
12J7GT	.72
12K7G	.72
12K7GT	.60
12K8	.88
12K8GT	.88
12Q7GT	.60
12SA7	.60
12SA7GT	.60
12SC7	.72
12SF5	.60
12SF5GT	.60
12SF7	.72
12SF7GT	.88
12SG7	.72
12SH7	.72
12SJ7	.60
12SJ7GT	.60
12SK7	.60
12SK7GT	.60
12SL7GT	.88
12SN7GT	.80
12SQ7	.54
12SQ7GT	.54
12SR7	.72
12SR7GT	.72
12X3	.98
12Z3	.88
14A4	1.06
14A5	1.56
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B7	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
14X4	.88
19	1.06
19T8	1.06
20	1.56
22	1.28
24A	.72
25A6	1.06
25A6G	1.06
25AC5GT	1.06
25C6G	1.06
25L6	1.06
25L6GT	.60
25Y5	1.06
25Z5	.54
25Z6	.72
25Z6GT	.54
26	.60
27	.54
28D7	.98
30	.72
31	.88
32	1.06
32L7GT	1.28
33	1.06
34	1.06
35/51	.72
35A5	.72
35B5	.72
35L6GT	.60
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.50
35Z5GT	.46
35Z6G	.88
36	.88
37	.60
38	.72
39/44	.59
41	.60
42	.60
43	.60
45	.60
45Z5GT	.60
46	.88
47	.88
49	.88
50	1.56
50A5	.88
50B5	.72
50C6G	1.06
50L6GT	.60
50X6	.88
50Y6GT	.60
53	.88
55	.72
56	.60
57	.72
58	.72
59	1.06
70L7GT	1.42
71A	.72
75	.60
76	.60
77	.60
78	.60
79	.88
80	.42
81	1.28
82	.88
83	.88
83V	1.06
84/6Z4	.60
85	.72
89	.72
99V	1.28
99X	1.28
117L7GT	1.42
117M7GT	1.42
117N7GT	1.42
117P7GT	1.42
117Z3	.54
117Z4GT	1.06
117Z6GT	.88
FM-1000	1.28
1273	.88
9001	.89
9002	.69
9003	.49
9004	.49
9005	.98
9006	.49

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ment of the radio proximity fuzes. In 1944 he went over to the War Department where he served as an expert consultant on proximity fuzes. He was appointed chief of the Electronics Division in 1945, and in 1947, when the Atomic Physics Division was organized, he became assistant chief of the division under Dr. E. U. Condon, director the Bureau of Standards and chief of the physics division.

Dr. Astin received, through the British Embassy, His Majesty's Medal for Service in the Cause of Freedom in recognition of "valuable services rendered to the Allied War effort."

Dr. Astin was in England from September, 1944, to March, 1945, as a representative of the Bureau of Division 4, National Defense Research Council. His work during that time involved the use and evaluation of the proximity fuze.

A HAM CLUB composed of officers and enlisted men of the Airways and Air Communications Service has been organized in Gravelly Point, Virginia, operating stations W4ACS on 10, 20, 40, and 80 meters.

Commanding General H. M. McClelland secured the gear for the club which consists of three BC-610 transmitters, two SX-28s and one "Super Pro." Ham members include Major Joe H. Beler of AACS whose last call was D4ABE, Bremen, Germany. T/Sgt. Leonard Finkle, KL7FY, of Providence, R. I., will be in charge of the maintenance and servicing of the rig.

A COMPLETE REVISION of the experimental general mobile radio service has been proposed by the FCC, with three new classifications provided: Land Transportation Radio Services, Domestic Public Mobile Radiotelephone Services, and Industrial Radio Services.

In the land transportation service proposal taxicabs receive eight frequencies in two blocks of four in the 152-162 megacycle band. Intercity buses which would also fall in the land transportation service setup receive eight frequencies in the 42 -44 megacycle band originally allocated to the general mobile services, and in addition eight frequencies in the 30 -40 megacycle band. Intercity truck service, which would also be included in this new arrangement, receives eight frequencies in the 30-40 megacycle band.

In the public mobile service, seven zones would be established in the 30 -40 megacycle band. Commenting on this proposal, FCC said that it no longer appears necessary to differentiate between either frequency assignments or service areas insofar as 'urban' and 'highway' services are concerned. Consequently the 30-40 megacycle frequencies can be pooled with the available 152-162 megacycle frequencies. The net result is that any single zone would have five pairs of usable frequencies, and as improved equipment becomes available, the remaining frequencies allocated to this service can be employed.

In granting authorizations in any

area, the Commission proposes to permit service on an interference-free basis. In other words, not more than one applicant will be authorized to operate in any area on a particular frequency or frequencies.

The proposed industrial radio service setup would provide four categories of operation: Power, petroleum, forest products and special industrial. In the power radio service, authorizations would be issued to those engaged in generating, transmitting, collecting, purifying, storing or distributing by means of wire lines or pipelines, electrical energy, artificial and natural gas, water or steam. The petroleum service would be used by those engaged in prospecting for, producing, collecting, refining, or transporting by means of pipelines, petroleum, natural gas, etc. FCC hopes that the new service will provide a nationwide communications system for the petroleum industry.

The forest products service is quite novel, providing radio facilities to those performing tree logging, tree farming and related woods activities in remote areas where other means of communications are unavailable. Heretofore this type of service was only available to government. Frequencies used in this new setup would be shared with the petroleum service.

The industrial radio service proposal is also extremely interesting, offering radio communication facilities to those engaged in farming, ranching, irrigation, mining, and construction activities. Authorizations would also be granted to those conducting commercial and industrial services which involve an element of hazard to life or property, and to those whose operations react directly upon the public welfare or safety, as well as to those engaged in maintenance and repair work directly involving public health and well being.

A NEW HIGHWAY MAINTENANCE SERVICE has also been proposed by FCC for use by state, county, and municipal highway departments. Forestry radio would be expanded to include all state conservation activities, such as flood control, preservation of wild life, enforcement of game laws, etc. Relay, control and repeater stations, which serve as connecting links, would be authorized on a regular instead of an experimental basis.

Congratulations to the FCC for this outstanding series of radio facilities-expansion proposals!

FREQUENCY MODULATION STATIONS are now being set up in European and South American countries. In Milan, Italy, a 3-kw. 99.8-mc. experimental transmitter installed on the tower in Milan park for the fair in that city, is now being operated on a consistent basis. Two more 3-kw. FM installations are planned for Rome and Turin.

A ¼-kw. FM station is being installed in the buildings of the Letna technical museum in Prague, Czechoslovakia, and will operate on 100 mc.

There are three FM stations on the air in Buenos Aires, operating on 46.3

and 30 to 43 mc. One experimental station, operating a low-powered transmitter, is conducting tests on twelve v.h.f. channels from 60 to 300 mc.

A 1-kw. FM transmitter was placed on the air in Sweden recently, operating on 41.62 mc.....................L. W.

Receiver Design

(Continued from page 45)

thus resulting in a signal of varying amplitude being fed to the discriminator. This signal must be suppressed in the limiters or the FM detector itself, or some output will result giving a "false" peak. These "false" peaks cannot be tuned since the a.f.c. circuit will pull the oscillator to tune the correct one.

The a.f.c. circuits incorporated in receivers processed to date have operated very successfully and should provide the listener with additional enjoyment of FM reception.

The "FreModyne" Circuit

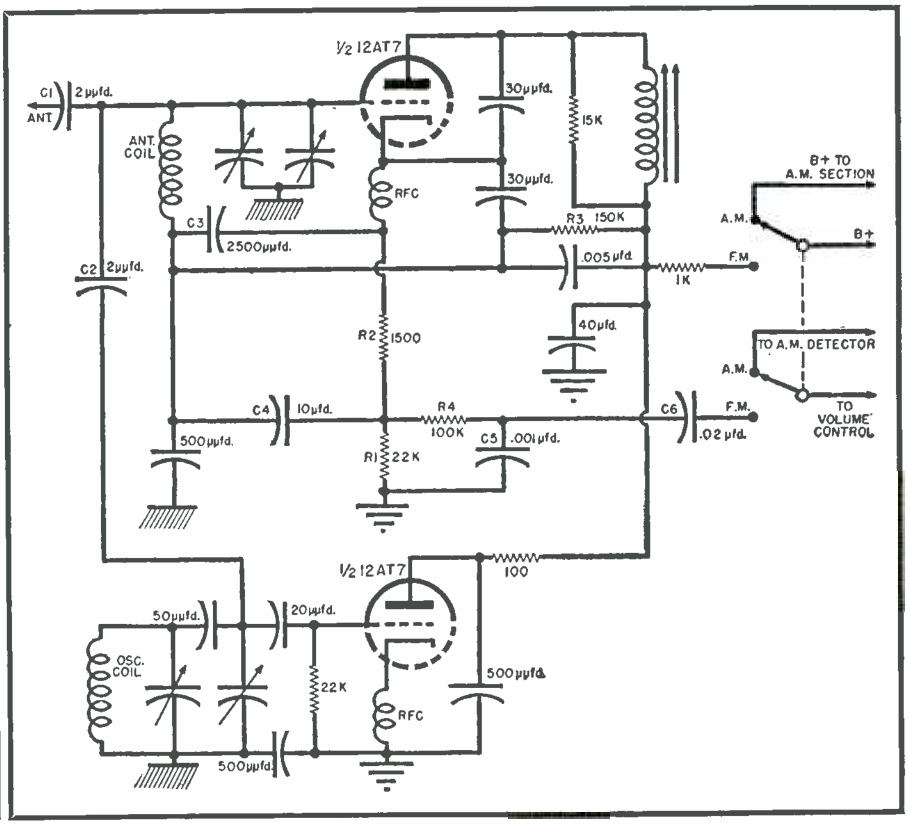
The FreModyne is essentially a superregenerative receiver which uses its selectivity curve as a means of FM detection. It employs the superheterodyne principle in order to allow amplification and detection at a fixed i.f. frequency. This circuit was primarily designed to be used in small receivers to provide FM reception at a minimum of cost.

Only one tube, a dual triode, is required in the circuit. An audio signal of sufficient amplitude to drive a conventional audio system is obtainable at the output. When this circuit is added to an AM receiver, switching from AM to FM is accomplished by switching just the "B plus" and audio leads, thus keeping the bandswitch as simple as possible. One of the triode sections of the tube, usually a 12AT7 or a 14F8, is connected as a conventional Colpitts oscillator. This section serves as the local oscillator variable from 110 to 130 mc. The other section of the tube performs the following functions: It acts (1) as a mixer, combining the local oscillator frequency with the signal frequency giving an intermediate frequency of 22 megacycles; (2) a superregenerative high-gain amplifier operating at the intermediate frequency, and (3) an FM detector. FM detection is accomplished by side tuning the receiver on the steep selectivity curve. As the FM signal shifts up and down the slope, the current in the resistive load in the cathode circuit varies proportionally with frequency deviation, giving an audio signal in the output.

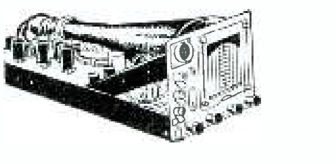
In order to keep the operation as simple as possible, a special stabilizing circuit is employed to eliminate the need for a regeneration control. The values of the parts in this circuit are chosen to give a specially shaped quench waveform for good selectivity and to provide detection linearity. This stabilizing circuit is effective over a wide range of signal strength.

A schematic of a FreModyne circuit used in the *Howard* Model 474 is given in Fig. 5. This receiver is a conventional four tube, plus rectifier, a.c.-d.c. set with a FreModyne circuit added. Since the AM section of this receiver is of conventional design, only the FM section is shown in Fig. 5. The FM signal is coupled to the grid of the mixer tube by a 2 mmfd. condenser, C_1. The oscil-

Fig. 5. Schematic of the FreModyne circuit used in the Howard Model 474.



"Communications"



INDICATOR BC 704 A

Indicator Part of Radar Set SCR 521. Makes an excellent foundation unit for a high gain scope. Has following tubes: 4-6AC7, 3-6H6, and 1-5BP1 CR tube. Comes enclosed in metal shield. New, with all tubes, less power supply.
With wooden carrying case.................$17.50

POWER EQUIPMENT

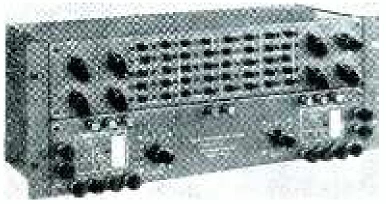
Step down transformer: Pri: 440/220/110 volts a.c. 60 cycles, 3 KVA. Sec. 115 v. 2500 volt insulation. Size 12"x12"x7" $40.00
PLATE TRANSFORMER. Pri: 117 v. 60 cy. Sec. 17,000 v. @ 144 ma. with choke. Oil immersed. Size: 26"x29"x13". Amertran $65.00
PLATE TRANSFORMER. Pri: 220 v. 60 cy. 3 phase. 30 KVA. Sec: 6150, 5620, 5050, 4500 volts. Oil filled. 89 gal. Size: 51"x32"x23". Amertran. Approx. wt. 1500 lbs. $250.00
Fil. Transformer: Pri: 220 v.a.c., 60 cy; .05KVA. sec: 5 v.c.t., 34,000 v. test $24.50
Fil. Trans. UX6899. Pri: 115v 60 cy. Sec: Two 5V 5.5A windings 29 KV Test $24.50
Plate Transformer: Pri: 115/230 v.a.c., 50-60 cy. sec: 21,000 v 100 ma. $145.00
LINE VOLTAGE REG. 2 KW Saturable reactor type Pri 95-130 v 60 cy Sec 115 v 60 cy. 17.4 A 2 Kw 100% PF $160.00
LINE VOLTAGE REG Pri 92--138v 57/63 cy 1ph15A Sec 115v 7.15A .82 Kw 96% PF $135.00
Voltage Reg. Transtat "Amertram" type PH 2KVA load. Input 90/130 v. 50/60 cycle output 115 v. $40.00

OIL CONDENSERS

1 mfd. 10 KVDC GEPYR #14F191..........$15.00
.06 mfd. 15 KVDC, GEPYR 25F585-G2..... 8.70
1.5 mfd. 6000 vdc Aerovox................ 12.50
.25 mfd, 20,000 vdc 17.50
10 mfd. 1000 VDC 1.79
3x10 mfd. delta connected synchro-capacitor, 90 v. 60 cycles, GE 4.95
.1 mfd, 6000 vdc, GEPYR 25F509G2 .... 3.85

INSTRUCTION MANUALS

BC312, BC 342 ....$1.25
SCR 281 $1.25; B-19XMTR .... .75
ZA EQP'T $.75; SCR 508 .... 1.00



FEDERAL F.T.&R 101-A TWO WIRE APPLIQUE

Provides necessary balancing facilities for four-wire repeater when used on two-wire lines which may be voice-frequency telephone lines of open wire, or non-loaded or loaded cable. Std. 19" channel iron rack mtg. Price, New, complete as shown with tech. manual $54.00

EE-89A REPEATER

Extends range of field telephone apparatus, such as EE-8 up to 25 miles, when inserted in a line. New, with spare tube and instruction manual, less standard type batteries $21.50

BC 686 LINE AMPLIFIER

With magneto ringer, 3-tube 25L6 amplifier. For local point-to-point telephone operation, remote operation of Phone Xmtr, remote reception of receiver output, monitoring facility. Requires only 24 vdc for tube B for full operation.
New, less tubes, in wooden chest $18.50
Per pair for 2-way pt-to-pt operation......... 35.00

HAND GENERATORS

GN 35: Output: 350 v, 60 ma, 8 v, 2.5 amp, less hand crank $3.50
GN 45: Output: 500 v, 100 ma, 6 v, 3 amp, less hand crank $4.15

DYNAMOTORS

Type	Input Volts	Input Amps	Output Volts	Output Amps	Radio Set	Price*
BD 77KM	14	40	1000	.350	BC 191	$9.95 N $5.95 LN
PE 73	28	19	1000	.350	BC 375	$4.95 N
DM 21	14	3.3	235	.090	BC 312	$2.79 LN
DM 21CX	28	1.6	235	.090	BC 312	$2.49 N
DM 25	12	2.3	250	.050	BC 367	$2.49 LN
DM 28R	28	1.25	275	.070	BC 348	$3.75 N
DM 33	28	7	540	.250	BC 456	$3.95 N
DM 42	14		515 1030 2/8	.110 .050	SCR 506	$3.95 LN
PE 55	12	25	500	.400	SCR 245	$4.95 LN
PE 86 N	28	1.25	250	.060	RC 36	$1.95 N
PE 101C	13/26	12.6/6.3	400 800 9 AC	.135 .020 1 12	SCR 515	$3.49 N
BD AR 93	28	3.25	375	.150		$1.95 N
23350	27	1.75	285	.075	APN-1	$3.50 N
35X045B	28	1.2	250	.060		$2.25 N
ZA .0515	12/24	4/2	500	.050		$3.95 N
ZA .0516	12/24	8/1	275	.110		$1.25 N
B-19 pack	12	9.4	275 500	.110 .050	Mark II	$6.95 N

*N—NEW; LN—LIKE NEW

ARC-5 ACCESSORIES

CONVERSION COILS FOR ARC-5 TRANSMITTERS

M.O. Coils	P.A. Coils	Antenna Loading Coils	Freq. Range
$1.00 each	$1.00 each	$.85 each	
#6029	#7247	#6033	3-4 Mc.
#6030	#9293	#6034	4-5.3 Mc.
#6032		#6035	7-9.1 Mc.

CONVERSION KIT, consisting of 1-M-O coil, 1-P.A. coil, 1-ANTENNA COIL, in any one particular frequency range $2.00
ARC No. 6558 variable receiving capacitor, 62 mmf /section, 3 sections, .03" spacing, 8 rotors. Worm drive ratio 33:1 ....$1.75
ARC No. 4990, variable xmtg capacitor, 22.4—145 mmf. .05" spacing, 11 rotors. Each $1.00
ARC 5632 Var. Xmtg. capacitor, 29.2—117 mmf. .06" spacing. 16 rotors, worm drive: 96:1 ....$1.00
Single rcvr. mtg. racks, $1.00; dual.....................$1.50
Single shock mounts for rack $.50, dual $1.00
DUAL CONTROL BOXES FOR RCVRS.............$1.00

BAND PASS FILTER

#70473. Sharp band pass peaked at 975 cps. High-to-high impedance. Can be plugged into 'phone output of receiver for good results. Cuts out QRM and QSB. New, with circuit diagram $2.25

HEADSETS

Dynamic mike and headset combination. A high quality, efficient unit, used in B-19 tank Xmtrs. Mike and phones complete, new $2.75
R-15 headsets: 8000 ohms impedance, rubber cushions. Comes with 8" cord and plug PL 55. New $1.95
HS 30 headset. Insert type headset cuts out background noise, and low impedance (500 ohms) assures efficiency and fidelity. A MUST for every ham at this price.................$ .85
Xfmr to match 8000 ohms output ....$ .35
HEADBANDS: HB-1, HB-4, HB-30, New ....$ .25 ea.

MINE DETECTOR

AN/PRS-1. Can be used to detect buried objects, such as rocks, tree stumps, water pockets, etc. Every home-owner, camper, prospecter needs one. Complete unit, consisting of detector unit, amplifier, headphones, meter, resonator, with all necessary cables and tubes, new....................$12.75
With Batteries $21.65

BC 221 FREQ. METER ASSEMBLY

Ideal foundation unit for an extremely stable VFO or Freq. Meter. Consists of temperature compensated coils and capacitors. Tunes with 220 mmf. condenser. Low Range: 125-250 kc; high range: 2000—4500 kc. New, with 220 mmf capacitor and BC 221 schematic........$7.95

TUNABLE PKG'D "CW" MAGNETRONS

QK59	2675-2900 mcs	QK61	2975-3200
QK60	2800-3025 mcs	QK62	3150-3375
New $45—each		New $55—each	

TUBE	FRQ. RANGE	PK. PWR. OUT.	PRICE
2J31	2820-2860 mc.	265 KW.	$15.00
2J21A	9345-9405 mc.	50 KW.	$25.00
2J22	3267-3333 mc.	265 KW.	$15.00
2J26	2992-3019 mc.	275 KW.	$15.00
2J27	2965-2992 mc.	275 KW.	$15.00
2J32	2780-2820 mc.	285 KW.	$15.00
2J38	Pkg. 3249-3263 mc.	5 KW.	$25.00
2J39	Pkg. 3267-3333 mc.	8.7 KW.	$25.00
2J55	Pkg. 9345-9405 mc.	50 KW.	$25.00
3J31	24,000 mc.	35 KW.	$17.50
W.E.	700A 680-710 mc.	100 KW.	$35.00
W.E.	720BY 2800 mc.	1000 KW.	$25.00

KLYSTRONS: 723A/B—7.75 707B $20.00

MAGNETS

For 2J21, 2J22, 2J26, 2J27, 2J21, 2J32, and 3J1 725 A, Each $8.00
4850 Gauss, ⅝" bet. pole faces, ¾" pole diam. $8.00
1500 Gauss, 1½" bet. pole faces, 1⅝" pole diam.......... $8.00
1000 Gauss, electromagnet, adjustable 2⅜" to 3" bet. pole faces. 2½" pole diam. $12.00

A COMPLETE LINE OF MICROWAVE EQUIPMENT IN STOCK: 10CM, 3CM, 1.25 CM. SEND FOR OUR MICROWAVE FLYER.

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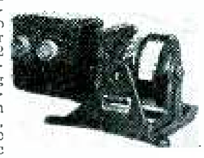

The most powerful, compact assembly offered on surplus for beam rotation. 90:1 gear ratio turned by 24 vdc motor that will run on 12 vac. Bicycle type sprocket for easy coupling to any shaft. 9¼"LX-6½"W x 4"H. with mounting facility. New, guaranteed, complete with 110 vac to 12 vac step down transformer $16.50

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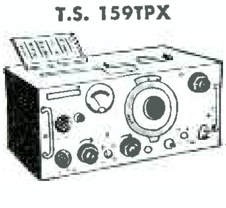
Sperry klystron tuner, model 12 ....$2.00
Sine potentiometers, GE#251 x 96 or W.E. #KS 15138 L01 ....$3.50
CG27, "N" cable ass'y. 3' long, male to female $2.50
Phase-Shifting Cap. 180 deg. W.E. #D-150734. $2.50
Klystron sockets for 723 A.B. and similar types 2 for $1.00
10-cm. McNally cavity type SG. Ea $3.00
Crystal mixer "S" band. Complete with type "N" fitting and IN22 crystal $3.85
Line insertion attenuator, type OAX-1, 20 Db. attenuation, with 3-contact plug and socket (Amphenol 16S-5) $2.25
Delay Line, 5.0 micro sec max, 500 ohms impedance, 12 taps $4.00
Trihedral Radar Reflector MK 1 .... $4.00
Lighthouse Cavity for GL 446. Cavity dim: 3¾" x 2¼" diam. $5.50
TS 115/APS-2F 10 cm antenna in lucite ball, with type "N" fitting $4.50
OAJ Navy type CYT66ADL, antenna in lucite ball, with Sperry fitting $4.50
10 cm. feedback dipole antenna, in lucite ball for use with parabola $8.00
"K" Band 1.25 cm. Rotary Joint $45.00
PE 206-A Input: 28 VDC @ 38 amp. Output: 80 volts @ 500 volt-amp. 800 cy. Leland Electric. New complete with instruction book, relays, filters, etc. $12.50

MICROWAVE TEST EQUIPMENT

W. E. I. 138 A. Signal generator, 2700 to 2900 mc range. Lighthouse tube oscillator with attenuator & output meter 115 VAC input, reg. Pwr. supply. With circuit diagram $50.00
TS-238 GP. 10 cm. Echo box with resonance indicator and micrometer adjust cavity $85.00
3 cm. wavemeter. 9200 to 11,000 mc transmission type with square flanges $15.00
3 cm. stabilizer cavity transmission type.... $20.00
Direct reading VSWR meter. Complete with amplifier, bolometer input—AC crystal—DC crystal connections $45.00
3 cm. Wavemeter. Micrometer head mounted on X-Band guide. Freq. range approx. 7900 to 10,000 Mc. $75.00

T.S. 159TPX



Measures frequency between 150 & 200 mc. by heterodyne method. Power of Xmtr can be directly measured. Measures DC voltages up to 500 Volts. Original operation on 110 V. 400 cy. but conversion kit makes it operable on 110 V. 60 cy. new, complete with tubes, crystal, cal. chart, antenna, meter & conversion kit and data for 110 V, 60 cy operation $29.95

ANTENNA AN/122-A: Dipole, 12' L, ideal for that 6 meter beam. One side of dipole adjustable for fine tuning. Get four of them for only $20.00, or $5.65 each.
ANTENNA AN/104-A. The best deal for two meters. 21" L, of streamline construction, with 831R connector, all set to go. $.75 ea or 2 for $1.35.
ANTENNA AN/128-A. A complete two-meter beam, originally designed to work with IFF set RC 148-A, this unit is extremely compact, rugged, efficient. Consists of two vertical radiators working against a square reflector 3'x1'. You can't beat this unit for high gain and directivity. New $40.00
Adcock Direction Finding Beam Arrays, including apx 12 ft crossbeam and 4 vertical dipoles, New and complete $47.50
30 ft. MAST SETS. Heavy duty rugged plywood. Crated in 3 sections with coupling material. Two masts for ideal flat-top antenna. New $40.00 per set.
140-600 MC. CONE TYPE ANTENNA, complete with 25' sectional steel mast, guys, cables, carrying case, etc. New $49.50

CATHODE RAY TUBES

3BP1	$1.25	3GP1	$3.35
3FP7	$1.20	5FP7	$1.75
5BP1	$1.20	3DP1	$2.25
3EP1	$2.95	5JP2	$4.00

12GP7 .... $10.95

XMTR TUNING UNITS

From BC 375: TU-9 (7.7-10mc); TU 10 (10-12.5 mc); TU 22 (350-650 kc); TU 26 (200-500 kc). Each $2.25
For BC 610: TU 48 (2.5-3 mc); TU 52 (6.35-8 mc) TU 53 (8-12 mc) ....Each $1.75
For BC 223AX: TU 17 (2-3 mc); TU 18 (3-4.5 mc) Each $1.95

5J30 THE NEWEST THING IN UHF, 10-350 MC. MAGNETRON IN GLASS ENVELOPE. 200 W.C.W. OUTPUT. NEW, COMPLETE WITH DATA SHEET $39.50

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D-167332 (Bead)
D-170396 (Bead)
D-168392 (Button)
D-168391 (Bead)

lator signal is also coupled to the grid by condenser C_2 and the difference frequency is developed in the plate circuit of the mixer. The plate load of the mixer is the i.f. transformer which is tuned to 22 mc. This signal is amplified by a Colpitts oscillator type superregenerative detector. The audio signal is developed across resistor R_1 in the cathode circuit. This signal is coupled to the volume control by C_6 after passing through the de-emphasis network, comprised of R_1 and C_5. Resistor R_2 and condenser C_3 control the wave shape of the quench voltage. The series circuit, made up of R_4 and C_1, develops a stabilizing voltage. As grid current flows, the electrolytic condenser C_1 is charged. The discharge path is through R_3. The time constant of this circuit is such that it will give stable operation with maximum audio output. Since a superregenerative circuit is sensitive for only short intervals, many noise pulses, which occur between these intervals, are not received.

According to sensitivity measurements released by *Hazeltine Electronics Corp.*, the quieting sensitivity is approximately 200 microvolts. Although a signal of less strength can be heard, the signal-to-noise ratio is low.

A view of a receiver incorporating a FreModyne circuit is shown in Fig. 1. This sub-chassis is shock-mounted and is bonded to the main chassis with a braided strap. The tuning condenser has two three-plate sections which are used as the r.f. and oscillator tuning sections. The oscillator coil can be seen beside the oscillator trimmer. The i.f. transformer and converter tube can be seen at the right of the sub-chassis.

Fig. 4 shows a bottom view of the same chassis. The FM sub-chassis is at the lower left. The decoupling filter has been disconnected to give access to the parts in the sub-chasis. Due to the construction of the sub-chassis, little of the wiring detail can be seen but the photo shows what a small space is required for the FreModyne circuit.

Alignment of this circuit is quite simple. An unmodulated signal at the i.f. frequency is fed to the antenna terminal. The i.f. transformer slug is adjusted for minimum noise. The dial is set to 105 mc. and a 105 mc. signal is fed in from the signal generator. The oscillator trimmer is set for minimum noise to calibrate the dial. The tuning condenser is then rocked while adjusting the antenna trimmer for minimum noise. As can be seen, no special equipment is required since a conventional AM signal generator can be employed. Harmonics may be used if the signal generator does not have fundamental output at the FM frequencies.

The performance of this FM detector is surprising when the small number of parts used is taken into account. It is especially successful in strong signal areas and, due to its high selectivity, will give adjacent channel rejection of a higher order than most conventional FM receivers, especially when tuned on the side of the selectivity curve away from the adjacent channel.

(To be continued)

International Short-Wave

(Continued from page 107)

Polskie," but when Kary heard the station he did *not* hear such announcement. Possibilities are Moscow and Belgrade. *Does anyone know the true identity of this station?*

Radio Baghdad, Iraq, gives its schedule as on 767 kc. at 2300-0030; on 7.617 and 7.092 at 0800-1400 (Arabic); on 7.092 they use Kurdish at 1000-1300, and *English* at 1300-1400; this latter channel is heard in Sweden through heavy "ham" QRM. (URDXC) Also believed to be station heard on this frequency in Australia. (Gillett)

Haganah Radio, Israel, uses approximately 6.950, daily 0530-0700, 1500-1515, according to Herman Bluman, North Africa; there may be other times and frequencies. Ohrwall, Sweden, airmails me that "Cori-Israel," P.O. Box 661, Tel Aviv, Israel, is heard on 6.950 with *English* news at 1230. In a recent DX broadcast from Stockholm, Sweden, it was stated that an observer in London reported this *English* period and said the transmission begins with six "pips" time signal, and the announcement, "This is Cori-Israel, the broadcasting station of the Jewish State. Here is the news." At end of the transmission comes the phrase, "We shall be with you again tomorrow morning at 0230. So long and goodnight, everybody."

According to a Swedish DX session, *Radio Douala,* Cameroons, is now on a new channel of 9.160 (approximately), with good strength at 1300-1500 weekdays and 1300-1600 Sundays.

YV7RB, Cumana, Venezuela, verifies with a white card printed in blue, signed by J. J. Salindo, Director. (URDXC)

"The Democratic Greek Army Radio" is operating in Greek at 1230 and in French at 1400; it is on approximately 6.830; it is possible that it also carries a program in French on 7.860 around 1700. (Swedish DX Broadcast)

Beirut, Lebanon, 8.030V, has news now at 1330-1345 (may not be daily); schedule seems irregular. Now announces as "Arab Voice of Lebanon." (Pearce, England)

Haganah Radio has been heard by Pearce in England on 6.830 with *English* at 1230-1245, saying will be "back tomorrow in English" at 0230. Also heard at 1330 with broadcast in Italian.

Leopoldville tested some time ago on 11.720 (Radio Congo Belge), but has recently been reported moved to 11.670 at 1100-1500 in parallel with OTM2, and OTM3, 9.380; the 11.720 channel, however, is reported still used by OTM4 daily at 0515-0700. (Swedish DX Broadcast)

Harry Johansson, Sweden, flashes, that Bucharest, Roumania, on 11.900, is often heard well at 1630-1700.

Radio Maroc, Rabat, French Morocco, lists schedule of 0145-0400, 1300-1900 on 9.082; on 16.666, 0700-0930; lists call CNR3 and power 2.5 kw. (Harry Johansson, Sweden)

Oslo is now broadcasting the National

Norwegian Home Program over 17.825 daily 1200-1800. (Swedish DX Broadcast)

"Radio Watani El-Kurds," or "Kurdish National Radio," Iraq, is reported daily 1030-1100 on approximately 7.010. (ISWC)

Addis Ababa, 9.620, Ethiopia, is scheduled daily with *English* at 1045; the 19-m. outlet is not currently in use (at least on voice). (ISWC)

YDC, 15.145, Batavia, Java, is heard daily 0800-1000; is in native except at 0930-100 when has *English* for U. S. (Balbi, Calif.)

Praia, Cape Verde Islands, 5.890, is reported at 1530-1700. (Swedish DX Broadcast)

Bornbirn, Austria, is reported heard in Western Europe with fair signals on about 6.000; scheduled 2300-1700 (with occasional brief pauses); 500 watts. (Schwarz, Austria)

Radio Malaya, 6.125, Singapore, is heard 0800-1030; at times is in parallel with 4.82. (Balbi, Calif.)

Official schedules of *Radio Moscow* to the United States are listed—0745-0815, 15.41, 15.39, 15.23, 11.96, 11.88, 11.87; 1820-1930, 15.39, 15.31, 15.23, 11.96, 11.88, 11.87; 1930-1950, 15.31, 11.96. (USSR Embassy)

A Soviet outlet on 6.075, to Orient at 0800-1030, strong signals, maybe Petropavlosk. (Balbi, Calif.)

Recently, Rome's 15.12 outlet (transmitter at Milan) has had news at 1915; 11.81 is quite weak. (Balbi, Calif.)

Summer schedules announced by *Radio Australia* are—Forces Program, 2200-2300 (weekdays) and 2100-2300 (Sat. and Sun.) VLB5, 21.540, VLC9, 17.840, VLG11, 15.210; on Sat. and Sun., VLA6, 15.200, is added. Sporting Service on Saturdays for Forces, VLB5, 21.540, VLG11, 15.210, at 2215-0230 (that is, Friday-Saturday EST). West Coast of North America and Africa, 2330-0045, VLA5, 15.320, VLC9, 17.840, to America; VLB5, 21.540, VLG11, 15.210, to Africa. French program to Europe and Tahiti, 0100-0145, VLA8, 11.760, to Europe; VLA8, and VLG6, 15.240, to Tahiti; on Sat. and holidays, VLA6, 15.200, replaces VLG6. Wednesdays in Siamese to Siam, 0130-0150, VLC, 15.200. British Isles and Europe, 0200-0315, VLA6, 15.200, VLB3, 11.760 (not Sat.), VLC10, 21.680 (closes 0245). French to New Caledonia and French islands of Pacific, 0248-0345, VLG3, 11.710; VLC4, 15.320 (at 0300-0345). Forces Program and to Asia, 0300-0645, VLB3, 11.760; VLC4, 15.320 (at 0345-0645); VLA6, 15.200 (at 0330-1115); VLG3, 11.710, carries Asiatic program at 0355-1000. East Coast of North America, 0700-0845, VLB, 9.540, VLC7, 11.810. British Isles and Europe, 0900-0945, VLB3, 11.760; VLC6, 9.615, carries same program to Asia. West Coast of North America, 1000-1115, VLC3, 11.760, VLB9, 9.615; at 1015, VLG8, 9.680, joins to Africa. British Isles and Europe, opens 1500 on VLA8, 11.76, VLB, 9.540, VLC, 15.210; VLA8, VLB close 1630; VLC closes 1655. Forces and East Coast of North America, 1643-1815, VLB11, 15.160, to Forces in Japan and North Pacific (and for relay by Kure, Japan, on 6.105); VLA8, 11.76, to Eastern North America; at 1710, VLC, 15.200, is added to South America, and VLG6, 15.230, is added to British Isles and Europe; all close 1815.

PCJ's *new* 21.480 channel, Hilversum, Holland, is scheduled with *Radio Nederland* programs around 0700-1030 *daily*, and with *"Happy Station Program"* on Tuesday *only*, 0330-0500. (Callahan, Pa.) *If anyone in the U.S. or Canada picks up this outlet, please let me know.* Address is Ken Boord, 948 Stewartstown Road, Morgantown, West Virginia, U.S.A.

Chavez, Cuba, reports YV3RC, *"Radio Carora,"* in Carora (Lara State), Venezuela, with test transmissions on 4.900; schedule was not given.

Radio International, Tangiers, appears to have moved from 6.200 to approximately 6.265; signs off 1800. (Nilsson, Sweden)

In a vertification from ZRB, South African Air Force Station, Telecommunications Training and Development Centre, P.O. Odonata, Nr. Pretoria, Transvaal, South Africa, this information was given:

"We are a stronger station than the SABC stations in the Union. At present we are transmitting with an output of just under 5 kw.; the SABC stations—Cape Town, Durban, and Johannesburg—are rated at 2½ kw. ZRB is still in the 'infant' stage, but we hope to have it running 'full steam ahead' within the next two or three months. At present we are having a double mixer panel built to enable us to transmit on two frequencies instead of just the one (9.110). When 6.210 is in use, we will be glad to let you know and will appreciate reception reports on same." Schedule was listed 0000-1100. Takes some relays from SABC, and plays recordings a great deal. Gives weather and other reports of interest to aviation.

KZOK, 9.695, Manila, Philippines, is heard in New Zealand at 0500. (Gary)

Norway's 17.825 channel, 5 kw., has been heard at 1130 on occasion, calling New York. (Eisele, N.Y.)

From Rex Gillett, Australia, come these tips—Pietermaritzburg, South Africa, was noted some time ago on old channel of 4.855 to 1645 sign-off, but more recently has been back on 4.878; "Here is Radio Sumatra, Medan," is announcement in Dutch at 0803 on 7.210, following recorded music; prewar call was YDX. *Radio Noumea,* New Caledonia, is now on approximately 6.000 and is fine level; heard to around 0530. Berne, Switzerland, is heard on 15.305 concluding an *English* period to South Africa at 1545. Pakistan has been heard on *medium-wave* (1167 kc.) at 1030, announcing "This is Radio Pakistan," but so far has not been heard on SW.

For the summer the night beam from Berne, Switzerland, to North America is on 11.810, 15.305, 9.535, at 2030-2230; the first period to North America is at 1730-1815, I am informed.

* * *

Acknowledgement

During the summer (considered by many as a "lull" season for DX) I have found reports from readers to be holding up well. Keep them coming!. .K.R.B.

SSB Selector

(*Continued from page 55*)

when the *difference* is taken.

When both sidebands (*F-M*) and (*F+M*) are impressed simultaneously, such as in conventional AM reception, the net result will be a superposition of the above two cases. Thus, 2 units of lower sideband information and zero of upper will be delivered on the lower sideband position, while 2 units of upper sideband information and none of lower will be delivered on the upper sideband position.

It is possible to pick off an audio voltage produced by both sidebands by connecting to the output of network *B* ahead of the differential network. The only difference between this type of reception and that afforded by a conventional receiver is that the incoming carrier is built up or "exalted" by the local oscillator in the YRS-1. "Exalted" reception ("Locked Oscillator" reception as it is termed in the case of the YRS-1) reduces distortion effects which are brought about by selective fading conditions on high frequencies or by severe heterodyne interference. Under such conditions, only a small segment of the frequency spectrum occupied by the transmitted signal fades, leaving the remaining portion of the spectrum at the original level. *A* of Fig. 7 shows the normal relationship between carrier and sideband amplitude. If, under selective fading conditions, only the segment of the frequency spectrum occupied by the carrier faded, the resulting signal would look something like *B* of Fig. 7, and as far as the receiver detector is concerned, over-modulation with accompanying distortion has taken place. If the carrier is "exalted" by inserting an unmodulated signal of the same frequency and phase into the detectors, the signal appearing at the detector would then appear as in *C* wherein the effective percentage of modulation is greatly reduced. Fading of the exalted carrier as shown in *D* of Fig. 7 will then only

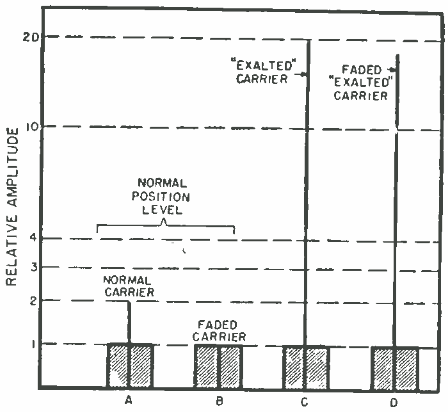
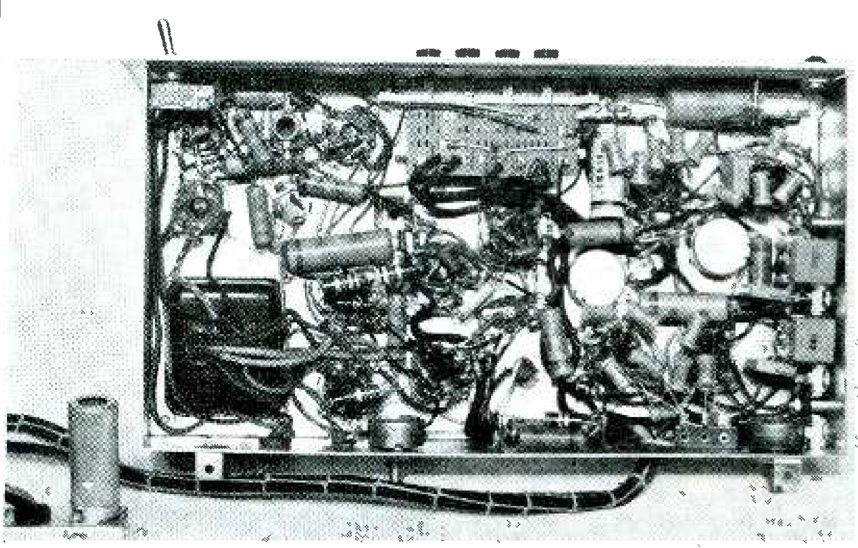


Fig. 7. (A) Normal relationship between carrier and sideband amplitude. (B) Result when carrier only fades, producing severe distortion. (C) Carrier "exalted" by inserting unmodulated signal of same frequency and phase into detectors. (D) Fading of "exalted" carrier increases effective modulation depth only slightly.

slightly increase the effective depth of modulation, since, in most cases, the amplitude of the local oscillator is ten to thirty times as great as the amplitude of the received carrier.

Fig. 5 shows in block form that the YRS-1 functions as a complete second detector and beat frequency oscillator and these circuits are therefore not used in the receiver when the YRS-1 is used in the "Sideband" and "Locked Oscillator" positions. The i.f. voltage from the receiver is picked off the last i.f. stage and fed to a cathode follower input stage which employs a triode connected 6AK6. To minimize loading of the receiver i.f. stage, the cathode follower is constructed on a separate, small chassis which is installed in a convenient location inside the receiver. The i.f. voltage from the cathode follower is fed to the two detectors V_3 and V_7 through L_2 which is simply a small, iron core peaking coil resonated to the receiver's i.f. V_2, together with grid inductance L_1 and plate transformer T_1 form a conventional, electron coupled oscillator whose output and input circuits are also resonated to the receiver

Fig. 8. Under chassis view of the YRS-1 showing straightforward wiring.



i.f. Transformer T_1 is somewhat overcoupled so that the voltages developed across its primary and secondary winding are approximately equal. V_1 operates as a reactance tube and controls the exact frequency of the oscillator so that it remains in synchronism with the received signal. V_4, V_5, V_8 and V_9 form the A and B networks respectively. The RC circuits in these networks are tuned by means of trimmer condensers to the frequencies indicated on the diagram. These RC combinations must be tuned as closely as possible to the specified frequencies and should employ precision components which are capable of long time stability. Potentiometers R_{24} and R_{47} comprise the differential network from which is selected the desired sideband voltage. A stage of resistance-coupled audio amplification utilizing V_{12} boosts the selected voltage before it is fed back into the input of the receiver's audio system.

As shown in block form in Fig. 6, connection of the adapter to a conventional communications receiver is relatively simple and requires no major operation on the receiver itself. The i.f. voltage for the cathode follower can usually be obtained from the top of the receiver chassis by means of a small lug connected to the plate pin of the second detector tube. The connection between the receiver's second detector and audio system must be broken and in most cases this is done automatically when an external audio signal is fed into the "phono" input jack of the receiver.

It should be pointed out that the efficiency of the YRS-1 in rejecting unwanted sidebands and in passing desired sidebands depends to a great extent upon correct alignment of the i.f. channel in the receiver. If the alignment of the i.f. channel is questionable, it is recommended that these stages be carefully realigned so that the full capabilities of the adapter will be realized.

Satisfactory operation can be obtained with the YRS-1 only when the receiver to which it is attached is stable in its operating characteristics. The most troublesome source of instability in many receivers is the tunable oscillator which heterodynes the incoming signals to the intermediate frequency. Instability in this oscillator may fall into one or more of the following classifications:

1. Moderately slow drift in frequency, usually stabilizing within two hours of operation. This drift is caused by temperature readjustment as the receiver reaches a stable operating temperature.

2. Erratic jumps in frequency. This may be caused by line voltage changes, sudden release of stress due to thermal changes as the receiver warms up, poor sliding contacts on the oscillator tuning condenser, or poor voltage regulation in the plate power supply. Poor voltage regulation may cause the frequency of the oscillator to change with the setting of the manual (r.f.) gain control or with a.v.c. action.

3. Frequency modulation of the oscillator at power line frequency or harmonics.

It should be remembered that certain amounts of all three types of oscillator instability exist in the very best equipment. The YRS-1, however, will work satisfactorily with the majority of receivers in use by amateurs today. The primary point to be made here is that connecting the YRS-1 to a cheap a.c.-d.c. receiver is somewhat akin to putting telescopic sights on a slingshot.

If the receiver itself has excellent stability, satisfactory operation may not be obtained when receiving certain types of stations whose frequency control systems suffer from excessive instability of the types listed above. Naturally, nothing can be done to correct such defects at the receiving end, and the only solution to this problem lies in dropping definite hints to the transmitting operator to the effect that your Single Sideband Selector is not capable of following a v.f.o. which drifts 500 cycles per minute.

Operation of the adapter in conjunction with a receiver is simplicity itself. For conventional amplitude modulation reception, the band can be tuned with the adapter set to the "Normal" position, and once the desired station is located, either "Sideband" button can be depressed to determine which sideband is clearer of interference. When heterodyne interference is encountered on both sides of the desired carrier, the receiver's normal crystal filter phasing adjustment can be used to minimize the disturbance on a strong heterodyne within the sideband accepted for reception. This generally reduces the audio fidelity, just as in normal receiver use. For c.w. reception, the receiver b.f.o. should be turned off when the YRS-1 is used in the "Sideband" or "Locked Oscillator" positions. The necessary beat note is produced by the incoming signal beating against the local oscillator in the YRS-1. The usual procedure for c.w. operation is to tune for signals with the YRS-1 in the "Locked Oscillator" position and then, when the signal has been located, to switch to the appropriate sideband. If interference develops, retune the receiver to the other side of zero beat and depress the other sideband button. The advantage of the YRS-1 over the crystal filter is that an entire sideband spectrum of interference is removed, rather than a small "notch," and furthermore, removal of such interference is automatic because critical phasing controls are not involved. "Chirpy" c.w. signals can be copied on the YRS-1 whereas the crystal filter makes this difficult and sometimes impossible.

Reception of single sideband, suppressed carrier signals, is, of course, perfectly feasible with the YRS-1. If the carrier is totally suppressed, the local oscillator in the YRS-1 will have no incoming voltage on which to lock but will operate to provide ideal single sideband reception. With a transmitter carrier attenuation of, say 20 db., however, sufficient carrier voltage will be fed into the YRS-1 to enable the local oscillator to lock-in automatically at the correct frequency.

—30—

Electronic Timer
(Continued from page 59)

minute. Adjust the potentiometer (R_2) to approximately its midpoint and with the positive test lead connected to the cathode of the selenium rectifier, turn on the timing switch (S_2). The immediate voltage reading, before the tube is ionized, should be 125 volts. Should there be less than 90 volts present at the cathode of the rectifier, turn off the line voltage and check the power supply for the source of the trouble. If the voltage reading is within reasonable limits the tube should fire, activating the relay in about 20 to 30 seconds. After this has occurred, transfer the positive test lead to the plate of the tube where the voltage should be on the order of 10 volts.

Our next point of interest lies in the grid circuit where we particularly want to know the value of the maximum available voltage. This measurement is accomplished by transferring the positive test lead to arm of potentiometer R_2. Rotating the potentiometer (R_2) from its maximum clockwise position to its maximum counter-clockwise position should change the voltage from minus 60 volts to minus 10 volts.

Here again we are confronted with the problem of how much tolerance should be allowed between the voltage readings taken by the author and those taken by the reader. It should be remembered that several factors greatly influence these readings. The most important of these factors are:

1. The internal resistance of the voltmeter, which upsets high impedance circuits, such as grid circuits, due to its loading effect.

2. The effect of different line voltages. The author used a line voltage input of 115 volts and a meter resistance of 1000 ohms-per-volt for all measurements.

If the above voltage tests prove to be within ten per-cent of the specified values we can turn our attention to the operation and calibration of the unit. The author finds that a white drawing card furnishes a very suitable face for the unit although colored cards may be used. Scribe a circle 1⅛" in diameter around the shaft of the potentiometer (R_2) and attach a knob to the shaft. We are now prepared to calibrate the unit.

The calibration of the timer is relatively simple and all that is required is a little patience. Turn on the main switch (S_1) and set the dial pointer to approximately its center value and allow the unit to warm up for a period of five minutes. This warm-up period is necessary to stabilize the circuit components and allow for a more accurate calibration.

Connect a lamp or other suitable device to the outlet of the timer and turn on the timing switch (S_2). If the normally closed contacts were used the lamp should extinguish in about 30 seconds. Note in pencil opposite the index of the dial pointer, the actual time required to extinguish the lamp. Repeat this procedure at points about halfway between the center and minimum and maximum. This provides us with three points of known value and from there on we shall have to resort to the "cut and try" method. The author finds it advisable to calibrate in 1 second steps up to 5 seconds, and in 5 second steps from there on.

After all the major points have been located and recorded, by the process previously described, the remaining interval markings can now be located, more easily, by means of a pair of dividers. The use of dividers at this point, for locating each individual second between 5 and 10 or 10 and 15 seconds, etc., will not result in excessive loss of accuracy. The dial should now be finished using black, waterproof ink which will greatly add to the appearance and durability of the timer.

In operating the unit there is one important item to keep in mind. Allow at least 15 seconds standby between operations to allow the voltage across the *RC* network to build up to the preselected value. —30—

Servicing Hints

(Continued from page 60)

marked chassis we find it effective to mark the tube number on the chassis near the respective sockets, with a *Dixon* Phano For Glazed Surfaces pencil, No. 77.

Should you have occasion to service one of the old *Sparton* receivers, Models 591 or 593, you will be confronted with the fact that the type 182-B and type 484 tubes are no longer available. The type 280 in the receiver may of course be replaced with a type 80. The type 484 may be replaced with type 27 or 56. The type 182-B may be replaced with either type 45 or 71-A. If the type 45 is used, the filaments must be connected in series. When replacing the 182-B, both of the tubes must be replaced at the same time. Both tubes must also obviously be replaced with the same type tube, that is, with two type 45's with their filaments in series, or with two type 71-A.

When confronted with a dead receiver, several sections of the receiver may be quickly eliminated as responsible for the cause. Turn the set "on." If there is no sound, except hum, when the volume control is rotated, the trouble is in the audio section. If there are no signals, but there is a variation in the "live" sound in the speaker when the volume control is rotated, the trouble is between the antenna and detector. If there is little or no signal, but a loud hum, the filtering should be checked, with particular attention to the power supply. When no hum is present, then look to the voltage supply, plate circuit of the output tube, output transformer, or speaker.

In following alignment instructions, particularly with reference to some of the older receivers, it may sometimes be found that best results *cannot* be obtained by adjusting the oscillator trimmer and padder condenser at the exact values given in the instructions. For example, in aligning a *Fada* 686 model receiver we obtained much better results by adjusting the oscillator trimmer and padder condenser, *not* for the exact frequency stipulated, but for maximum gain. This may be found to be below or above the specified points, and can be determined by the trial and error method.

Following the alignment of any superhet receiver, a high background "hiss" may result. This can be eliminated by detuning the primaries and secondaries of the i.f. transformer slightly, or by utilizing the antenna system to get a better signal-to-noise ratio.

For better selectivity in t.r.f. sets a good aerial coupled to the receiver through an .00025 mfd. mica condenser is indicated. A ground should also be used on the older t.r.f. receivers.

At times it is extremely difficult to check for loose connections or to read the value of a resistor or condenser, because of their position in the chassis. A dentist's mirror is a valuable asset in overcoming this difficulty.[2]

Set owners are usually fussy, and rightfully so, about having their cabinets scratched up. To prevent this, particularly when removing the chassis from a table model receiver, we appropriated a discarded doll bed pad from our daughter. The pad is placed on the bench, the receiver on the pad. The chassis is then removed from the cabinet with little concern regarding scratches; there is just the right amount of thickness, or cushion, to the pad.

Inability to get the proper lighting for removing the chassis and speaker from a console receiver, may be remedied to best advantage through the very simple expedient of a heavy-duty light such as is used by auto mechanics.

Since there is nothing more frustrating than being unable to find each piece of hardware when starting to reassemble a receiver, we keep a glass pint jar handy on the bench, in which we drop the parts as they are removed from the receiver. When we start to reassemble, we dump the parts in one pile, and work from that. One advantage of the glass is that it is non-conductive.

One reason why a set, which operates with a floor aerial, will operate satisfactorily in your shop, but not in the customer's home, is that the customer "wads up" the aerial in a heap on the floor. Some set owners still do not realize that the wire must be extended full length for best results.

In very cold weather, if a low hum develops in a receiver that you have just delivered to the customer or that you are testing shortly after having picked it up for servicing, consider the possibility of a frozen electrolytic. It should be permitted to thaw out gradually in a warm place.[2]

You may have experienced the same difficulty we have when trying to read schematics which, because of the many numbers of stages and circuits involved, are reduced to very small proportions when placed on the same size page as the simpler schematics. The answer to this problem—a small magnifying glass—is obvious, but if you have put off getting one as long as we did, you will find it well worthwhile to take the time to acquire the glass.

The following many never happen to you, but it did to us. We set ourselves to the job of testing every condenser in a receiver for leakage or insulation resistance, and capacity. First we tested the electrolytics, then the paper tubulars, after which we moved on to the micas. Finally we came to a mica that didn't act according to Hoyle. After feudin' and fussin' with it longer than we care to admit—yes, it was a molded resistor.

Some molded resistors look very much like mica condensers; are ordinarily black, and have three colored dots which are read in the same sequence as the body, end and dot colors on the carbon resistors. It was an embarrassing experience, but we didn't feel quite so badly about it when the good books deem it advisable to remind one not to confuse a ballast tube with a regular metal tube!

Old Timers who have read this far are probably musing, "I've known all this a long, long time." Yet there was a time, Old Timer, when all this was new to you. So, too, with many of the newcomers in the radio servicing field. It is for them, Old Timer, the younger generation who will carry on when you and I have tested the last tube and flicked for the last time the switch on a test instrument, that these "kinks" are written.

Thanks for listening—and good luck!

Bibliography

[1] *"Radio Circuit Hints, Volume I," Sylvania Electric Products Inc.*

[2] *"Service Hints, Volume III," Sylvania Electric Products Inc.*

—30—

Signal Tracer

(Continued from page 38)

is very simple, as can be seen from an examination of Fig. 2.

The test prod is connected to the "high" side of the rectifier circuit—that is, to the coupling condenser and anode of the crystal. The low side of the circuit is connected to a short length of flexible wire terminated by an alligator clip for connection to the receiver or amplifier chassis or "B-minus" point.

Undoubtedly, an individual builder can reduce the dimensions of the probe still further by employing a handle with less girth. The size of the author's probe was dictated by the width of the phone jack (*J*, in Fig. 2).

Output Circuits

For ordinary aural tracing, simply plug a pair of high-resistance headphones into the phone jack. A modulated signal must be employed when checking the various stages of a receiver with headphones plugged into the probe. If crystal phones are used, they must be shunted with a 100,000-ohm, ½-watt carbon resistor to provide a d. c. path

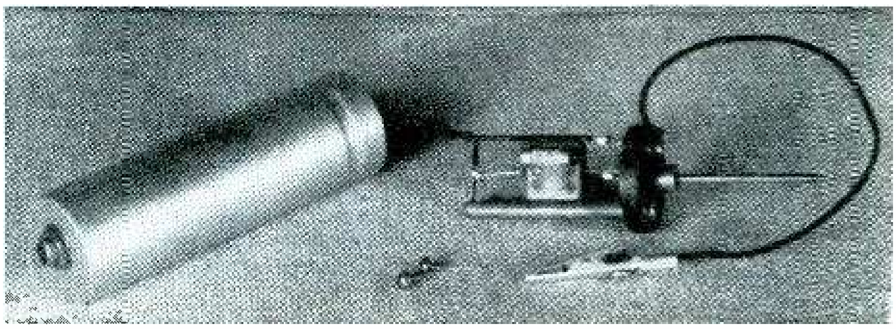


Fig. 3. Simplicity of test prod construction may be easily seen in this photograph.

for the crystal rectifier.

For visual checking, a 0-50 d. c. microammeter (*M*) with variable multiplier resistor (*R*) is plugged into the probe jack. Either a modulated or unmodulated r. f. signal may be employed in visual checks. Multiplier rheostat *R* allows the meter range to be increased for strong signals.

Both output devices are shown in Fig. 2. The meter lead is made from a short length of standard microphone cable with a phone plug on one end and an *Amphenol* Type 75-MC1M male plug on the other. The plug-in jack, mounted through the top of the meter case (See Fig. 1), is a matching *Amphenol* Type 80-C 1-contact female chassis connector. Rheostat *R* also is mounted through the top of the meter case which is a *Par Metal* SM13.

Using the Tracer

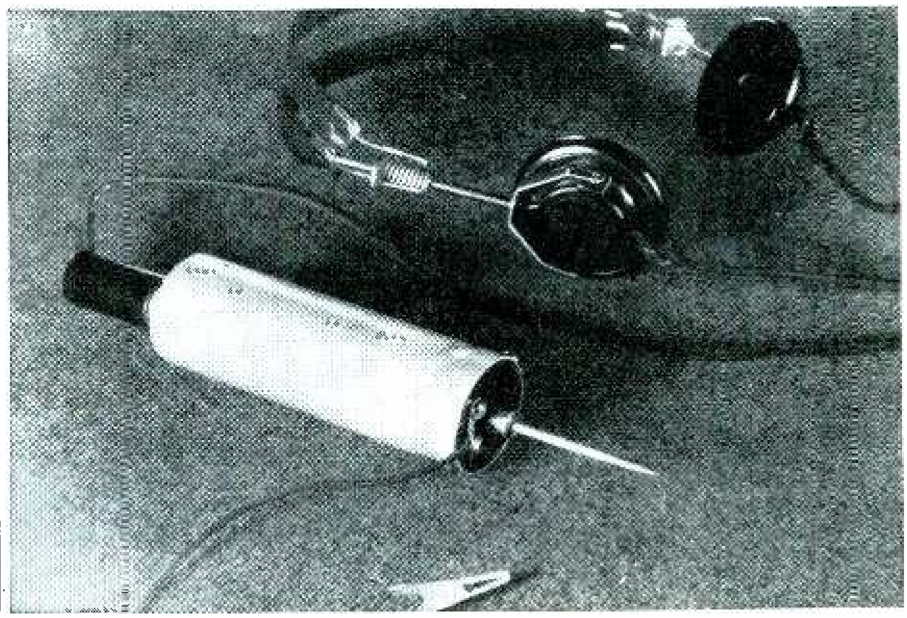
The crystal signal tracer is used in the conventional manner. Supply a suitable test signal to the input terminals of the receiver or amplifier under test, and move the probe from point to point through the various stages, starting at the input and working progressively through to the output. When the signal increases at some circuit point beyond the full scale value of the meter, bring it back down on the scale by adjusting rheostat *R*. When checking a radio receiver, a modulated test signal need be employed only when headphones are used. Either a modulated or unmodulated signal may be used with the meter. The isolating condenser, C_1, protects the meter and crystal against any d. c. component present in the circuit under test.

When checking a radio-frequency signal at the antenna and ground terminals and at the grid of the first tube in a radio set, it may be necessary to employ the high (usually 1-volt) r. f. output of the test oscillator in order to get a satisfactory deflection of the microammeter. The headphones, however, are sensitive to very small values of modulated signal voltage. The author has found that an r.f. signal just barely audible in a pair of *Trimm* phones used with the probe is 30 millivolts r.m.s. This is a 100-kc. signal modulated 30% at 400 cycles.

Most operators will prefer to use both aural and visual checks in signal tracing. The meter will show the comparative signal strength, stage gain, etc., while the headphones will establish whether hum, noise, or other extraneous voltages are present along with the signal and if the signal has become distorted in a set or amplifier stage.

—30—

Fig. 4. Headphones are plugged into probe for aural tracing of modulated signal.



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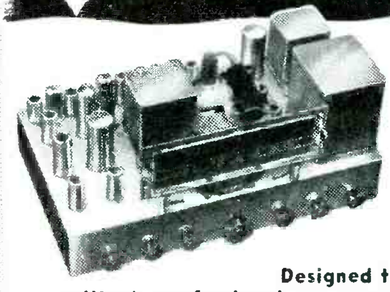

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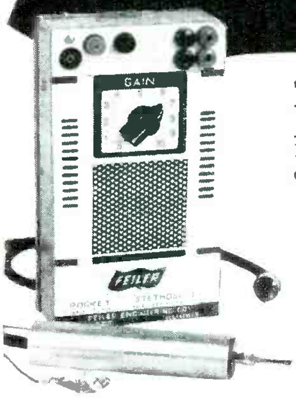

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Technical BOOKS

"ESSENTIALS OF RADIO" by Morris Slurzberg and William Osterheld. Published by *McGraw-Hill Book Company, Inc.*, New York. 786 pages. Price $5.00.

This text provides the much-needed bridge between elementary radio texts and books of the engineering level. The authors have presented a comprehensive study of the principles of operation of vacuum tubes, their basic circuits, and the application of these circuits to low frequency radio receivers.

For persons studying radio by self-instruction or the student in trade or vocational schools or junior colleges, this text will be of assistance inasmuch as a minimum knowledge of mathematics is prerequisite and the use of the equations and vectors which appear in the text is fully explained.

The book is divided into fifteen chapters dealing with an introduction to radio, circuit analysis, simple receiving circuits, vacuum tubes, detector circuits, tuning circuits, r.f. amplifier circuits, a.f. voltage amplifier circuits, power amplifier circuits, vacuum tube oscillator circuits, power supply circuits, audio units, transmitting circuits, receiving circuits, and test equipment.

One of the most valuable features of the book is the inclusion of 18 comprehensive appendices dealing with symbols used in electronics, letter symbols and abbreviations used in electronics, conversion factors, formulas used in radio and electronics, a wire table, standard color codes, sine and cosine tables, common logs, a table of frequency-wavelength-*LC* product, etc.

The book is clearly and simply presented and the student should experience no difficulty in grasping the subject matter. The lavish use of illustrative material helps to further clarify the subject under discussion. This book is enthusiastically recommended as a home-study text.

* * *

"ANTENNA MANUAL" by Woodrow Smith. Published by *Editors and Engineers, Ltd.*, Santa Barbara, California. 301 pages. Price $3.50.

Hams and servicemen have been waiting a long time for a book covering the most popular types of antennas—this is it!

Written by the author of the "Radio Handbook," the new manual describes in detail several new antennas which are finding high acceptance among amateurs. Included are the "Bobtail Curtain," the "Vertical Triad," the "Octopush," the "X-Curtain" (an improved Lazy-H) and the "Electrotator."

The book is thoroughly practical and covers such subjects as radiation and propagation of radio waves, transmission lines, basic antenna theory, low and medium frequency antenna systems, high frequency antenna systems, v.h.f. and u.h.f. antenna systems, receiving antenna considerations, coupling to the antenna system, measuring equipment and techniques, and antennas for navigational aids.

There will probably be a lot of ham stations on the air without the benefit of this book, but the real hams will want to investigate this book and do a little revising of their antenna systems. All in all, this is a FB piece if we ever saw it!

* * *

"ELEMENTARY INDUSTRIAL ELECTRONICS" by William R. Wellman. Published by *D. Van Nostrand Company, Inc.*, New York. 362 pages. Price $4.00.

This is a basic book covering some of the principles involved in the more important applications of electronics in industrial plants. It is not designed as a manual for the serviceman engaged in troubleshooting or maintaining industrial electronic control equipment but rather as a guide for the beginner.

The text covers such subjects as alternating current fundamentals, basic principles of vacuum tubes, basic principles of gas-filled tubes, electronic symbols and terms, the industrial applications of kenotrons, applications of hot-cathode gas-type rectifiers, mercury pool rectifiers, vacuum tube amplifiers, industrial high-frequency heating, electronic control of motors and generators, electronic control of resistance welding, photoelectronic devices, and electronic lamps.

The material is presented in easily-understood form. A series of experiments has been included in order that the instructor (or student if self-instructed) can set up typical industrial electronic problems without resorting to elaborate or expensive equipment.

The book may be used equally well in the classroom or by the student studying the subject at home.

—30—

GULF DIVISION HAM CONFAB

THE 18th Annual West Gulf Division Convention is being held this year in Houston, Texas, August 20, 21, and 22. Headquarters for the confab will be the Rice Hotel in Houston. A full program of technical sessions has been planned.

Representatives from ARRL Headquarters, FCC, Army, Navy, and the research departments of leading universities will appear on the program.

The fee will be $7.50 for the main convention events on August 21 and 22 including the banquet. Without the banquet ticket the tariff is $5.00. The extra day, August 20, will have a specially planned program including a cocktail party and buffet dinner. That day's activities will cost $2.00 per person.

The grand ball and dinner will conclude Saturday's events, while the banquet will be held on Sunday. As an incentive to early registrants, a communications receiver is being given as a pre-registration prize.

For further information and registration details contact W. Leo Havard, Convention Chairman, Houston Amateur Radio Club, Box 907, Houston, Texas.

—30—

W3KPX Multi-Unit

(Continued from page 43)

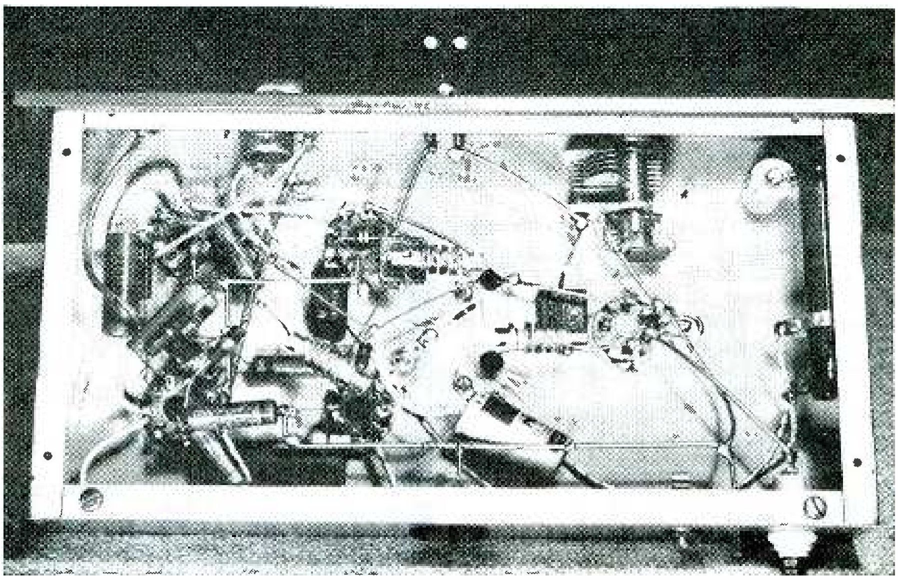
mum grid current indication on the meter and left there. The oscillator should be switched off and on several times to make certain that it will operate every time it is turned on. If the crystal becomes unduly warm, it is an indication of too much regeneration and C_{13} should be adjusted to a higher-capacitance setting. *All crystals, unless they are broken, will oscillate in this circuit:* in fact, crystals which have been discarded from other circuits, will generally oscillate readily in the regenerative triode circuit. There is little danger of damaging crystals, such as those of the military type, unless an excessive amount of regeneration over a long period of time is used. For use as an ordinary crystal oscillator, with normally active crystals, C_{13} may be placed in the short-circuited position.

For use as a calibration unit, the crystal oscillator is turned on and its carrier is tuned in on the receiver. *The b.f.o. is not used.* Now, place the "Signal Shifter" selector switch on *"VFO"* position and tune the "Signal Shifter" dial until zero beat is obtained between the v.f.o. and crystal oscillators. The accuracy of the zero beat can be checked by leaving the v.f.o. and crystal oscillators set as just described and rotating the receiver dial slightly to each side of resonance. If no beat note is heard, the v.f.o. is operating on the same frequency as that of the crystal oscillator.

To recalibrate the v.f.o. against the crystal oscillator, set the "Signal Shifter" dial to the reading *on its calibration chart* which corresponds to the crystal oscillator frequency and adjust the bandsetting condenser (a screwdriver adjustment inside the "Signal Shifter") for zero beat between the two signals. It is advisable to recalibrate at several points across the band, using a different crystal, of course, for each calibration frequency.

Before using the unit for FM, make certain that the crystal oscillator is operating in a stable condition. Only 80 and 160-meter crystals are suitable for satisfactory FM transmission although some deviation can be obtained on 10 meters using a 40-meter crystal. When using an 80-meter crystal, adjust the crystal oscillator as outlined above and tune the receiver to one of its harmonics, preferably on the 10 or 20-meter bands. Best adjustment can be carried out by feeding a 400-cycle sine wave audio signal to the microphone jack. The receiver, unless it incorporates a discriminator circuit, should be detuned to one side of the carrier (if the signal peak reads S9 on the carrier level meter, detune until the meter reads about S6). Feed the 400-cycle signal to the audio input jack and turn up the gain control slowly. The signal will be heard as the control is turned up and as soon as the tone becomes audible, leave the control alone. Now, with an insulated screwdriver, adjust C_{12} for maximum volume. Bring up the gain slightly and readjust C_{12}. A point will be found in the condenser adjustment where the gain control will have a pronounced effect on the deviation as it is turned up or down. With C_{13} short-circuited, the deviation at 3500 kc. will vary from 200 to 2000 cycles depending upon the type of crystal used. When multiplied to 28,000 kc. and translated in terms of deviation on that band, this means that a frequency deviation of from 1600 to 16,000 cycles may be obtained. This deviation is entirely adequate for communications purposes. On loud sound peaks (wide deviation), however, it will be found that the crystal will have a tendency to momentarily swing out of oscillation. *This is a characteristic of any straight crystal oscillator when reactance modulated.* In this unit, a slight amount of regeneration is applied to overcome this condition. With C_{13} short-circuited, follow the procedure outlined above and turn up the gain until the signal, as heard in the receiver, begins to "break up." Mark the set-

Fig. 4. Under chassis view of multi-unit, NBFM, crystal oscillator, signal spotter.



ting of the gain control knob. Now, open up the regeneration control very slowly and advance the gain control. As C_{13} is opened up, considerably more deviation will be obtained before the signal quality deteriorates. Do not use an excessive amount of regeneration, however, as the crystal may lose control on voice amplitude peaks.

Remove the 400-cycle signal source and attach the crystal microphone to the input jack. The deviation on voice can be adjusted by listening to the FM signal on the *operating frequency* (not the crystal frequency) with a pair of headphones on the receiver. Adjust the gain control for best tone quality while speaking in a normal voice.

—30—

Mac's Service Shop

(*Continued from page 52*)

"For the simple reason that they are faster and give more precise information. After you have worked with the simple instruments for a while, you will have a firm grasp of what they can teach you—but that will be longer than you think. Then it will be time to take up instruments that will save time."

"I think I get what you mean. When you are learning the service business, the important thing is *to learn;* and the more you have to use your growing knowledge of theory the better; however, after you are ready to start to make a living at the business, *time* is the thing that is important, and any instrument that saves time means money in your pocket."

"That is said better than I could say it, Barney," Mac applauded. "A draftsman does not stick to the compass and straight-edge of his geometry class when he goes to work. He has a whole flock of drawing instruments. In the same way a serviceman should have the most up-to-date equipment he can afford. The funny thing is that—if he just realized it—he cannot afford *not* to have modern service instruments. If he has the business he should have, a few minutes shaved from each service job will more than pay for the cost of up-to-the-minute, time-saving equipment in a few months."

"You were telling me that a serviceman ought to know his service instruments frontward and backward. Do you mean that he ought to build those instruments himself?"

"That depends a lot on how good a serviceman he is, or rather how advanced he is in theory. While he is learning, it is an excellent idea to build a few comparatively simple service instruments so that he can appreciate the problems involved and be better qualified to keep his equipment in repair. But a man who is operating a successful service business cannot afford to devote the necessary time to designing and building service equipment. It is much better for him to work at his specialty, radio service, and earn the money with which to buy equipment built by men who make a specialty of doing just that.

If a man can make more money working at a specialty not his own, he is in the wrong business."

"I might say," Mac went on, "that there are some service equipment kits on the market now that do a good job of filling an in-between demand. The fellow who is just getting started and who has some spare time on his hands can buy these kits and assemble some of his own instruments. Most of the headaches associated with from-the-ground-up construction have been removed, and these kits enable the beginner to have instruments he could not otherwise afford. What is more, their construction will teach him some more theory, on which he is still probably a little shy."

Barney set another midget radio on the bench and picked up the test prods of his multimeter. "I'm sold, Boss," he stated. "From now on Old Multi here and I are going to be bosom pals. I'm going to listen to everything he tells me, and I'm going to beat the books so that I can understand what he is saying. Don't let me even touch that scope until you are convinced I am really ready."

"Good boy, Barney," Mac said. "With an attitude like that, it will not be long. As the Arabs say: 'A man should not sleep on silk until he has first walked on sand.' " —30—

Push-Push Portable

(Continued from page 41)

will draw approximately 16 milliamperes. Operating from a 300 volt supply, the transmitter gives reliable coverage over a 15 mile radius in the city at night with the most modest type of antenna and greater coverage and good DX results with a beam.

The power supply was built as a companion unit on a matching 5" x 7" chassis. The filament requirements of the transmitter are 1.85 amperes at 6.3 volts and a power transformer delivering this and having a high voltage winding of 70 milliamperes or more will be satisfactory. Although the transmitter will draw more than this current, the high voltage is not operating continuously and the winding may therefore be somewhat overloaded. —30—

"Our first trip to the Opera, Dear, how thrilling!"

A LOW COST EXTENDED RANGE SPEAKER

By ROBERT DRAIN and ARTHUR O'NEIL

THE advent of frequency modulation broadcasting throughout the country, plus increased interest in high quality reproduction of recorded music, has stimulated a desire upon the part of discriminating listeners for receiving and reproducing systems capable of delivering an extended audio range. Anyone possessing a satisfactory receiver is somewhat loath to retire it and purchase a postwar model merely to acquire FM reception. Several exxcellent FM tuners, designed to be used in conjunction with existing audio and speaker systems, are now available, and while these provide suitable reception, it will generally be found that prewar loudspeakers fail to deliver the higher frequencies which give FM transmission its brilliance and realism. Of course, the substitution of any one of several available extended range speakers on the current market would remedy this lack, but these speakers in themselves represent a considerable investment. The authors, who are actively engaged in program and enginering work in FM broadcasting, were already in possession of good quality receivers and FM tuners, but were dissatisfied with the speaker performance. Limitations of pocketbook precluded the immediate investment in one of the better wide-range speakers, so experimentation was in order.

A three-inch permanent magnet speaker, of the type used in intercoms, was mounted coaxially with a good quality 12 inch dynamic, vintage about 1938. A mounting "spider," fabricated of aluminum sheet was used to center and rigidly support the "tweeter" (Fig. 1B). In our case, a used 16 inch metal-base transcription recording blank was employed as stock, the center being cut out with a fly-cutter, to accommodate the cone of the midget speaker, and the rest of the support fashioned with tin snips. Aluminum is easy to work, and has a low period of vibration.

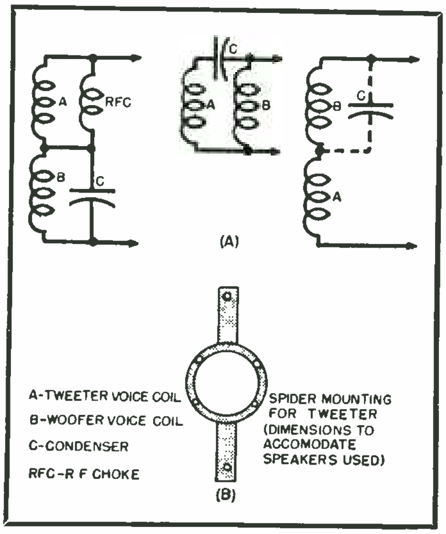
Various combinations of series and parallel circuit combinations were tried (See Fig. 1A). The inductances tried were r.f. chokes, ranging in value from 2½ to 80 millihenrys. Condensers ranged from .25 mfd. to 2 mfd. The impedance of the two voice coils is a factor in arriving at a proper combination, as it is obvious that the voice coil offering the greater impedance will develop the greater voltage. The basic problem is to limit the amount of low frequency energy fed to the "tweeter."

It should be stated right here that results cannot be expected to equal those given by a carefully designed high fidelity reproducer. Careful tests with adequate equipment would undoubtedly reveal a certain amount of distortion, phase shift, and impedance mismatch, as well as an over-all response curve that would be far from flat. From a listening standpoint however, a combination can be hit upon that definitely enhances the reproduction of music and speech without producing noticeable distortion. An audio oscillator is helpful in arriving at a proper combination of capacitance and inductance. Experiment with various combinations and connections until the greatest high boost is experienced, swinging the oscillator through the range of frequencies. Placing a finger lightly on the cone of the "tweeter" will aid in determining the effect of the various coupling methods. No definite rules can be given, as the best combination for any particular pair of speakers varies. Follow the audio oscillator with tests using music. Latin-American, electric organ, or gypsy strings are excellent for this purpose. Remember that no appreciable change in quality can be noted at low volume, nor will there be a marked improvement in the reproduction of program material of medium frequency range.

When a proper balance is achieved no blasting of either speaker will be apparent, even at relatively high levels. If desired, a switch may be incorporated to cut out the "tweeter" for AM reception during noisy periods, or when listening to records with a high scratch level. It goes without saying that experiments should be conducted with the speakers mounted on a suitable baffle, to insure over-all balance in the completed job.

-30-

Fig. 1.



FM Detectors

(Continued from page 57)

carrier value, the opposite is true and now the voltage across R_2 dominates. As the signal varies back and forth, the voltage applied to each diode varies, resulting in the same characteristic obtained with the Travis double-tuned circuit.

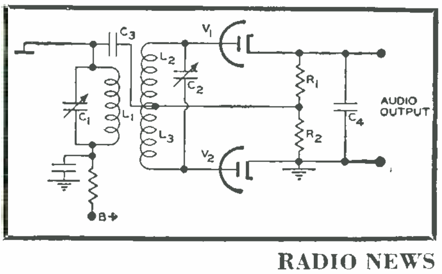
A Modified Discriminator. A modified version of the Foster-Seeley unit is the circuit shown in Fig. 9. The difference between this unit and the preceding circuit is to be found in the elimination of L_4 and the use of only one condenser across the output instead of two. It may appear that E_{L4}, the reference voltage so necessary for the proper operation of the discriminator of Fig. 5, has been eliminated. Actually, this is not so. The reference voltage is still present, but in a slightly altered position.

If we trace the circuit from the top of L_1 through C_3 and R_2 to ground, we see that R_2 is in parallel with L_1 and hence E_1 appears across R_2. In the network containing V_2, we find that both E_3 and E_1 (from across R_2) act on V_2. We have transferred the voltage from L_1 to R_2 for tube V_2. Thus, R_2 not only develops the rectified voltage for V_2, but it also receives E_1 from L_1.

In the V_1 network, R_1 is also found to be in parallel with L_1. Hence R_1 receives this reference voltage and R_1 is to V_1 what R_2 is to V_2. No unwanted intermediate frequencies reach the following audio stages because of C_4. Its low reactance to intermediate frequencies bypasses them around R_1 and R_2. However, being only on the order of .0001 mfd. or so, it does not affect the audio frequencies developed across R_1 and R_2. Aside from these changes the operation of the circuit is identical with the preceding network.

FM Ratio Detector. The Foster-Seeley discriminator has been shown to be capable of converting an FM signal into its corresponding audio voltages. But is it wholly an FM detector, or will it react to AM, too? It will respond to AM, as the following example discloses. In the circuit of Fig. 4, let the incoming signal develop equal voltages across R_1 and R_2. This would occur when the signal is unmodulated. Suppose that the voltage R_1 and R_2 is 4 volts, each. When modulation is applied, the voltage across each resistor changes, resulting in some net output voltage. Say that the voltage across R_1 rises to 6 volts and the volt-

Fig. 9. A modified version of the Foster-Seeley discriminator circuit.



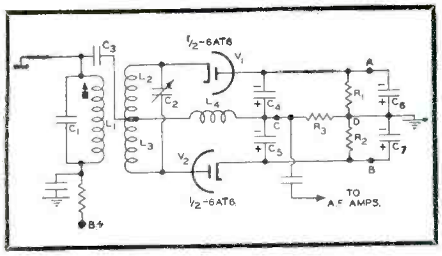


Fig. 10. A balanced ratio detector.

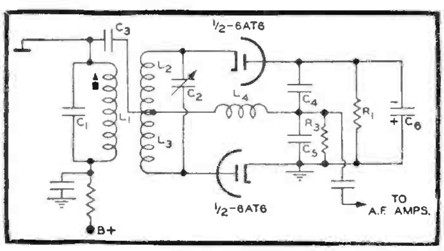
age across R_2 decreases to 2 volts. The output voltage, at this frequency, would then be equal to the difference between these two values, or 4 volts.

However, let us increase the strength of the signal until we have 8 volts, each, across R_1 and R_2, at midfrequency. With the same frequency shift as above, but with this stronger carrier, the voltage across R_1 would rise to 12 volts and that across R_2 decrease to 4 volts. Their difference, or 8 volts, would now be obtained at the output of the discriminator in place of the previous 4 volts. Thus, the discriminator responds to both FM and AM. It is for this reason that one or more limiter stages precede a Foster-Seeley discriminator. The limiter clips off all amplitude modulation from the incoming signal, and an FM signal of constant amplitude is applied to the discriminator.

When unmodulated, the carrier produced equal voltage across R_1 and R_2; let us call these voltages E_1 and E_2, respectively. With the weaker carrier, on modulation, the ratio of E_1 and E_2 was 3 to 1 since E_1 became 6 volts and E_2 dropped to 2 volts. With the stronger carrier, on modulation, E_1 became 12 volts and E_2 dropped to 4 volts. Their ratio again was 3 to 1, the same as the previous weaker carrier. Thus, whereas the difference voltage varied in each case, the ratio remained fixed. This demonstrates, in a very elementary manner, why a ratio detector would be unresponsive to signal amplitude changes.

Balanced Ratio Detectors. A balanced ratio detector circuit is shown in Fig. 10. L_1C_1, $L_2L_3C_2$, C_3 and L_4 are exactly the same as previously noted in the Foster-Seeley discriminator. They serve to apply voltages to V_1 and V_2 which will vary with the signal frequency. The rest of the circuit, however, now departs radically from what we had before. For one thing, V_1 and V_2 are connected in series and when any voltage is applied to the circuit, a current will flow around the network, charging C_6 and C_7 to the average value of the incoming signal.

Fig. 11. An unbalanced ratio detector.



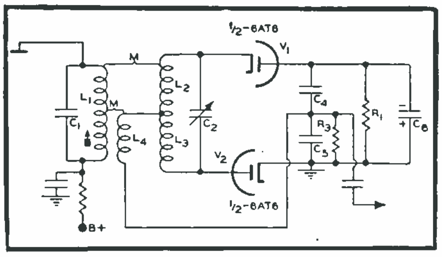


Fig. 12. In this ratio detector, L_4 receives its voltage from L_1 by inductive coupling direct.

The voltage between points *A* and *B* will remain constant as long as the incoming carrier is constant. Due to the relatively long time constant formed by R_1C_6 and R_2C_7, momentary changes in signal amplitude, generally interference, will be absorbed by this network and not affect the output voltage. This is desirable.

To see how this circuit works, let us assume that the voltage coming in is at the i.f. midfrequency. Equal voltages will be applied to V_1 and V_2 and equal voltages will appear across C_4 and C_5, with the polarity noted. At the same time, there will be a voltage developed across *A-B* equal to the average value of the signal. Half this voltage will appear across R_1C_6 and half of the total voltage will be across R_2C_7. Since C_4 is in parallel with R_1 and C_6, all will have the same voltage. The same is true of C_5, R_2, and C_7. As a consequence of these conditions, there will be no *difference of potential* between points *C* and *D* and no audio output. This, again, is similar to the previous discriminators.

Now let the signal frequency swing below the mid-i.f. value. V_1 will receive more voltage than V_2 and more voltage will develop across C_4 and less across C_5. The carrier amplitude has not changed, however, because this is an FM signal, and consequently the voltage between points *A* and *B* remains the same. To use numerical values, assume that the voltage across R_1, C_6 is 6 volts and R_2, C_7 is also 6 volts. Due to the signal frequency shift, the voltage across C_4 rose from 6 to 9 volts, while C_5 dropped from 6 to 3 volts. Since E_{C4} is now greater than E_{R1} and E_{C5} is less than E_{R2}, currents will flow in these circuits. These currents, flowing through R_3, will develop a voltage drop of 3 volts here, with point *C* positive and point *D* negative. If now we add up the voltages around both branches, we see that they check out. The rise in voltage across R_3 results in an audio output. When the signal swings in the opposite direction, C_5 receives more voltage than C_4 and the polarity of the voltage across R_3 reverses. In this manner, for signal frequency swings above and below the center point, positive, zero, and negative voltages will develop across R_3. This is the audio output voltage. At all times, the sum of the voltages across C_4 and C_5 must equal the average carrier voltage present between points *A* and *B*. Changes in frequency do not alter the total voltage, but merely the ratio of E_{C4} to E_{C5}. That is why this is known as a ratio detector. Changes in signal amplitude will not change the ratio of E_{C4} to E_{C5}.

To illustrate this, consider the example used in the foregoing paragraph. A signal frequency shift caused the voltage across C_4 to rise from 6 to 9 volts, while the voltage across C_5 dropped from 6 to 3 volts. The ratio of E_{C4} to E_{C5} is 9/3 or 3/1. Now let us assume that the carrier amplitude is doubled, momentarily. This would double the numerator of our ratio, but leave the value of the ratio unchanged. Thus, $9/3 = 18/6 = 3/1$.

Any momentary increase in carrier will affect the numerator and denominator of this ratio in like measure and consequently leave the basic value of the ratio unaltered. The same is true of carrier decreases. Actually, due to the presence of the long time-constant network of R_1, C_6 and R_2, C_7, the momentary changes in carrier amplitude only *tend* to make the voltages across C_4 and C_5 go up or down. By the time the voltage in the circuit actually changes, the pulse or disturbance has passed.

Ratio Detector Modifications. The ratio detector of Fig. 10 can be converted to the unbalanced ratio detector of Fig. 11, by transfering the ground connection and combining C_6 and C_7 into one condenser and R_1 and R_2 into a single resistor. The rest of the circuit remains the same, however, because the total value of E_{C4} and E_{C5} still is governed by whatever voltage is developed across the long time-constant circuit and this, in turn, is set by the carrier amplitude. In Fig. 12 we have another unbalanced ratio detector. L_1, instead of receiving its voltage from the primary L_1C_1 through a direct capacitive connection, it is now coupled inductively to L_1. The result is unchanged because the voltage across L_1 still depends upon the voltage across L_1.

In all ratio detectors, the voltage in the long time-constant circuit is dependent upon the average value of the incoming carrier. Since this voltage is negative with respect to ground in the ratio detector, it can be employed as an a.v.c. voltage. Thus, we will find this voltage actually being connected back to the stages it is desired to control. This particular point in the ratio detector is also useful when FM receivers are being aligned or tested.

—30—

"Guess I have it focused a little too sharp!"

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

MULTITESTERS

Radio City Products Company's Bulletin 133 is devoted to a new series of "Hi-Meg" multitesters.

This series of test instruments is available in six different open face models and in portable types. The series features a unit which operates without batteries and tubes in a high ohmmeter circuit. The unit makes resistance measurements of from 50 megohms to 1000 megohms. The low ohm range uses a single cell battery.

For a copy of Bulletin 133 write *Radio City Products Company,* 152 West 25 Street, New York 1, New York.

CONNECTOR CATALOGUE

Cannon Electric Development Company is currently offering copies of the new C-47 condensed catalogue covering the company's line of multi-contact electric connectors for radio, aircraft, communications, etc.

Also included in the catalogue are pages devoted to d.c. solenoids and signal equipment of various types.

A copy of catalogue C-47 will be sent to those requesting it from the Catalogue Department, *Cannon Electric Development Company,* Humboldt Street and Avenue 33, Los Angeles 31, California.

RADIO KITS

R & M Radio Company has issued a new flyer which lists various kits available in addition to a line of surplus items.

Kits listed in the circular include b.c.-short-wave receivers, portables, superhets, as well as an FM receiver construction kit.

A copy of this flyer can be secured by writing *R & M Radio Company,* 1426 North Quincy Street, Arlington, Virginia.

PYRAMID CAPACITORS

A new 12-page catalogue listing the company's line of capacitors has just been issued by *Pyramid Electric Company* of Paterson, New Jersey.

Included in the catalogue are the company's "Tynee-Dry" units "Cartrij-Dry" types, radio noise filters, "Metl-Can" units, and the new "Twist-Mount" line of electrolytics.

A copy of Catalogue J-5 may be secured by writing *Pyramid Electric Company,* 155 Oxford Street, Paterson, New Jersey.

TRANSFORMER CATALOGUE

The publication of a new 24-page catalogue, the 140-H, has been announced by *Standard Transformer Corporation* of Chicago.

Listed are over 400 *Stancor* stock items, including audio and power transformers and reactors, power packs, volt adjusters, radio transmitter kits, and television components.

Also included are charts on transmitting tubes, driver-modulator combinations, and matched power supplies.

Catalogue 140-H is available without charge from Department D, *Standard Transformer Corporation,* Elston, Kedzie, and Addison Streets, Chicago 18, Illinois.

RCA RECEIVER FOLDER

An up-to-the minute folder covering the complete *RCA Victor* line of television receivers is now available to *RCA Victor* television dealers through their distributors for use as direct mail pieces and customer handouts.

The new folder is printed in color and carries illustrations and descriptive material on eight *RCA* table model, console, and console combination instruments. Space for the dealer imprint has been provided.

RCA Victor dealers should contact their distributors to get their supply of these folders.

WARD-LEONARD CATALOGUE

Ward-Leonard Electric Company of Mount Vernon, New York has just issued a new catalogue, D-130, describing and illustrating the company's line of stock units in resistors, rheostats, and amateur radio relays.

Included in the catalogue is the company's line of "Vitrohm" resistors and rheostats in a wide range of types and values. Ham relays listed include units for antenna, r.f., break-in, bandswitching, keying, overload, time delay, safety, sensitive, latch-in, and remote control. Details are also given for building a transmitter control panel.

A copy of Catalogue D-130 may be secured by writing the Radio and Electronic Distributor Division, *Ward-Leonard Electric Company,* 53 West Jackson Boulevard, Chicago 4, Illinois.

TEST INSTRUMENTS

Browning Laboratories, Inc. of Winchester, Massachusetts is currently offering copies of the new four-page folder which lists the company's line of radio and electronic equipment.

Prices and pertinent data is given on frequency meters, grid dip meters, frequency calibrators, power supplies, capacitance relays, oscilloscynchroscopes, sweep calibrators, and two tuners.

After looking over this condensed folder, you many secure full data sheets covering any or all items listed.

A copy of the data sheet will be forwarded on request. Write to *Browning Laboratories, Inc.,* Winchester, Massachusetts.

—30—

Recording of Sound
(Continued from page 51)

by reducing this curvature along the axis and placing it in a vertical position. This is particularly true in rectangular horns that are not subdivided, but the effect is obtained at frequencies around 400 c.p.s. even in the case of multicellular designs. This result might be theoretically developed from the previously mentioned inverse relationship between the diameter of the sound source and the magnitude of the distribution angle.

It has been said that response curve compensation is relatively easy to achieve electrically, but this does not mean that there is no available method for accomplishing such results acoustically. In radio receivers the response is often characterized by a "boomy" quality caused by the resonant frequency of the cabinet in which the speaker is housed. This occurs when the resonant frequency of the air column in the enclosure falls in the lower audible range. Thus whenever the sound generated approaches this frequency, the air column is set into vibration and becomes a virtual source providing physical amplification. In engineering practice, it is almost always true that a disadvantage in one context can be turned to good account if properly applied. This phenomenon provides an excellent example.

Physical resonance resulting in effective amplification is a common effect. Whenever a sound is generated in the presence of a column of air at its resonant frequency, there will be a more efficient transfer of energy into the surrounding medium than at other frequencies. Thus, in an idealized case, if the response of a speaker were perfectly flat over the entire audible range except for a dip at one specific frequency, this fault could be compensated within limits by placing an "organ" pipe of the correct frequency in the vicinity of the speaker. Clearly this principle is capable of extension to correct the response at an indefinite number of frequencies. Resonators of this kind have been developed successfully. Designing such an installation to correct all of the faults in a loudspeaker response curve is beyond the realm of practicality. However, it is entirely feasible to install resonators in loudspeaker enclosures in such a manner as to "brighten" the high frequency response with excellent effect. Commercially this involves too great a cost for widespread application, but in specific installations the experimenter may be rewarded with interesting and remarkable results.

1. The term "blocked impedance" is used to describe the impedance measured with the speaker cone held immovable.

2. "Radiation impedance" is the increase in impedance caused by the effect of the transmitting medium on the vibrating surfaces. The terms "radiation resistance" and "radiation mass" (the reactance is generally positive), are the rectangular components.

3. The "Force Factor" of a speaker is

the ratio of effective force on a blocked speaker cone to the current flow through the system creating the force.

4. The "Damping Factor" is the ratio $r/2m$ where r is resistance and m is mass. The time constant of the structure may be considered $1/(r/2m)$ and corresponds to the time for a decay to 1/2.718 of maximum.

5. "Critical damping" exists when $r = 2\sqrt{sm}$ where s represents stiffness. This means that a system returns to its static position from a displacement without any oscillatory motion. Electrical trigger circuits of the Eccles-Jordan type may be said to be critically damped.

6. "Transients" are the "on" effects of initial oscillation when a system is set into forced vibration. The steady state is reached when these oscillations are damped out. Transients also appear as "off" effects when the driving force is removed and final exponential decay occurs. It is clear that highly damped systems are important in loudspeakers. Music reproduction involves abrupt on/off effects continually, and oscillatory excursions of the cone result in serious distortion. The effect is similar to extremely reverberant conditions, or to a piano played with the loud pedal constantly depressed. The human ear is highly, but not critically, damped.

7. "Linearity" may be defined as the condition where displacement is exactly proportional to the driving force. It is also required that the system respond equally well in both directions of excursion.

8. "Amplitude" distortion occurs when the system does not follow Hooke's law (displacement is proportional to the applied force) equally well in both directions. This effect may be shown with a characteristic curve similar to the E_g-I_p curve of a vacuum tube amplifier stage.

If the curve, as shown in Fig. 4, is not linear, amplitude distortion results. In order to gain some conception of the importance of symmetrical response, consider the condition in a non-linear system where two sine waves of frequencies a and b (a greater than b) are applied. The resultant frequencies will include a, b, $a—b$. $a + b$, $2a$, $2b$, $2a—b$. $2b—a$, ... ! The ear responds to this garble with accurate reproduction, and the central nervous system of the listener is confused accordingly. Realizing that this is a case far more simple than is ever encountered in practice, it is clear that proper enclosures for loudspeakers are of vital importance. If the speaker cone does not see the same impedance in both directions, serious amplitude distortion will occur.

9. In any system of damped vibration the amplitude decays exponentially after shock excitation, and the ratio between successive peaks is constant. The amplitude A of the waveform envelope may then be expressed as a time function

$$A = a_{max}\epsilon^{\frac{rt}{2m}} \quad \ldots\ldots\ldots\ldots (1)$$

where a_{max} is the initial peak amplitude, m is the mass and r represents resistance. The logarithmic decrement per cycle is the natural logarithm of the ratio a_{max}/b_{max} where b_{max} is the second positive peak, and is given by

$$k = \frac{rp}{2m} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where p is the resonant period of the system.

In idealized considerations of perfect piston action from the speaker diaphragm circumference, the resistive component of radiation impedance varies in approximate proportion to the frequency squared. In all real circumstances, sections of a diaphragm are vibrating independently and interaction occurs. In addition to its own radiation impedance, each (effective) diaphragm sees a positive or negative impedance resulting from the action of the other radiators. Thus, the total radiation impedance is the sum of these impedances as seen by each diaphragm.

Where r_r is the resistive component of its own impedance and r_{r2} the resistive component of the associated impedances, the radiated acoustic power W of a diaphragm is given by:

$$W = (r_r + r_{r2})\, V^2 \times 10^{-7} \text{ watt} \ldots\ldots (3)$$

V is expressed in centimeters/seconds and represents the r.m.s. velocity of the diaphragm. Thus, in the idealized piston at frequencies where λ is greater than piston circumference, radiation of constant power requires that $V = 1/f$. This condition is approached by designing the speaker with a fundamental resonant frequency as low as possible so that the action is largely controlled by the positive reactance of mass at lower frequencies. The resistance approaches 41.3 mechanical ohms per centimeter squared at wavelengths approximating $2\pi r/2$ where r is the diaphragm radius. This produces efficient transduction of electro-acoustic energy. Where λ is greater than $2\pi r$ the effective reactance is increased to a mass approximated by an air column of cross section corresponding to the diaphragm size and a height of .8572 times the diaphragm radius.

Displacement of the diaphragm being given by V/w, it is clear that the high-level low-frequency radiation requires diaphragms large in size. This is not compatible with the spatial dispersion of high frequencies which would be ideally accomplished by a point source. Hence the aforementioned need for dual speakers in wide range systems.

Nearly all electrical phenomena that could be applied to the design of electro-acoustic transducers have been explored experimentally.

Crystal speakers have been produced commercially for high frequency use in dual systems. Low frequency response is limited by the permissible swing without fracture of the element. In generating ultrasonic frequencies in the upper region of the spectrum (50 kc. to 600 mc.) crystal speakers have an important application. Magnetostriction effects are also widely applied in the lower ranges above audibility (20 kc. to 50 kc.).

Electrostatic effects have been used where one plate of a large condenser is free to move. Even harmonics may be canceled by placing the moving element between two fixed perforated stators and making push-pull connections. Polarizing potentials, problems of electrical coupling to a driving source and other difficulties have hampered continued development.

Ribbon velocity speakers, where the conductor also functions as a diaphragm, have found limited application in high frequency designs. It is difficult to obtain efficient coupling to the air, and although the surface phase relationships are exceptionally even because of the equalized energy distribution, such units are not widely used.

In electroacoustic arrangements many of the principles of purely electrical systems are equally applicable. Thus the most efficient transfer of energy occurs when the impedance relationship of the speaker unit and the source of power are conjugate. Ideally, a vacuum tube should work into a speaker which represents a pure resistance. Moving coil construction most closely approaches this condition, and this is a factor in the wide acceptance of dynamic speakers. The blocked impedance appearing at the electrical terminals of moving coil designs appears as a series *R-L* circuit. At low frequencies approaching resonance in such structures, the impedance increases and a low impedance source contributes to a mismatch reduction of efficiency.

The greatest problem in converting electrical power to acoustic power is concerned with a satisfactory impedance match between the vibrating structure and the transmitting medium, which is generally air. This is the primary reason for the use of horns, and such devices may be properly considered as transformers for coupling the diaphragm to the air. Exponential designs have been most widely used because of the sharp rise in throat resistance at relatively low frequencies for a given horn length.

REFERENCE

Michel, B.M.H.: "The Design of Loudspeaker Systems," Radio-Electronic Engineering Edition of RADIO NEWS, June, 1945. Vol. 4, No. 6.

(Next Month: Design Data for Dividing Networks)

CONTROLLING AMPLIFIER FROM REMOTE TUNER

By G. R. STATHAM

A NUMBER of articles have been published covering radio tuners designed to feed into standard audio amplifiers to take advantage of the high quality reproduction which is usually a feature of such units.

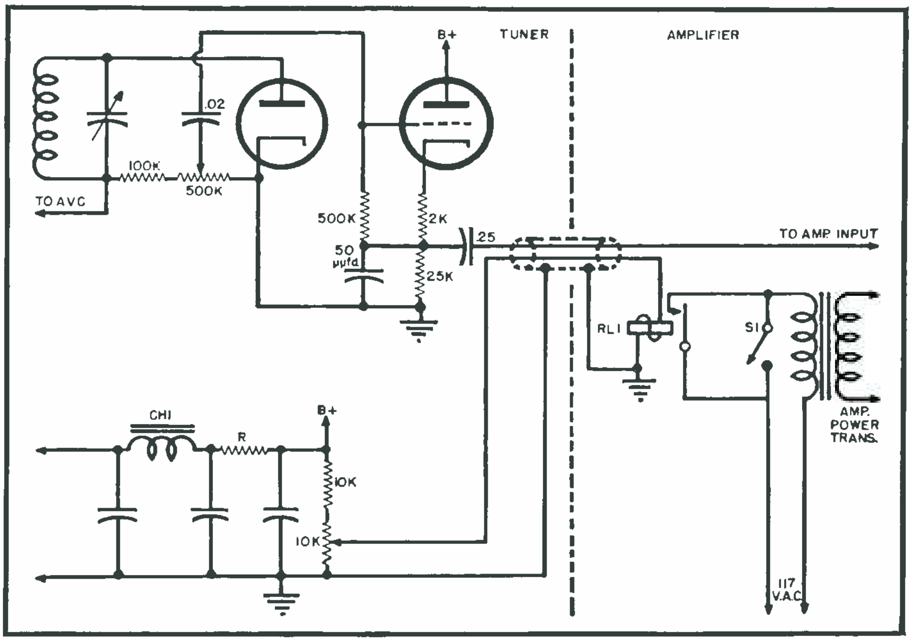
It is frequently advantageous to be able to locate such radio tuners some distance from the amplifier and this makes it desirable to incorporate in the tuner some means of fully controlling the amplifier, switching it "on" or "off" coincidentally with the tuner.

The writer was unable to locate any information on this type of control and the simple arrangement shown in the accompanying diagram was devised. Since this arrangement proved to be entirely satisfactory the idea is being passed on to other readers in the hope that it will be of some help to them.

The relay used to switch the amplifier is fed from an adjustable tap on the bleeder of the receiver power supply. The relay used was a type drawing about 6 ma. at 40 volts, but a fairly wide latitude could be allowed in choosing a relay since plenty of power is available in the tuner for its operation. The tuner actually used was a ten-tube superhet with the output stages removed.

Use of a cathode follower permits almost any type of line to be used to feed audio to the amplifier without distortion or loss. The bass and treble controls in the amplifier are preset and do not usually need to be changed for the different types of programs, but tone controls could be incorporated in the tuner if desired. —30—

Diagram of remote control system. Resistor, R, is adjusted for correct value of "B+" voltage. Relay is not critical, any low current, low voltage type will do.



Within the Industry

(Continued from page 30)

auto radio activities with the exception of sales and its associated functions.

The second appointment named F. T. Sterritt as advertising manager of *Bendix* radio and television products. Prior to joining *Bendix*, Mr. Sterritt was advertising and sales promotion manager of *Sparton Radio* and assistant advertising manager of *Zenith Radio*. He has also had active exeprience in the selling field.

* * *

AL GATES is the new representative for *Air King Products Co., Inc.* in the New England territory.

Mr. Gates, formerly with *Fada Radio and Electric Company, Inc.*, served as district manager for that organization during the past three years. He covered all of New England and Eastern New York State.

In his new position, Mr. Gates will cover the states of Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, and New York (except New York City) on behalf of *Air King* radios.

* * *

THE GULOW CORPORATION, manufacturers of transformer components and small assemblies for the electrical and electronic industry, has been acquired by John C. Hindle through the purchase of all outstanding stock of the company.

Mr. Hindle has been associated with the electronic industry for many years. He was formerly General Manager and part owner of the *New York Transformer Company*. He also helped organize *Hardwick, Hindle, Inc.*. now a division of the *National Lock Washer Company*.

At a recent meeting of the Board of Directors, it was decided to change the name of the company to *Eastern Transformer Co., Inc.* The new company has moved to larger quarters at 147 West 22nd Street, New York 11, New York.

* * *

ALBERT J. FRIEDMAN has been named Chief Antenna Development Engineer for *J.F.D. Manufacturing Co., Inc.*, of Brooklyn.

Mr. Friedman has spent 15 years in various branches of the electrical engineering field and has specialized in television and FM development work for the installation and servicing industry for the last four years.

He was formerly asociated with *Federal Telephone & Radio Corporation* of Nutley, New Jersey and the *Island Electronics Company* of Freeport, Long Island.

Mr. Friedman is now conducting a nation-wide series of forums on antenna installation and servicing on behalf of *J.F.D.*

—30—

Facsimile Newspapers

(Continued from page 39)

blades and passes from it through the paper to the other blade. In the process, it carries metal from the "printer blade" and deposits it on the paper, making it black where the current is strongest, shades of grey where it is weaker, and white where no current passed through.

The result is a continuous strip of paper emerging from the recorder at a rate of about 3.5 inches per minute and delivering pages 8.2 inches wide (plus margins) and 11.5 inches long. A black "page separation signal" about half an inch deep across the page usually carries the station call letters, frequency, etc., in white letters.

To demonstrate facsimile broadcasting to New Yorkers, the *Times* and WQXR/FM had available the following equipment (produced by *General Electric* on *Hogan* System patents): a dual scanner studio console with monitor and test recorders, and 18 *General Electric* AM-FM home console receivers with fax recorders mounted in place of record players.

The recorders were set up in leading Manhattan department stores, except for one which was placed in the *Times* Building lobby and one at Columbia University School of Journalism.

The scanner was installed at the end of a large room in the *Times* Building which was turned over to the fax operation. Leased telephone lines linked the scanner with the WQXR/FM transmitter, in another midtown building. A few days training sufficed to prepare WQXR engineer Athan Cosmas to maintain and operate the scanning equipment.

To help the *Times* set up editorial and copy production staffs and operations, Frances Clark, Robert Palmer, and this writer were "lend-leased" by *Newspaper Publishers' Facsimile Service*, a department of *Radio Inventions, Inc.* The *Times* assigned a "Facsimile Editor," several assistants, artists and Vari-typists to the project. A news service teletype was installed in the fax office, and the *Times* photographic facilities were put at the disposal of the fax editor.

After a week of "trial runs" in which fax editions were prepared and scanned, but not broadcast (except for a special broadcast to Columbia University), *The New York Times* Facsimile Edition was ready to go on the air.

Times fax editions were broadcast six times daily, every day but Sunday (when department stores were, of course, closed). They delivered the latest news and pictures, plus features by leading *Times* writers, in permanently recorded form—via the airwaves. The three-column format was designed to resemble—as closely as production facilities allowed—the *Times* itself, though obviously no single fax edition could deliver the massive amount of information in a regular *Times* edition.

Editorially, the job was much the same as for an ordinary newspaper, but

A facsimile recorder console made by General Electric Company from designs by J.V.L. Hogan and Radio Inventions, Inc.

faster. Edited stories were typed in even columns on Vari-typers, proofread and corrected, trimmed and placed on the makeup table. Small headlines were Vari-typed; larger ones were set by hand in letters printed on transparent paper (Fototype). Stories, headlines and pictures were pasted on "makeup sheets" already bearing nameplates and page numbers—and the editions were ready to go.

As *The New York Times* sound newscast concluded at five minutes past each hour from 11 to 4, WQXR/FM switched control to the facsimile scanner. Engineer Cosmas made a brief announcement, then began transmitting page one of the latest *Times* Facsimile Edition. Sometimes a fresh news story was still being pasted on page three or four while the first pages were being sent; but not a deadline was missed. At the end of page four, a closing announcement, then control was shifted back to the station.

The pages of news and pictures delivered by the *Times* and WQXR/FM to home-style facsimile recorders spread over Manhattan may not be—in either content or format—the models for facsimile broadcasts to come. But in view of the FCC's green light for commercial faxcasting, they looked like harbingers of another revolution in radio—publishing via the airwaves.

—30—

HAMFESTERS RADIO CLUB

THE Hamfesters Radio Club of Chicago will forego their Annual Picnic and Ham Fair this year in order that all Hamfesters and their friends may attend the National ARRL Convention being held in Milwaukee on September 4, 5, and 6th.

The Hamfesters are running a contest to tell all their friends, who normally depend on the annual picnic for their yearly get-together, to meet them in Milwaukee during the Convention this year instead. The Pfister Hotel in Milwaukee has been assigned to the Hamfesters as organizational headquarters.

—30—

NEW RECEIVERS ---------- on the Market

LEATHERETTE PORTABLE

Crosley Corporation is marketing the new Model 9-302 three-way portable which is housed in an alligator-grain

brown leatherette case trimmed with ornamental metal.

The set, which measures 10-1/16 by 13¼ by 5¾ inches, features a superheterodyne circuit with tuned r.f. stage and a 3-section gang condenser. The slide-rule dial is calibrated for easy, accurate tuning. A special conversion socket for changing operation from a.c.-d.c. to battery is provided. The unit incorporates a 4 by 6 inch oval PM speaker and a built-in antenna.

The portable uses five tubes plus a selenium rectifier and carries the Underwriters' Laboratories approval.

Crosley Corporation, Cincinnati, Ohio can supply additional details on request.

TEMPLETONE PORTABLE

"The Companion" is the name *Templetone Radio Mfg. Co.* has given to its new three-way portable which will retail in the moderate price class.

Available in five colors, the new re-

ceiver uses a special single long-life "A" battery in addition to operating on a.c. and d.c. The new battery contains a special cell mixture which provides performance up to 40 hours and eliminates the ten contacts required when five flashlight cells are used.

Four electronic tubes plus a dry rectifier permit instant reception on either battery or power line. A 4 inch Alnico V PM dynamic speaker is used. The receiver measures 6 by 4⅞ by 4¼ inches and weighs only five pounds including batteries.

Templetone Radio Mfg. Co., New London, Conn. will supply additional data on request.

CLUB TV RECEIVER

Radio Corporation of America has introduced the Model 741PCS, a big-screen television receiver which has been designed especially for clubs and public places.

The set has many interesting new

features including a tamper-proof panel with secret lock which protects controls against manipulation by unauthorized persons, a slide-away screen cover, simulated leather side panels, stain-resistant treatment of the entire cabinet, and set-in "kick" panels around the cabinet base.

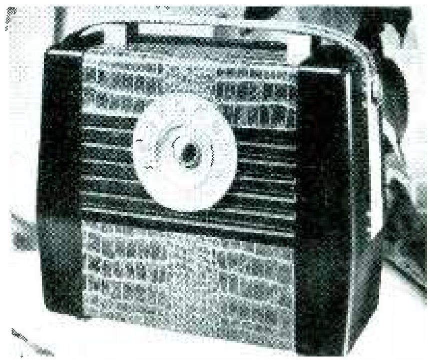
The set features a 15 by 20 inch viewing screen and incorporates the "Eye Witness Picture Synchronizer," the Automatic All-Channel Station Selector, and the "Golden Throat Tone System."

Additional data on the Model 741PCS is available from the *RCA Victor Division, Radio Corporation of America*, Camden, New Jersey.

COLORED PLASTIC PORTABLE

A new, three-way portable radio which features a smartly styled modern cabinet of colored plastics is the latest addition to *RCA Victor's* line of portables.

Known as the Model 8BX5, the new portable achieves its striking appearance through the use of a contrasting balance of maroon plastic and simulated alligator luggage-type covering. The maroon plastic is employed for the ends and the speaker louvers, while the alligator grain material is used as a saddle around the body of the instrument



and for the decorative strap handle. The metal trim is in a golden color.

The receiver operates on battery, a.c., or d.c. and features the company's "Golden Throat Tone System," a.v.c., built-in "Magic Loop Antenna," storage space within the case for the power cord, and a supersensitive PM electrodynamic speaker powered by four tubes and a rectifier.

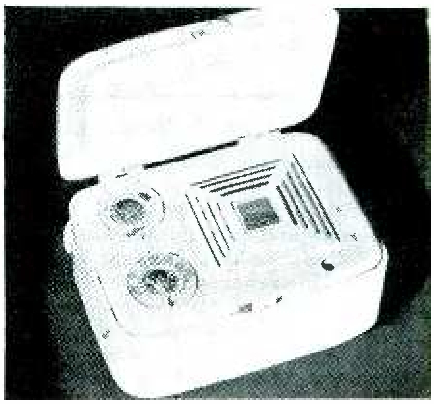
The unit measures 9½ inches by 11 inches by 5 inches and sells in the moderate price class.

Write the *RCA Victor Division, Radio Corporation of America*, Camden, New Jersey for further details on the Model 8BX5.

LIGHTWEIGHT PORTABLE

A new four-pound personal portable which features a cover and safety lock is being introduced by *Garod Electronics Corporation* as the "Starlet II."

Available in ivory, maroon, ivory-



maroon, ivory-blue, with contrasting and matching plastic carrying handles, the face of the receiver is available in iridescent metal finishes which blend

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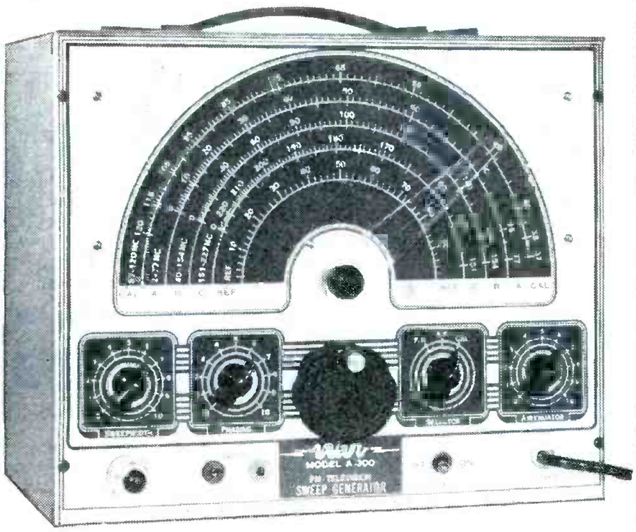

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PM SPEAKER	
2" PM	$ .89
3" PM	.95
4" PM	1.39
5" PM	1.39
6" PM	1.69

ALNICO MAGNES	
8" PM	$3.25
12" PM light magnet	4.79
12" PM 46 cy magnet 15 watt	7.95

METAL SPEAKER & CARRYING CASE

For 5" or 6" Speakers. Room for 3 tube amplifier. Dimensions 10" x 8" x 4½". Attractive brown and tan Hammerloid finish. Complete with backplate, wood baffle and hardware.
Price **$1.49**

Standard 500,000 ohm VOLUME CONTROL WITH SWITCH. Nationally known manufacturer @ 39c.
Price 10 for **$3.50**

Standard brand 40 MFD x 40 MFD, 150 Volt Condenser @ 49c. Price 10 for **$4.50**

TWO GANG SUPER HETERODYNE CONDENSERS @ 59c. Price 10 for **$5.50**

THREE GANG SUPER HETERODYNE @ 79c.
Price 10 for **$7.50**

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.

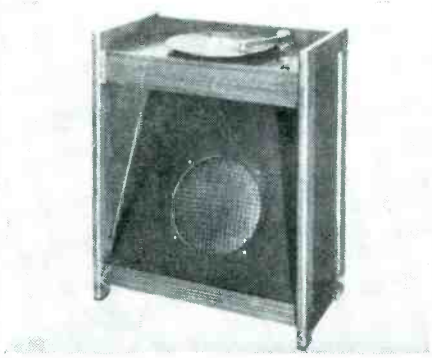
or contrast with the cabinet. The "on-off" switch and volume control, as well as the tuning knob, are of clear plastic. The set measures 8 by 5¾ by 3½ inches when closed.

Garod Electronics Corporation, 70 Washington Street, Brooklyn 1, New York is the manufacturer.

RECORD DEMONSTRATOR

Designed to meet the need for rugged equipment to withstand hard usage in demonstration booths, *The Magnavox Company* is currently introducing the "*Magnavox* Demonstrator."

The instrument has an acoustically balanced tone range extending from 50



to 7500 cycles and at the limited volume levels used for record listening it is said to provide excellent reproduction.

The unit includes the new *Magnavox* "Pianissimo 6 Pickup" which tracks the record at only 10 grams pressure.

The demonstrator is moderately priced to be within the reach of most record dealers. Inquiries for further information should be addressed to *The Magnavox Company*, Fort Wayne, Indiana.

"DORAFONE"

Setchell Carlson, Inc. of St. Paul, Minnesota is introducing a novel unit, the "DorAfone," which provides two-way

communication as well as radio reception in a single unit.

Both the master radio and the desk extension have 5 inch speakers and are connected by a 50 foot cord. The units are available in either black or ivory plastic cabinets with built-in antenna.

The "DorAfone" operates on either a.c. or d.c., 115 volts.

A data sheet covering operation and special features of the "DorAfone" may be secured by writing *Setchell Carlson, Inc.*, 2233 University Avenue, St. Paul 4, Minnesota. —30—

Home TV Servicing
(Continued from page 37)

with a sputtering noise (This trouble is characteristic of receivers constructed from kits but may also be found in commercial sets): Check the corona ring at the base of the high voltage rectifier as it may be loose or out of place.

S. *Brown spot on center of screen:* This is caused by ion bombardment which is generally the result of an open beam-bending coil, or the rotation of the coil from its correct position.

T. *Poor focus:* In this instance first adjust the focus control. Next retighten the focus coil and check the setting of the focus coil variable adjustments. Very often the focus control may be set incorrectly because the televiewer decided to make adjustments himself and because of this many of the other controls are very likely to be incorrectly set. Check to see that the focus coils used are those made for the particular model in which they are being used. For instance, the *Philco* Model 48-1000-125 cannot be used with yoke assemblies (these include focus coils) made for the Model 48-1000. If this is done very poor focusing will result.

U. *Slanted picture, entire raster off-balance:* First check the position of the horizontal and vertical deflection yokes. These coils may be out of place because of insufficient tightening of screws and nuts associated with them or because the cabinet may have been moved frequently and roughly.

V. *Beat patterns (herringbone lines running through picture):* (See Fig. 8.) This condition is caused by an interfering r.f. of a frequency close to the oscillator of the channel being used. This frequency may be within the set itself for although most sets have traps one or more of these units may be out of adjustment. If the pattern is very pronounced and appears only across part of the picture this may be caused by short-wave diathermy interference (See Fig. 9.). The only solution to this particular problem is for the diathermy

Fig. 7. Thin horizontal bar across screen due to loss of vertical sweep. See Point M.

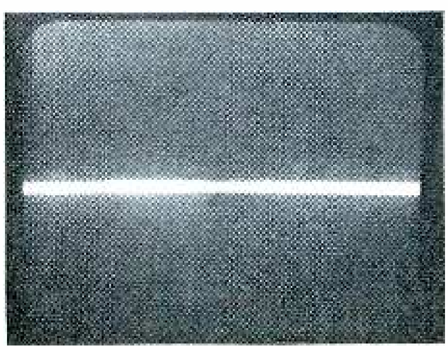


Fig. 8. Beat pattern caused by an interfering r.f. of frequency close to oscillator.

equipment to be completely shielded.

W. *Poor resolution:* This phenomenon manifests itself in a bunching together of vertical lines of the horizontal resolution wedge. These will usually be blurred near the center of the pattern and thus represent a loss of high frequencies. A deficiency of highs may also be attributed to defective peaking coils, video coupling, or bypass condensers, antenna mismatch, or video i.f. out of alignment, etc. Most of these troubles actually cause a phase shift and as such require elaborate test equipment to properly isolate and correct them.

X. *Transmitter as a source of trouble:* Although the transmitter could be blamed for many of the early troubles very few of them can be attributed to this cause today. This is true even when the trouble appears to be with only one station. This particular fault is very likely due to the antenna not favoring the station, the oscillator or fine tuning control not being set correctly, or some condition in the teleset itself which simulates a weak station. Of course, the station itself could be weak, but if the receiver ever operated correctly, the trouble is probably not with the transmitter. A weak station has a tendency to pick up noise and other external intereferences, thus if the teleset is not perfectly aligned or certain parts are slightly defective or out of place, poor reception will result.

Y. *How to avoid additional troubles:* When completing a servicing job be sure that all tube shield cans are replaced properly; tighten all screws and nuts. In multi-chassis sets be sure that the correct plug is inserted into the correct socket. Failure to do this has caused serious damage such as ruining of the

Fig. 9. Short-wave diathermy interference. See Point V for methods of correction.

power transformers, rectifiers, etc. During the entire servicing procedure be sure to handle the cabinet, chassis, kinescope, etc. with extreme care.

As indicated in the foregoing outline quite a few adjustments and repairs can be made in the customer's home, but there are also many which require attention in a well-equipped shop. All alignment and most major repairs must be handled at the service bench. However, an on-the-spot interpretation and analysis of the trouble can be a real time and money saver when the set reaches the service shop.

Final Service Procedures

If the receiver has not been restored to proper operating condition and the antenna, lead-in, or external interference are not obviously at fault, a new chassis and or a new focus and deflection assembly should be tried. Now if the set functions properly have the customer sign the receipt and write a full report stating what has been done and why. However, if after replacing the chassis the set's operation still doesn't meet the company's standards then report all that has been done, in writing, and list your recommendations along with any specific conditions that might affect the servicing of this set in the company's shop.

If the set has been put into good operating condition demonstrate to the customer the proper adjustment and function of all external controls. Again have him run through the complete operating procedure without assistance. Before you consider the service call complete, sit down and watch a portion of the program. If it appears too bright cut down the brightness control and readjust the constrast. Point out to the customer that too bright a picture causes a strain on the eyes and leads to a disinterest in the program. If the picture appears too dim and cannot be made reasonably bright by readjusting the brightness control it may be necessary to move the teleset to another position in the room.

The service call may now be considered complete. It is advisable for the serviceman to write up all that he has observed and accomplished so that this information is readily available for future reference.

Conclusion

Television is one of today's most rapidly expanding industries. The continuance of this expansion is dependent upon a number of conditions, one of the outstanding of which is the successful servicing of television receivers. That is, if the sets are not kept constantly in good operating condition television is due for a definite setback. However, if all television servicemen read current television literature, study textbooks, and, if possible, take some form of television schooling and sincerely follow the service analysis techniques outlined in this article, television sales should spiral upwards very rapidly. In this way, television will become one of the greatest industries in America.

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LETTERS *from our readers*

B.C. INTERFERENCE

"LET me add a letter to the one Jack Watt has written RADIO NEWS in the May issue. Here is one radioman who is slightly going nuts by degrees because every customer that I have wants me to separate the stations on the radio, get the noise out of the set, and eliminate the fading which is so bad that the radio goes completely dead.

"I want to thank Mr. Watt for his letter and I for one will take one of my letterheads and explain what is happening on the broadcast bands and get my customers to sign it. We will forward it to you so you can pass it on to the FCC for their consideration.

"It used to be a pleasure to listen to a radio. Today it is disgusting. If something is not regulated somewhere I am afraid that there will be less radios sold and naturally there will be less repaired.

"Just my nickel's worth."

D. E. Boughans
Boughans Radio Repair Shop
Silas, Alabama

* * *

WANT TO HELP?

"I FIRST saw a copy of your magazine about a year ago. Since then I have failed to get more than four copies of it. I came across some of these at various bookstalls and second-hand dealers. I ordered it at my local stationers and they got one copy for me and never could get another. It was advertised in English magazines but when I wrote they could not accept subscriptions from Ireland on account of the dollar shortage.

"Since I cannot order RADIO NEWS direct from the U.S.A., I ask if some kind reader would let me have any copies of this magazine with which he may be finished and so keep alive the spark in my blood."

C. A. Farrell
27, Long Avenue
Dundalk
Co. Louth, Ireland

* * *

PROFESSIONAL STATUS

"IT is no shrewd observation that there is a growing desire among the radio service industry to be given a professional status. Fortunately (yes, fortunately), it will not be that simple. Look at the record. Every continuing professional group owes much of its success to the formation and observance of a strict and sensible code of ethics. Such homogeneity of purpose and action is indeed rare among radio servicemen. Even the isolated cases of unity, the Servicemen's Associations, are not the whole answer. Business will not be built by membership in organization 'X'. It will be built by better work, lower prices, and that elusive intangible called 'confidence.'

"This writer does not believe that he is the crackerjack repairman of the century. However, here are some practices which have produced gratifying results in customer confidence and satisfaction.

"No customer leaves the shop without an itemized receipt—for many this is the first time. The customer receives, in a little bag, all parts removed from his set—a part is either good or it is junk. Next, no broadcast set that comes out of its cabinet leaves the shop without a signal generator-v.t.v.m. alignment. I have clocked myself at under two minutes on the simpler a.c.-d.c. sets and I'm not the best that ever came along. Finally, I do not hesitate to tell the customer that I make 40 per-cent on parts. He suspects it anyway and the more I make on parts the less I charge for labor.

"Personally, I do not resent the cheats, because they make the legitimate serviceman look all the better, but from the standpoint of social good, this is hardly a noteworthy view. I do believe that any plan for professionalizing the radio service industry must include a universal and workable code of ethics, with emphasis on creating customer confidence."

Sterling K. Berberian
Sterling's Radio & Television Service
East Lansing, Michigan

* * *

REPLACEMENT PARTS

"RIDER lists the correct address of each manufacturer for which he publishes schematics at the head of the page for the various models in each index. This is changed, if necessary, in succeeding indexes so that the serviceman may obtain his parts with the minimum loss of time. As you know, there are numerous items for which there are no practical substitutions and a duplication of the original component must be used for a satisfactory job.

"The service industry received a much-needed shot-in-the-arm during the period of the war and now most servicemen possess fine instruments, up-to-date service manuals, and the rest of what it takes to do a good job of repairing radios.

"Now here is the rub. It is almost impossible for each serviceman to have the correct addresses of each jobber handling the various radios, so of necessity, he forwards his orders to the manufacturer. He then notifies his customer the reason for the delay and hopefully awaits the shipment of his order. Sometimes weeks, or even months, later the manufacturer writes 'Our policy precludes direct shipment, please place your order with the agency whose address is given below.'

"Then follows a letter to the jobber who is apt to be out of stock. Thus be-

gins more hopeful waiting culminating in the customer losing patience entirely and taking his work elsewhere. Thus the loss is borne not only by the customer but by the serviceman and the manufacturer.

"It seems that it would be a very small service for the manufacturer to forward the letter direct to the jobber thus saving the serviceman some delay. He could also require periodic inventories from the jobber demonstrating his ability to ship parts from stock. Something must be done about this situation. The ride on the gravy train seems to be over. Our customers are the manufacturers' customers too!"

Michael Williams
Mike's Shop
Dunn, N. C.

* * *

HE AGREES

"HATS off to A.C.W. Saunders for his 'Open Letter to the Radio Manufacturer.'

My open letter would be to the various radio service organizations throughout the country. Come on, fellows, here is a man who has brought our problems out in the open. Let's get back of him and make his letter the beginning of a campaign. Can you take the hint?

"During the war, Uncle Sam had requirements for radio equipment that all radio manufacturers are acquainted with. A mere handful of these requirements applied to present-day production would give the public a set which could be adequately serviced. If the manufacturer would spend the same amount of time in planning his set from a service angle that he and his organization spend in damning the serviceman, many customers would have a better acceptance of their radio.

"Come on service organizations! If the manufacturer can't, or won't, do his job right, let's do something about it. Mr. Saunders has started the ball rolling! Get back of it and keep pushing until we get it right up to the front door of the radio manufacturer."

I. L. Hillman
Hillman Radio Laboratories
Idaho Falls, Idaho

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AACS SEEKS MEN

RADIO hams and the 40,000 former members of Airways and Air Communications System are being urged to investigate re-enlistment advantages, according to AACS' Commanding General, H. M. McClelland.

Critical categories of soldier-specialists in the electronics field are forcing AACS to continue indefinitely the hiring of civilian-specialist operators and teachers in order to adequately man its far-flung facilities. These specialists now number 177.

Amateur radio operators who are high school graduates enlisting in the AACS this summer could continue their hobbies—earn and learn at the same time, according to the General.

Persons interested in further details regarding openings in the AACS should contact Airways and Air Communications Service, A.T.C., Washington 25, D. C.

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Communications Receiver

(Continued from page 48)

and such dials are available with complete calibration. The communications features increase the selectivity to such a degree that satisfactory operation of the average slide rule dial is not possible.

Power Supply and Audio Chassis

There is no radical difference between a good audio amplifier and just another audio amplifier. Both require approximately the same number of parts and the same amount of effort in construction. The parts may be slightly more expensive for the good amplifier.

From an operating standpoint, the difference can be radical. The main difference will be in hum content, maximum audio output, distortion, and gain and tone control operation.

The amplifier used in this receiver includes the following features; ample chassis space, power supply with sufficient output to furnish power for the amplifier as well as the additional external load, adequate power supply filter, push-pull 6L6 audio output stage, 15 watts output at 10 per-cent distortion, grounded-grid phase inverter driving the 6L6 stage, two audio amplifier stages giving adequate gain for tone control operation, high frequency tone control that will increase or decrease high frequency response, low frequency tone control that will increase or decrease low frequency response, phono-radio switch, separate power switch, fused a.c. input, three input terminals, speaker plug, d.c. power output plug, voltage regulation for high frequency oscillator operation, hum reduction to a satisfactory level, and variable output impedance.

Taking any one of these features out of the amplifier would reduce the quality of the unit very little. On the other hand, including all of these features improves the quality by a large margin.

The high frequency tone control only affects frequencies above 1000 cycles while the low frequency tone control only affects frequencies below 1000 cycles. Tone controls operated in this manner do not change the average operating level necessitating readjustment of the volume control each time a tone control is changed.

Incorporating the variable output impedance feature increases the possible use of the amplifier at a later date. If the amplifier is to be used for p.a. it may be advisable to connect the variable output leads to a switch so that impedance selection can be made without the aid of a soldering iron. Since this amplifier is capable of 15 watts output, under these conditions a speaker with less than a five watt rating should not be used lest the speaker cone be fractured. Incidentally, a five watt level would seldom be used.

Construction Details

The input circuit consists of a phonograph equalization network and a radio

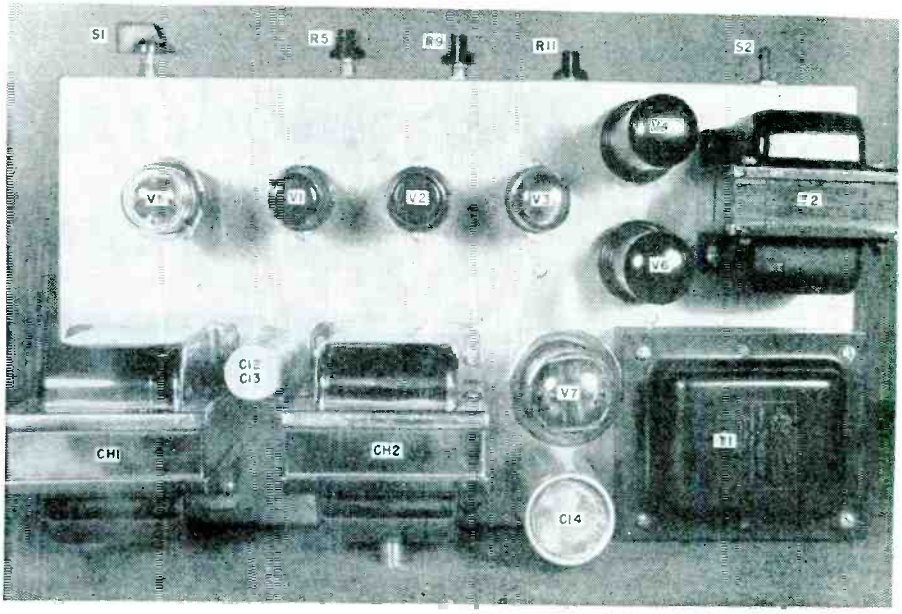


Fig. 5. Top chassis view of amplifier and power supply unit with important above-chassis components identified in accordance with parts list.

input voltage divider connected to the phono-radio switch, S_1. By using a two-deck switch, spare contacts are available for mounting resistors R_1, R_2, R_3, R_4, and condenser, C_{11}. C_{11}, 250 mmfd. condenser, gives the correct equalization for a QTJ cartridge. The actual value of C_{11} will vary for different types of cartridges.

Since more gain is available than is necessary for radio operation, R_3 and R_4 form a voltage divider to attenuate the excess output. Resistor R_3 determines the actual amount of output. Normally, the value of R_3 is selected to equal the output of the phonograph equalization network.

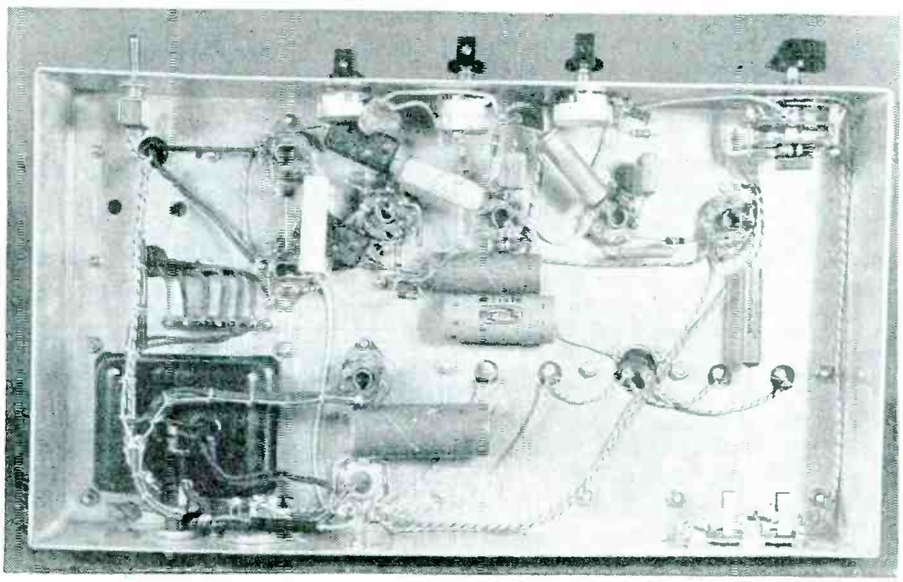
Switch S_1 is also used to open the 150 volt lead for all types of operation with the exception of radio. This switch connects to the volume control R_6 and condenser C_1 feeds the audio to the grid of the first amplifier tube, V_1, a 6SF5 tube.

The cathode of this stage is grounded. This eliminates the possibility of hum pickup due to cathode filament leakage when the cathode is operated above ground by a bias resistor. Bias is obtained by a high value of R_6. The output of the amplifier will have to be in excess of 15 watts before this stage can be driven into distortion.

Coupling condensers C_9 and C_{10} and resistors R_{19} and R_{20} are selected to give a small amount of attenuation at low audio frequencies. The operation of the bass tone control will then cause the low frequency response to increase or decrease depending on where it is set. Resistor R_{21} furnishes bias for the two output tubes and should have at least a five watt rating.

Output transformer T_2 has variable output taps. These taps connect to a multiple tiepoint. Output impedance can then be changed by selecting the proper tiepoint. Where the output impedance requirements vary from application to application the addition of a rotary switch may be advisable in order to

Fig. 6. Under chassis view of amplifier and power supply unit showing wiring simplicity.



eliminate the necessity for changing leads when the amplifier is put to different uses.

The construction of the power supply and filter is simple and straightforward. Choke CH_1 is high inductance, low current and CH_2 is low inductance and high current.

The speaker socket is a five-prong tube socket while the power output unit is an octal tube socket. Connections to these sockets should follow those specified in the diagram as this simplifies the construction of cables. The same pin numbers are used for connections to the power sockets on the other chassis.

The filament leads are not grounded. Although it is common practice to ground one side of the filament, voltage drop in the hot lead causes a potential difference between points on the chassis, a condition which may result in hum.

It is advisable to shield the input leads from the input terminals to the phono-radio switch.

The distortion content of the amplifier is as follows: 5 watts—4.5 per-cent; 10 watts—6.7 per-cent; and 15 watts—10 per-cent. The frequency response at various tone control settings is indicated in Fig. 2. These measurements were made at a 5 watt level.

The distortion content could have been reduced by the addition of negative feedback. This would have complicated the circuit somewhat and since to the average ear a distortion content varying between 1 and 5 per-cent is not noticeable, this was not considered worthwhile.

Adequate space is available to make circuit changes for those who have pet ideas on just what the well-built amplifier should have. As is, the amplifier will equal or outperform most amplifiers now on the market.

The high frequency response can be easily changed to meet individual requirements. Increasing the capacity of C_2 will cause additional high frequency attenuation while increasing the capacity of C_4 will increase the high frequency response.

(To be continued)

AFCA News

(Continued from page 22)

the *Development Department* of *Ansco*, who came down from Binghamton, New York. The Executive Secretary of AFCA, General S. H. Sherrill emphasized the importance of a closer cooperation between the communications industry and military development agencies. Out of town guests included Rear Admiral Joseph R. Redman, former Chief of Naval Communications, and now Vice President of *Western Union:* Col. W. W. Watts, Vice-President of the *RCA Victor Division* and President of the Philadelphia Chapter of AFCA; Col. George P. Dixon, Vice President of *IT&T* and former President of the New York and Rio Chapters; and Maj. Gen. R. B. Colton, Exec. Vice Pres., *Federal Telecommunication Labs, IT&T.*

Kentucky

Col. William M. Mack, new Commanding Officer of the Lexington Signal Depot, has been elected President of the Kentucky Chapter.

Richmond

The new President of the Richmond Chapter is Mr. E. T. Maben of the *Chesapeake & Potomac Telephone Company* of Va.

Rio

The AFCA Chapter in Rio de Janeiro has been holding joint meetings with the Telecommunication Association of Brazil. The main speaker at the June meeting was Col. Armando Dubois Ferreira, Chief Signal Officer of the Brazilian Army.

Sacramento

The Sacramento Chapter met on June 16th at the Sacramento Signal Depot. Mr. Francis Noel, State Director of Audio-Visual Aids, spoke on the military and naval use of training aids during the war and showed the progress which has been made, as a result, in civilian education.

Washington, D. C.

Mr. Frederick G. Macarow, Vice President and General Manager of the *Chesapeake & Potomac Telephone Company*, has been elected President of the Washington Chapter.

AFCA Awards

West Point

The AFCA award for excellence in the study of electricity at the U. S. Military Academy went to Cadet William C. Burns. The award consisted of an SX-43 *Hallicrafters* Receiver.

Chapter of the Year

The certificate of merit for the "Chapter of the Year" was won by the Far East Chapter, under the leadership of Brig. Gen. George I. Back.

ROTC

Honor awards were made to the following outstanding ROTC students of Signal Corps Units: John S. Blackwell, Cornell University; Bernerd H. Droz, State College of Washington; Carlton H. Musson, Michigan State College; Howard R. Oliver, Agricultural & Mechanical College of Texas; Richard G. Barhite, University of California; Earl E. Burdick, Kansas State College of Agriculture & Applied Science; Douglas E. Wagner, Iowa State College; James A. Leonard, Massachusetts Institute of Technology; and Jack Wasserman, New York University.

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XTALS—GRIND 'EM DRY

BY PAUL M. CORNELL, W8EFW

IF you should want to grind a crystal blank into a finished crystal or move the frequency of a present crystal, we suggest a slightly different approach to the grinding problem—grind 'em with dry abrasive powder. This eliminates the mess of water and abrasive paste.

A flat piece of cast iron makes a good surface on which to grind the crystal. I have used a round piece, turned down on a lathe, quite successfully for some time. The grinding process goes faster than usual because the abrasive particles find their way into the pores of the iron and as the crystal is moved across the surface of the metal, the anchored particles of abrasive act like a file under the quartz instead of as friction rollers. For fine grinding and finishing, a piece of hard wood or masonite dusted with the fine grinding powder works very well.

A variation of the process, developed when iron was not available, uses an ordinary piece of plate glass covered by a sheet of writing paper. Thus, the surface of the glass is not damaged in the grinding process but the anchoring action takes place with the abrasive particles finding their way into the pores of the paper. There is some rolling effect, but grinding is fast and satisfactory. The finish grinding is done on another sheet of paper on the glass. This paper is covered with the fine grinding compound and because of the smaller pores, the file action is more apparent with the finishing process. If the paper shows wear, it should be replaced with a new sheet and the grinding compound shifted from the old sheet to the new. However, a considerable amount of grinding can be done on one sheet before it is necessary to replace it because of wear.

This dry grinding process has proven to be a quicker and much cleaner method of grinding crystals. No more do we have a gritty paste and water mess all over the place. The newly ground crystal can be wiped clean of the grinding dust with an ordinary piece of cloth and in many cases the crystals go into oscillation without further cleaning with fluid. However, it is good insurance to clean the crystal with carbon tet or just plain soap and water.

All the usual rules for grinding crystals apply to this method. Surfaces should be kept flat and proper allowances made for center grinding with certain types, etc., but the big advantage lies in the elimination of the messy dust and water mixture associated with the "wet" grinding process.

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Television Receivers

(Continued from page 70)

Returning to the discriminator alignment, set the sweep generator at the i.f. value (21.25 mc. in this set) with a sweep of plus or minus 200 kc. On the scope screen the S-curve will be visible, Fig. 9. The primary and secondary of the discriminator transformer are adjusted until the center portion is linear. Now connect the output leads of an AM signal generator in parallel with those of the sweep generator. Set the AM unit to 21.25 mc. A wiggle or pip will appear in the S-curve on the screen at the 21.25 mc. point. See Fig. 9. By changing the marker frequency, we can determine the extent of the linear portion of the S-curve.

Receivers With Ratio Detectors

A. *Single Signal Method:* Starting first with the unbalanced ratio detector, Fig. 10, connect the output lead of the AM signal generator to the control grid of the 6AU6 i.f. amplifier tube. Set the signal generator to 21.25 mc. Place the vacuum-tube voltmeter between point *A* and ground. This is equivalent to placing it across the 5 mfd. condenser and the 22,000 ohm resistor. (At point *A*, the negative a.v.c. voltage is obtained).

With the equipment thus set up, adjust the primary of T_3 until maximum voltage is indicated on the vacuum-tube voltmeter. The next step is to adjust the secondary of T_3. The ratio detector used in this receiver is unbalanced. Consequently, to zero adjust the transformer secondary, it becomes necessary to artificially balance the detector, and this is done by connecting two 68,000-ohm resistors (within 1% of each other) in series, from point *A* to ground. Connect the common lead of the vacuum-tube voltmeter to the junction of these resistors and the d.c. probe to point *B*. The signal generator remains where it was, with the same dial setting (21.25 mc.). Now, adjust the secondary of T_3 for zero reading on the meter. This completes the adjustment of the ratio detector. Detector response linearity is checked by the method outlined for the Foster-Seeley circuit.

I.F. Alignment: Shift the AM signal generator to the control grid of the mixer tube. The ground lead of the generator connects to the receiver chassis. Set the signal generator to 21.25 mc. The vacuum-tube voltmeter is connected between point *A* and ground. The primary and secondary windings of T_1 and T_2 are now adjusted for maximum reading on the voltmeter. The symmetry of the i.f. response can be investigated by the method given for the previous i.f. system.

B. *Visual Alignment:* Visual alignment of receivers employing the ratio detector is best accomplished by first adjusting the ratio detector and then adjusting the i.f. circuits. The ungrounded vertical input terminal of the oscilloscope is connected through a 10,000 ohm resistor to point *B*, Fig. 10. The other terminal (ground) connects to the receiver chassis. The initial position for the sweep signal generator is between control grid and ground of 6AU6 i.f. amplifier tube. Set the generator to 21.25 mc., with a sweep of plus or minus 200 kc. On the oscilloscope screen, the S-curve, characteristic of ratio detectors, should be visible. Adjust the primary of T_3 for maximum linearity of the S-curve. Then adjust the secondary until the S-curve is symmetrical, with as much linear section above the 21.25 mc. marker point as below. The marker signal, obtained from an AM generator, can be used to determine the frequency extent of the linear section of the S-curve. The linearity should extend for at least plus or minus 100 kc.

The sweep generator and the marker generator are now shifted to the mixer signal grid. The ungrounded vertical input lead of the oscilloscope is connected, through a 10,000 ohm resistor, to point *A*. The ground terminal connects to the receiver chassis. Remove, temporarily, the 5 mfd. condenser connected from point *A* to ground. Keeping the signal generators at the same frequencies used above, adjust the primary and secondary windings of T_1 and T_2 for maximum amplitude and linearity of the response curve. The marker pip should be in the center.

Balanced Ratio Detectors. The foregoing receiver employed an unbalanced ratio detector. When the ratio detector is balanced (Fig. 3C), the procedure is modified only when the detector circuit itself is being adjusted. To adjust the detector, we proceed as follows: Connect the AM signal generator to the control grid of the last i.f. amplifier. Set it to the i.f. value, say 21.25 mc. Connect one lead from a vacuum-tube voltmeter to point *B*, (Fig. 3C). Attach the common lead to the receiver chassis. Back out the secondary iron-core adjustment of T_1 as far as it will go, and then adjust the primary iron-core for maximum meter deflection. Return to the secondary of T_1 now and adjust it for zero deflection. Check the linearity of the detector response, as discussed with the unbalanced ratio detector.

To employ the visual method of alignment, connect an FM sweep generator in parallel with the AM generator noted above. The AM generator will now provide a 21.25 mc. marker pip. Replace the vacuum-tube voltmeter by the vertical input terminals of an oscilloscope. Insert a 10,000 ohm resistor in series with the oscilloscope lead that goes to point *B*. Now adjust both windings of T_1 for an S-curve on the oscilloscope screen.

For alignment of the i.f. stages with an AM generator, the vacuum-tube voltmeter is connected between point *C* and ground. This is similar to its use with an unbalanced ratio detector. To observe response patterns by the sweep method, an oscilloscope is connected to point *C*. Disconnect, temporarily, the 10 mfd. condenser from point *C*. This, too, is similar to the unbalanced circuit.

(To be continued)

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RADIO Engineering Broadcasting, Aviation and Police Radio, Servicing, Marine Operating and Electronics taught thoroughly. Expenses low. Write for catalog. Valparaiso Technical Institute, Dept. N., Valparaiso, Ind.

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V.O.M. ASSEMBLY, consists of 18 wire-wound non-inductive, precision resistors mounted and fully wired on low-loss, wafer-type, rotary switch, ready to connect to your meter to make highest grade instrument. While they last, price, $2.50. Radioco, 1110 Marshall Bldg., Cleveland, Ohio.

YOU can accurately align superheterodyne receivers without signal generator. Complete instructions. $1. Money-back guarantee! Chas. Gates, Pecos 1, Texas.

GRILL Cloth. Celanese, light and dark pieces. 1000 square inches for $1 bill. Write for list of lowest priced national brand parts in nation. Bursma Radio, Route 5, Grand Rapids, Mich.

TEST sets TS-13AP; Factory incompleted. Including twin power supplies, large number of condensers, resistors, pots, etc. Also, beautiful grey rippled steel cabinet 20"x11"x10". Few left at $6.95 F.O.B. Alco Electronics, Box 214, Lawrence, Mass.

BC-348 R, 110 AC-External Speaker in cabinet. Schematics, etc., included. $80. Joseph L. Baker, RFD #1, Walbridge, Ohio.

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NEW cartoned tubes, 39c each. 1A5gt, 1C6, 1L4, 1R5, 1S5, 1T4, 3Q4, 3S4, 3V4, 5Y3gt, 6A7, 6AJ5, 6AQ6, 6AT6, 6BA6, 6BE6, 6BH6, 6BJ6, 6C5gt, 6F5gt, 6J5gt, 6K6gt, 6Q7gt, 6SA7, 6SD7gt, 6SF5gt, 6SK7gt, 6SQ7gt, 6V6gt, 6X4, 7E5, 12A6, 12F5gt, 12AT6, 12BA6, 12BE6, 12AU6, 12A8gt, 12J7gt, 12SA7gt, 12SK7gt, 12SQ7gt, 12SJ7gt, 12SH7, 12J5gt, 12SL7gt, 14J7gt, 25L6gt, 31, 32L7gt, 35B5, 35W4, 37, 38, 47, 57, 50B5, 70L7gt, 76, 89, 117L7gt, 117P7gt, 117Z3, 80. Write for bargain flyer. Henshaw Radio Supply, 3313 Delevan, Kansas City 2, Kansas.

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SEND for big list radio and photo equipment and supplies. Below retail. Lund, Box 918, GPO, New York 1, N. Y.

MAKE best offer for part or all our stock of 100 radios (4 miniature tube-superhetrodyne) Moore Supply Company, Harbert, Mich.

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WESTERN Electric 251-A Tubes, also 339-A Tubes Station WJG, Box 166, Memphis, Tenn.

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MISCELLANEOUS

BC-454 or 455 easily converted to hot ten meter receiver. Fixed or mobile. Instructions schematics, $1. N. Brown, 3327 Geronimo, Tucson, Ariz.

SWL's? QSL's? Made-to-order. Samples, 10c. Sakkera, WSDED-Press, Holland, Mich. (VHF-152A?) (DB-22A?)

A UNIQUE service to the electronic parts user; let us be your N. Y. buyer. We locate your needs at your specifications. Clouse Radio Wholesale, 820 Elsmere Place, New York 60, N. Y. Tr. 2-8454.

RADIOMEN, Servicemen, Beginners. Make more money, easily, quickly. $250. Weekly possible. We show you how. Information Free. Merit Products, 216-32R 132nd Av., Springfield Gardens 13, N. Y.

ERRATUM

In reviewing the book "The Radio Amateur's Beam Pointer Guide" (Technical Books, July, 1948, page 159) we mentioned that "This booklet has eliminated all guesswork by giving the setting in degrees from true north . . ." and "Each prefix is followed by a reading in clockwise degrees from true north." In both of these instances the expression "true north" should have read "magnetic north." We are indeed sorry that this error occurred.

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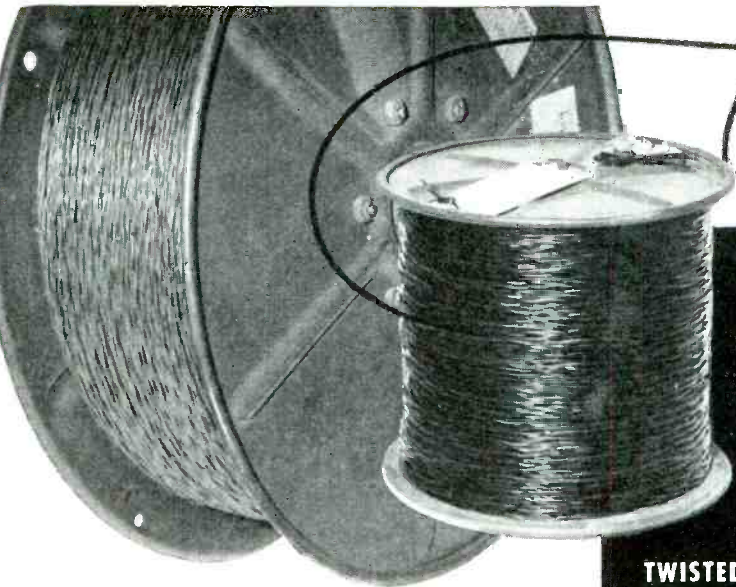

Wire

Plastic Coated Assault Wire

ON ORIGINAL STEEL REELS

TWISTED 2 CONDUCTOR #20-7 STRAND TINNED

★ WEATHER RESISTANT ★ DURABLE
★ LIGHT WEIGHT ★ FLEXIBLE

Available for Immediate Delivery at the following prices:

2,000 ft. steel reels (individually boxed)	Per 1000 ft.	**$ 8.00**
3,000 ft. pay out wooden reels (packed 2 reels per box)	Per 1000 ft.	**$ 7.00**
10,000 ft. steel reels	Per 1000 ft.	**$ 6.50**
20,000 ft. steel reels (same wire but single conductor)	Per 1000 ft.	**$ 2.50**

Other Wire Available from Wells

Field wire, No. 18 stranded, 7 strands (4 steel, 3 copper) 2 conductor, rubber-covered, weather-proof, 500 ft. reels	Per 500 ft.	**$ 5.00**
Aerial Wire, No. 12 Phosphor Bronze, 7 strands No. 20	Per 1000 ft.	**$15.00**
Aerial wire, No. 18 copper weld, solid, 3000 ft. reels	Per 1000 ft.	**$ 5.00**
Single conductor, No. 20 shielded, overall braid, 1000 ft. reels	Per 1000 ft.	**$15.00**
Single conductor, ANJC 48 No. 20 stranded, glass braid lacquered, 1000 V. insulation, 2000 ft. reels	Per 1000 ft.	**$10.00**
Single conductor, No. 20 stranded, glass braid lacquered, 3000 V. insulation (for transmitters) 1000 ft. reels	Per 1000 ft.	**$12.00**
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Wells Offers These Outstanding Values In

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RG8U - 52 Ohm co-ax cable. . . . Per 100 ft. coil - $2.95
RG29U - 53½ Ohm co-ax cable. . . . Standard TV antenna line. Per 100 ft. coil - $2.50

Also a Complete Stock of Co-ax Connectors

Jobbers Write for Wire Bulletin 110-A
Send Your Wire Requirements to WIRE DIVISION
Write for Amateur Catalog H-400C

WELLS SALES, INC.

320 N. LA SALLE ST., DEPT. R-8, CHICAGO 10, ILL.

Dispatcher's office is in constant communication with vehicles at all times, directing them to the scene, checking on progress in bringing fire under control.

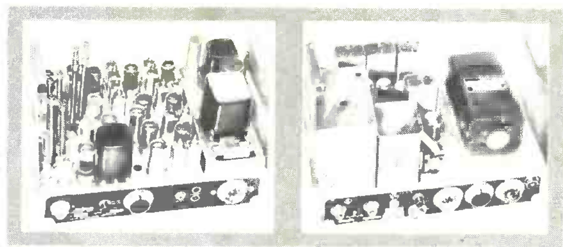
Columbus equipment reaches fires faster sped by 2-way *Motorola* Radio and Sylvania Lock-In Tubes

Those first few minutes are *vital* in fighting a fire!

That's why the Columbus (Ohio) Fire Department counts on Motorola 2-way FM to maintain constant touch between the dispatcher's office and 24 radio-equipped vehicles. Equipment returning to the firehouse can be instantly diverted enroute—dispatched to the scene of a new alarm.

And where fires are potentially big enough to call for *additional* equipment to bring them under control, a radio message from the scene to the dispatcher's office has the extra vehicles under way within seconds!

For service requirements like this, Motorola counts on Sylvania Lock-In Tubes to help maintain uninterrupted, efficient performance of its mobile units. These tubes stay firmly in place through jolting and jarring. They have few welded joints, no soldered ones. No warping or weaving of elements. Low loss, low leakage. For full information, see Sylvania Distributors, or write Radio Tube Division, Emporium, Pa.



Mobile FM transmitting and receiving units built by Motorola, Inc., Chicago, and used in 24 vehicles of the Columbus Fire Department.

Superior mechanical and electrical features of Sylvania Electric's famous Lock-In Tube make it ideal for equipment on the road, in the air, on the rails—for marine radar, FM and television.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; LIGHT BULBS; PHOTOFLASH BULBS