RADIO'S GREATEST MAGAZINE

SPECIAL TELEVISION NUMBER

OVER 175 ILLUSTRATIONS

Radio-Craft

HUGO GERNSBACK

August 38

25 Cents

in United States and Canada

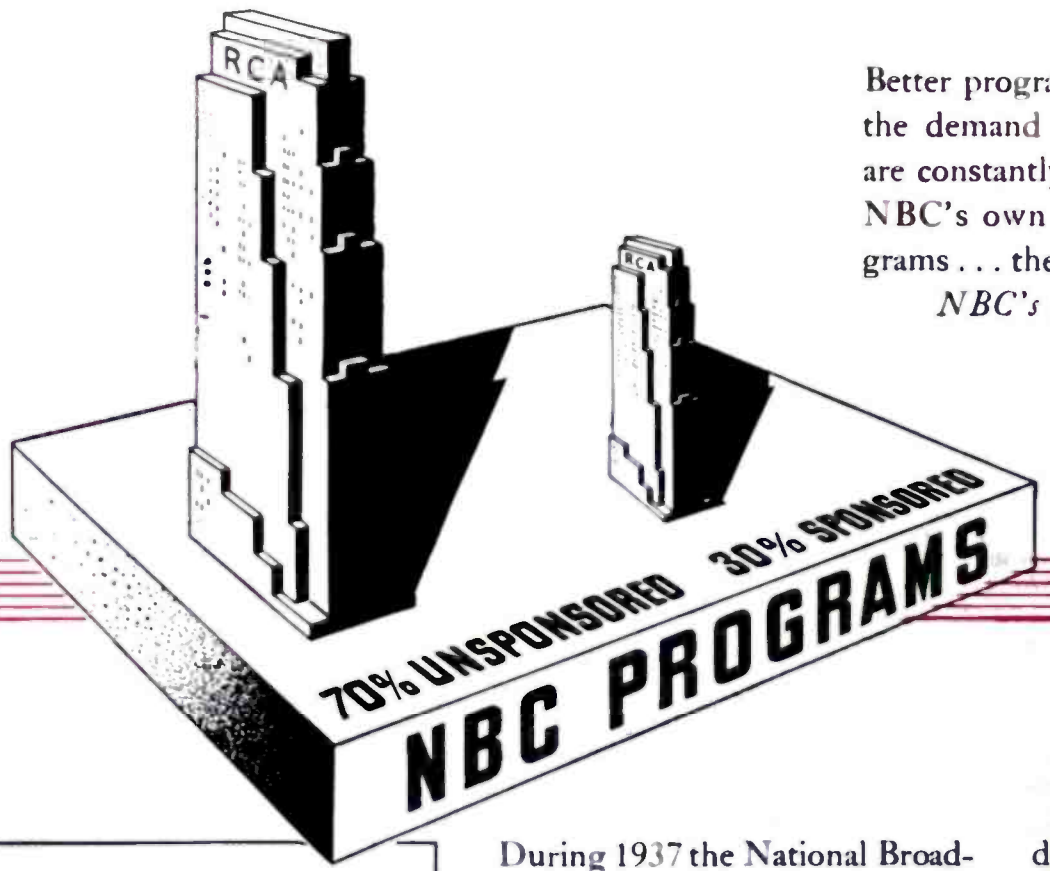
TOMORROW'S TELEVISION SERVICING

SEE PAGE 81

U. S. Television Stations • A Radio Script Show • Home-Made "Hearing Aid"
Beginners' 4-Tube "Vacation Portable" • Electrifying Service Oscillators

OVER 50,000 RADIO MEN READ RADIO-CRAFT MONTHLY

RCA Continues to Build America's Radio Audience!



Better programs—which increase the demand for better radios—are constantly being fostered by NBC's own unsponsored programs . . . they constitute *70% of NBC's time on the air!*

NBC HIGHLIGHTS

These are but a few of the many fine programs which make up NBC's *70% unsponsored time on the air!*

- ★ Metropolitan Opera Broadcasts
- ★ NBC Symphony Broadcasts
- ★ Music Appreciation Hour
- ★ National Farm & Home Hour
- ★ NBC Radio Guild
- ★ America's Town Meeting of the Air
- ★ The Radio Pulpit
- ★ University of Chicago Round Table

RCA presents the Magic Key every Sunday, 2 to 3 P. M., E. D. S. T., on the NBC Blue Network.

During 1937 the National Broadcasting Company, a service of RCA, broadcast more than 50,000 unsponsored programs. Such service accounted for 70% of all NBC time on the air. The variety offered was as wide as human interests.

Through the miracle of radio such programs bring to millions entertainment, information and help which they could not receive otherwise. Through NBC, living rooms become boxes at the Metropolitan Opera. Or they are filled with the sonorous cadences of great symphonies, played by the NBC Symphony Orchestra, conducted by Arturo Toscanini, or some other famous conductor.

Again, it may be current prices of eggs, or pork, or a discussion of books and plays. But whatever the subject, if it is of interest to any considerable part of the public, NBC provides programs which deal with it.

Programs such as these, together with the fine programs sponsored by NBC advertisers, have been largely responsible for the increased sale of radios. And in offering listeners better radios RCA further stimulates America's interest in fine radio programs.

Radio Corporation of America

RADIO CITY, N. Y.

RCA MANUFACTURING CO., INC. RCA INSTITUTES, INC. RCA COMMUNICATIONS, INC.
RADIOMARINE CORPORATION OF AMERICA NATIONAL BROADCASTING COMPANY

I will send you a Lesson on Radio Servicing Tips FREE

TO SHOW HOW PRACTICAL IT IS TO TRAIN AT HOME FOR

GOOD JOBS IN RADIO

J. E. SMITH
President
National Radio Institute
Established 1914

The man who has directed the home study training of more men for the Radio Industry than any other man in America.

Do you want to make more money? I'm sure I can train you at home in your spare time for a good Radio Job and for opportunities coming in Television. I'll send you a sample lesson FREE. Examine it, read it, see for yourself how easy it is to understand even if you have no knowledge of Radio or electricity.

Many Radio Experts Make $30, $50, $75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year. Full time Radio servicing jobs pay as much as $30, $50, $75 a week. Many Radio Experts operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay, see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems offer good opportunities now and for the future. Television promises many good jobs soon. Men I trained have good jobs in these branches of Radio.

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs, how to cash in quickly. Throughout your training I send you plans and ideas that have made good spare time money—from $200 to $500 a year—for hundreds of fellows. I send you special Radio equipment, show you how to conduct experiments, build circuits illustrating important Radio principles. My training gives you practical Radio experience while learning.

I Also Give You a Professional Servicing Instrument

Here is the instrument every Radio expert needs and wants—an All-Wave, All-Purpose, Set Servicing Instrument. It contains everything necessary to measure A.C. and D.C. voltages and current; to test tubes, resistance; adjust and align any set, old or new. It satisfies your needs for professional servicing after you graduate—can help you make extra money servicing sets while training.

Get My Book on Radio Television— Also Sample Lesson FREE

In addition to my Sample Lesson, I will send you my 64-page Book, "Rich Rewards in Radio." Both are free to any fellow over 16 years old. My book points out Radio's spare time and full time opportunities and those coming in Television; tells about my Training in Radio and Television; shows my Money Back Agreement; shows you letters from men I trained, telling what they are doing, earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny postcard—NOW!

J. E. Smith, Pres., National Radio Institute
Dept. 8HX Washington, D. C.

J. E. SMITH, President, Dept. 8HX
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligation, send me a sample lesson and your free book which points out spare time and full time Radio opportunities, and shows how I can train for them at home in spare time—about the N.R.I. Set Servicing Instrument you give. (Please write plainly.)

Name ..... *Age* .....

Address .....

City ..... *State* .....

14x-1

Please Say That You Saw It in RADIO-CRAFT

Radio-Craft
FOR THE SERVICE MAN · DEALER · RADIOTRICIAN

SPECIAL TELEVISION NUMBER

CONTENTS — AUG. 1938, Issue

Volume X Number 2

FLASH

Here is news that is *news! In addition to the regular articles and departments, September* Radio-Craft *and all following issues will contain a* new *section called "Radio Trade Digest." Here, in condensed, readable form, will be presented authentic information as to what's new in the radio industry; new products, choice gossip, personals, trade-building campaigns, convention news, commentaries, and all vital items that make a successful "newspaper" for the trade. Whether you be Dealer, Serviceman, Experimenter or merely casually interested in radio you will definitely find in this department considerable material of interest to you.*

Published by Radcraft Publications, Inc. Publication office: 29 Worthington Street, Springfield, Mass. Editorial and Advertising Offices: 99 Hudson Street, New York City. Chicago Advertising Office: RADIO-CRAFT, 520 North Michigan Avenue, Chicago, Ill.

Foreign Agents:
London—Gorringe's American News Agency, 9A Green St., Leicester Square, W. C. 2, England.
Paris—Messageries Dawson, 4 Rue Faubourg, Poissonniere, France.
Melbourne—McGill's Agency, 179 Elizabeth St., Australia.
Dunedin—James Johnston, Ltd., New Zealand.

RADIO-CRAFT is published monthly, on the first of the month preceding that of date; subscription price is $2.50 per year in U. S. and Canada. (In foreign countries, $3.00 a year to cover additional postage.) Entered at the post office at Springfield as second-class matter under the act of March 3, 1879.

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Don't be an untrained man. Let me show you how to get your start in Radio — a fast growing, live money-making industry.

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TELEVISION *and* PUBLIC ADDRESS

Television is sure to come as a commercial industry. Rapid progress is now being made in developing this new field. It will offer opportunities to the man who is trained in Radio. Here at Coyne you learn Television principles, and work on actual Television equipment. Public Address Systems offer opportunities to the Trained Radio Man. Here is a great new Radio field which is rapidly expanding. Prepare NOW for these wonderful opportunities! Learn Radio Sound Work at COYNE on actual **Sound Reproduction** equipment. **Not a home study course.**

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Mail the Coupon below and I'll tell you about my "Pay After Graduation" Plan **which has enabled hundreds of others to get Coyne training with very little money.** On this plan you can get your training first, then **take 18 months** to complete your small monthly tuition payments starting **5 months** after you begin training. **Not a home study course.**

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If you are short of money and need part time employment to help pay for your room and board while training, my Employment Department will help you get a part time job.

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Don't let lack of money prevent your sending in the Coupon. Mail the Coupon today and I Will send you the Big FREE Coyne Book full of FACTS.

H. C. LEWIS, Pres.

Radio Division, Coyne Electrical School

500 S. Paulina St., Dept. C8-8H, Chicago, Ill.

Dear Mr. Lewis:—Send me your Big Free Radio Book, and all details of your "Pay After Graduation" Plan **including valuable instruction in Electric Refrigeration, Air Conditioning and Automobile Electrical Work.**

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Address.....

City.....*State*.....

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You can buy any Gernsback Manual on Three Days' Approval

Perhaps you're new in Radio—or probably, in previous years you missed one of the Gernsback OFFICIAL RADIO SERVICE MANUALS. This is your opportunity to buy any edition you might need—get it in a way differently than ever before offered. Under a new policy—**FREE INSPECTION PLAN—you can buy any Gernsback Manual on Three Days' Approval.** There are thirteen Manuals and books from which to choose—every man in Radio should take advantage of this privilege.

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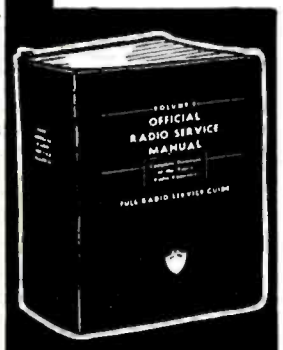
Latest Volume 7 Manual Included

Volume 7 of the OFFICIAL RADIO SERVICE MANUAL—the edition which stampeded the Radio industry this past year because it was published in a *new* way—in twelve monthly installments, is included under this new policy. **This volume is now complete**—twelve installments, totaling 1,800 pages, are bound in a hardcover binder and just packed with information you need today—and in the years to come. The coupon below gives you the privilege of inspecting this Manual also before you buy it.



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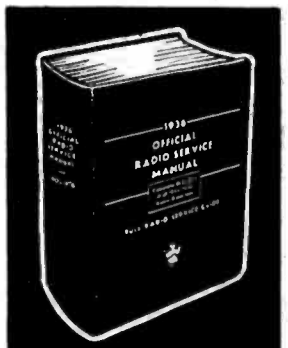

★ 1936 MANUAL ★

Contains 1,200 pages (over 2,500 illustrations) packed with service data of 1935-36-37 sets. Diagrams of over 1,500 receivers. Shows speaker connections, power transformer connections. Alignment procedure included with diagrams. Operating voltages for over 60% of sets are recorded. Assembly diagrams show relationship of separate units to each other. Size — 9 x 12 inches; hard cover, looseleaf binder.

PRICE $7.00

★ 1935 MANUAL ★

An authentic radio service guide of over 1,000 pages with more than 3,000 illustrations—contains schematic diagrams of 1934-35 receivers. Features many old sets never previously described, early all-wave and short-wave sets, auto-radios, midget and cigar-box receivers. Includes data on P.A. amplifiers, servicing instruments, tube information and FREE QUESTION AND ANSWER SERVICE. Size—9 x 12 inches; flexible, looseleaf covers.

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★ 1935 AUTO-RADIO MANUAL ★

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OVER 500 ILLUSTRATIONS
Looseleaf Binder—Flexible Covers

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★ 1933 AUTO-RADIO MANUAL ★

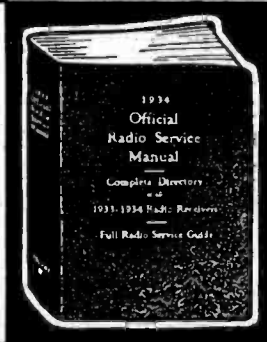
OVER 250 PAGES
OVER 500 ILLUSTRATIONS
Looseleaf Binder—Flexible Covers

PRICE $2.50

★ 1934 MANUAL ★

Contains over 400 pages—over 2,000 illustrations. The schematic diagrams cover 1933-34 receivers. Features voltage readings, I.F. transformer values in superhets, valuable tube data and FREE QUESTION AND ANSWER SERVICE. A handy index makes it easy to find any information on service problems. Master index includes diagrams published in previous MANUALS. Size—9 x 12 inches; flexible, loose-leaf covers.

PRICE $3.50



★ 1933 MANUAL ★

This 700-page Manual, with over 2,000 illustrations, contains page after page of operating notes — schematics showing location of parts on chassis—values of I.F. peaks, resistors and condensers. A complete section on construction of various types of test equipment, plus money-making ideas for radio men. Includes auto-radio installation and servicing. Size — 9 x 12 inches: flexible, looseleaf covers.

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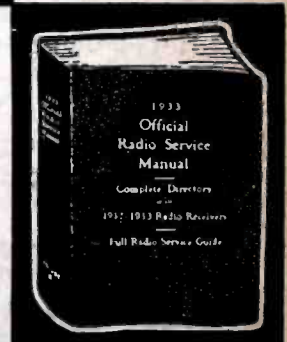

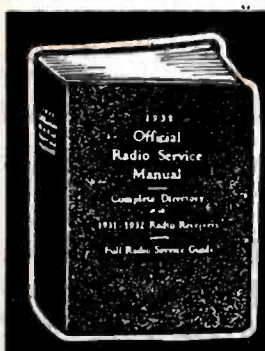

★ 1932 MANUAL ★

This Manual contains a full radio service guide of 1931-32 receivers. With over 1,000 pages and over 2,000 illustrations, it features a step-by-step analysis in servicing a receiver—chart showing operation of vacuum tubes — schematic diagrams with color coding indicated — commercial short-wave receivers and adapters and servicing public address equipment. Size — 9 x 12 inches; flexible, looseleaf covers.

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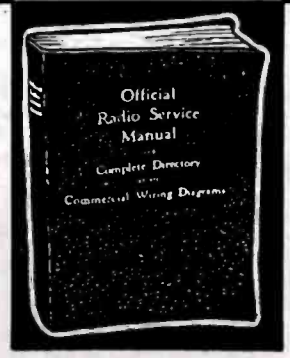

★ 1931 MANUAL ★

The first of the famous GERNSBACK MANUALS—contains all available wiring diagrams of nearly every receiver manufactured since 1927, and many prior to that year. This particular edition contains 650 pages (including supplements) with over 1,500 important diagrams. Most valuable to radio men is the RADIO SERVICE COURSE published in this edition. Size—9x12 inches; flexible, looseleaf covers.

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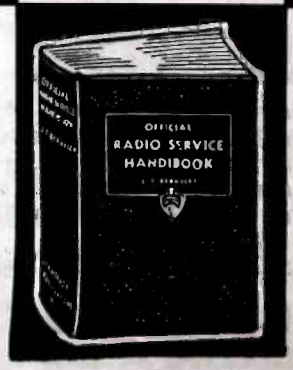
Including supplements.



OFFICIAL RADIO SERVICE HANDIBOOK

Here's the sensational book on servicing. Covers over 500 topics. Contains a special section of 250 pages of Operating Notes. The book covers: Circuit Theory and Analysis; Modern Servicing and Test Equipment; Practical Trouble Shooting; Specialized Receiver and Installation Data; Modernization and Conversion Data, etc. Over 1,000 pages—over 1,000 illustrations; hard covers. Size 6 x 9 inches.

PRICE $4.00

● This Policy Includes —

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Please Say That You Saw It in RADIO-CRAFT

Radio-Craft
FOR THE SERVICE MAN · DEALER · RADIOTRICIAN
''TAKES THE RESISTANCE OUT OF RADIO''

THE TELEVISION AGE

By the Editor — HUGO GERNSBACK

THE curious thing about all modern inventions is that they have a habit of changing our every-day lives to such a tremendous extent that it is sometimes difficult to visualize how much certain inventions have really changed not only our lives, our habits, but much of our civilization as well.

The Railroad can be cited as a good example. It has not only enriched the entire world tremendously but has changed the face of the world to boot. It opened up entirely new countries and did away with untold drudgery as well. The Telephone again changed much of our mode of living. Instead of transporting ourselves from office to office or from house to house we do our communicating, our business and our social friendly chats over the telephone thereby gaining time which may be used for other purposes than the walking or riding necessitated by personal calls.

The Motion Picture, and lately Radio, have had similar profound changes on humanity. The motion picture has taken the place of the theatre in many respects while Radio has brought the poor man his entertainment. It is no longer necessary to go to a concert or to a show when he can stay at home and get much better amusement than he possibly could at most small town theatres.

What will Television do when it finally penetrates into our homes as far as we ourselves are concerned? Adding Sight to present-day receivers, Radio—up to now blind—will again take a leap forward that cannot fail to change much of our mode of living in the future.

Of course, television is usually thought of as merely an instrument of entertainment. This, of course, is wrong, because television has other functions besides entertainment. Thus, for instance, television, when it first was thought of was usually pictured as a means of communication whereby *sight* was added to *sound* on our telephones. When television will finally come about it is almost certain that our telephones will have Sight as well. The telephone, while admittedly a valuable means of communication, cannot be used in many instances. For instance, if I wish to buy a certain article I will in most cases have to transport myself to the store; unless of course, I am intimately acquainted with the article. But suppose I wish to buy a lady's hand bag at a department store. I cannot do so over the telephone today because I cannot see a selection of bags over the telephone. In the future this will be changed entirely because I will be able to shop not only by *sound* but by *sight* as well. The large department stores will have special departments whereby articles will be shown to customers over the television-equipped telephone so that we can make our purchases without leaving our homes or our offices. Salesmen will be able to sell their prospects in a like manner. The bank clerk who is hesitant in cashing a check for an unknown person can call up the maker of the check and show him the check over the wire and so get an OK. There are thousands of other uses that can be easily pictured and from this it will be seen how tremendously our lives will again be changed when Television-equipped telephones are an accomplished fact.

Television in the home, for entertainment purposes, will also change our lives profoundly if present-day Radio is any barometer. It is almost a certainty that television will prove to be a powerful rival to the motion pictures. Indeed the motion picture interests have a case of the "jitters" every time television is mentioned. While I do not believe that television will ever displace the motion pictures it certainly will have an effect upon the magnitude of the motion picture theatre attendance, and while it is not likely that complete motion pictures such as "Snow White and the Seven Dwarfs" will ever be shown from start to finish over a home television set, yet it will probably pay the motion picture interests to show pre-views of coming pictures as a good piece of business. Television will encroach upon motion pictures, only in its capacity as a powerful magnet to keep people home where they can enjoy television programs, which as I said before, have no connection whatsoever with the motion pictures at all. The reason is a fundamental one rather, and that is that people who go to motion pictures maybe 2 or 3 times a week now-a-days, may then not wish to go more than once a week or maybe not even that frequently, feeling that the television shows which they can get at home for practically nothing will be every bit as enjoyable as going to a motion picture theatre and seeing perhaps a poor picture.

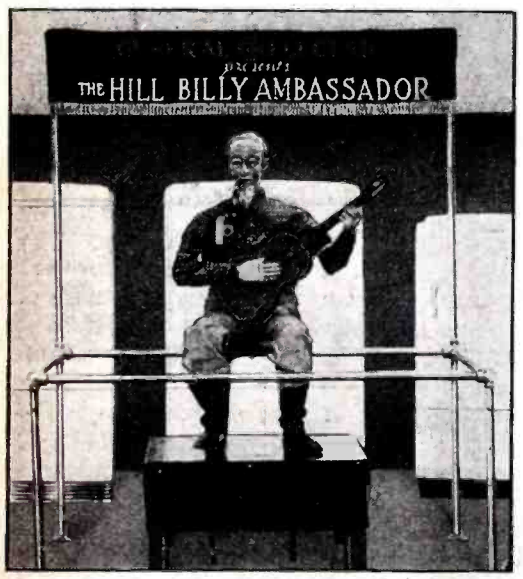
One thing television when it comes will probably do, is that it will help to make motion pictures a great deal better. Today there is much dissatisfaction on account of the poor entertainment value of many motion pictures. The coming of television, therefore, will be a powerful stimulant to "clean house" as far as the motion picture industry is concerned. They will then be forced to make the pictures so good and so entertaining that people will wish to see motion pictures rather than television.

From a purely educational standpoint television will do much to increase not only our knowledge but I do believe a higher education will be obtained via the television screen. We will be transported to every nook and corner not only in our own country but we will travel abroad as well and see scenes which most of us probably would never have been able to actually see without television. This will be a forceful stimulant not only to the imagination of the young but the old as well. Just as Radio has opened up new worlds in music to the average man who, in distant corners of the country never was able to hear good music in a lifetime, so television will bring *sight* to the most humble as well as to the rich and we will be enabled to tour the entire world at a pace never believed possible before.

These are only a few of the television uses. There are of course, hundreds of others, impossible to enumerate in a short article of this type, but whatever it will do, television will open up an entirely new world to all of us. A world that even the most daring imagination of today can hardly encompass.

THE RADIO MONTH

Newest in cathode-ray television pick-up cameras is this new type, which is raised and lowered electrically. To speed its operation, a single handle rotates, tilts and focuses it. A special optical system enables the cameraman to focus the image on the signal plate of the "camera tube."



By heck! Here's a "dummy" which isn't! He answers questions (concealed microphone, amplifier and loudspeaker set-up, remote monitored by headphone), "smokes" (suction device), and moves eyes, lips, arm, hand, foot, head (all around), says G.E.

"Television Tillie," like "Hill Billy", is a dummy—but less articulate. As a "stand-in" for testing B.B.C.'s costuming and lighting she's tops.

VIDEO BELLWETHERS

N.B.C./RCA went to town, last month, and gave 1,000 representatives of newspapers, and 200 students of New York University, optical and auditory treats via their 441-line all-electronic television system.

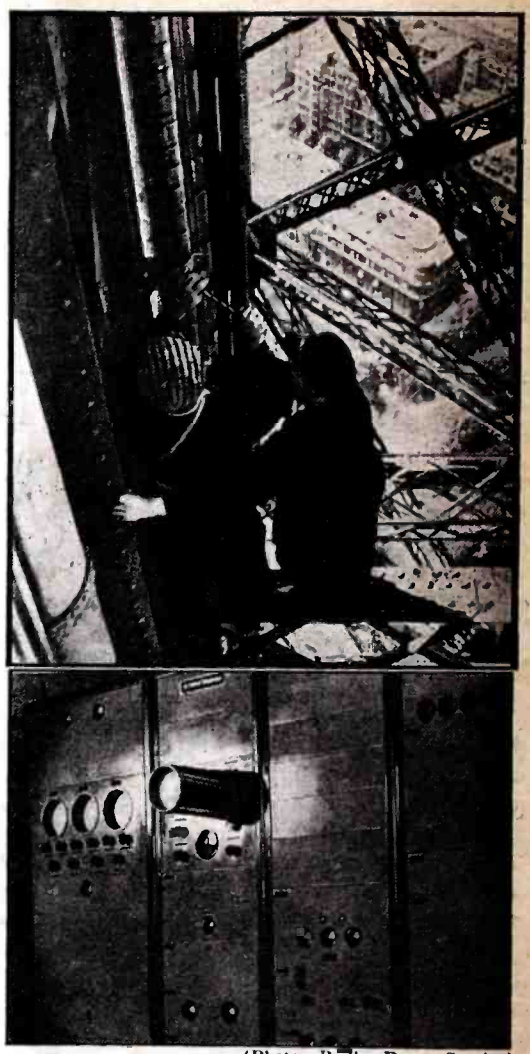
Said David Sarnoff, RCA prexy, cautiously, "Our experiments with television in the past 18 months have improved the system by increasing its capabilities and efficiency, thus enabling it to move closer to the inauguration of a television service for the American home."

Radio-Craft representatives at the press demonstration were of the opinion that (1) reproduction was flickerless, (2) eye fatigue was no greater than for movies, and (3) detail was excellent even to seeing whites of eyes on close-ups. Although 2 of the 15 receivers in use on the 62nd floor of Radio City, reproducing images transmitted by radio from Empire State Building 3½ miles away, acted up, the show with this exception was flawless. Image after reflection from the end of the cathode-ray receiving tube (the Kinescope, says RCA) measured about 7½ x 10 ins. wide; color, black/white and black/green, both being demonstrated. Feature of the show was the clever use of both natural (studio) and artificial (film) staging, in which performers seemingly left the studio, journeyed to foreign lands, and returned to the studio; critical observers were unable to detect this transition from spot pick-up to film-television, and reverse!

A feature of the demonstration to the N.Y.U. students was the use of a talk-back circuit. Professor Clark, on the 3rd floor of the RCA building, after delivering an illustrated lecture on the uses and principles of photoelectricity invited students, before the mirrors of 15 television receivers on the 62nd floor, to comment. Student Lillian Chase offered a query, and in response the professor beckoned to her, via the television set-up, to come down to the 3rd floor. The young lady was seen by the remaining students, 5 minutes later, alongside their teacher and talking to him. Told that she was being televised she slumped into a chair but soon regained her composure. This demonstration has inaugurated schoolroom use of television.

DIM "TOWER" VIEWS

Experimenters who saw only dim images from W2XBS, last month, can blame this on broadcasting from an experimental antenna array, on the North side of the Empire State Tower, directive North. Tall Northern buildings reflected some signals South, but this resulted in multiple images at the receiver. Station's normal service radius is about 50 miles; max., about 70 miles.



(Photo—Radio Press Service)

At top—view taken during the hauling up of the 1,200-ft. coaxial cable for feeding the new Eiffel Tower television antenna. Below—terminal equipment and monitor receiver; note monitor C.-R. tubes on which the images and waveforms may be viewed.

CAIRO CONFERENCE

RADIO broadcasters, set makers, and others in the radio field, have been experiencing sleepless nights, wondering what would happen to frequency allocations, etc., at the International Telecommunications Conference in Cairo, Egypt, which completed its current deliberations last month. The following brief outline by Sir Noel Ashbridge (B.B.C.'s Chief Engineer and U.I.R. Delegate to the Conference) regarding outstanding developments, therefore, will prove interesting.

The International Telecommunications Conference is normally held once every 5 years. It is composed of official delegations representing the Governments of almost every country in the world, and, in addition, there are delegations representing organizations operating radio-telegraph, telephone, or broadcasting services. There are also a few delegations representing international unions catering to various types of service, such as broadcasting and air services, and there were several delegates representing the interests of amateurs in various parts of the world.

(Continued on page 128)

IN REVIEW

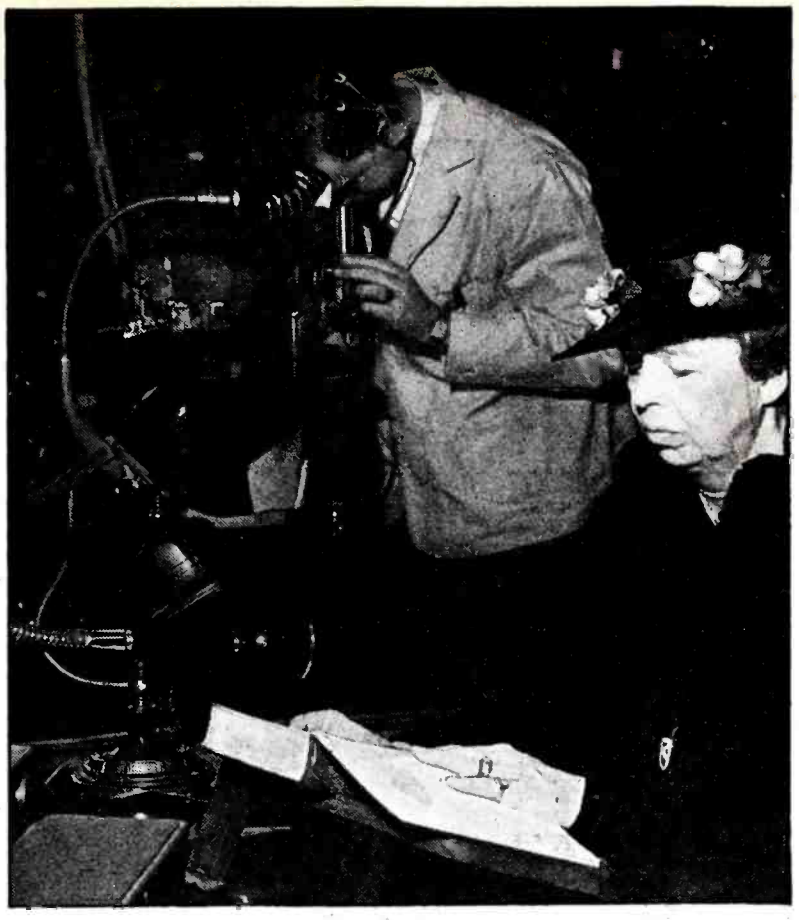
STATISTICS; POWER BY RADIO

A TRI-PART article in May *Fortune* adds much to their increasing bibliophile on "The Art" (Radio). Story title and blurbs are: "Radio I: A $140,000,000 Art (On the shoulders of U. S. broadcasting the entertainment of a nation; under its feet quicksand and uncertainty; in its pockets plenty of cash.); Radio II: A $45,000,000 Talent Bill (. . . which grows higher and higher as more and more advertisers compete for bigger and bigger Names on costlier programs to get better audiences.); and, Radio III: A 537,000,000 Set Business (Twenty-six million U. S. homes have radios, which means a market saturation of 87%—which sounds worse than it is.)".

Discussing superpower, the article describes how, within a given radius of 500 kw., WLW broadcast programs light household lamps (power by radio!), and a "singing arc" acts as a tubeless set to receive them.

Having assimilated what are virtually 3 complete, full-course literary dinners, the reader is offered a chaser, which tends to show how radio's very existence hangs by a thread, the Damascus sword being the "sufferance of a government bureau"; this agency is analyzed in the article, "Federal Communications Commission (Its job is to make broadcasters supply you with clear signals; its yearning is to make you a better citizen thereby. Result: confusion.)". The Commission, states this article, has outstanding 55,000 U. S. station licenses for all services; the figure includes 728 broadcasters, every one of which continue on the air only in the event that the F.C.C. renews their licenses every 6 months.

Shown above is a view of the final model of the heroic statue of Benjamin Franklin, which was unveiled, last month, in Franklin Hall, The Franklin Institute, Philadelphia, Pa. Pedestaled, it stands 18 ft. from the floor.



Mrs. Franklin D. Roosevelt is here shown reading into the microphone, in the sound studios of the American Foundation for the Blind, in New York City, the first chapter of her biography, "This is My Story." Only 25% of the sightless can read Braille; almost all can listen to "Talking Books" (200 of these phono record-books are available).

FRENCH TELEVISION

FRANCE has gone high-power television! Headlining the foreign television news, Radio Press Service, one of *Radio-Craft's* foreign correspondents, reported last month that P.T.T. (French equivalent to our Federal Communications Commission) had OK'd the operation by Eiffel Tower of a station claimed as "the most powerful television transmitter in the world." Starting in 1935 as a low-power, and later 10 kw., station transmitting 180-line images, the power will soon be boosted to 30 kw. and 441-line fidelity. French manufacturers cooperated with functionaries of the Broadcasting Service, who visited the several countries in which television was most fully developed, in reorganizing France's television program.

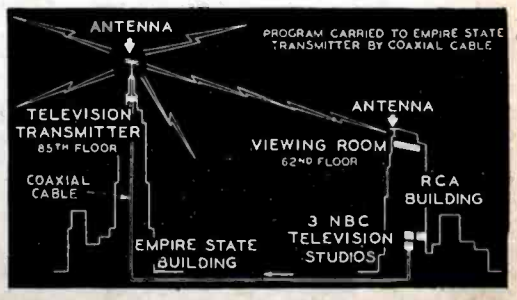
ANENT B.B.C. VIDEO

ALEXANDRA PALACE'S past, present and future television programs discussed last month in *Television and Short-Wave World* (London) may intrigue not only general readers of *Radio-Craft* but also American television interests.

For instance, more than 30 cars, vintage of 1896 to 1904, will be televised at Hurlingham Polo Grounds; races and games, using these museum-pieces, will enliven the affair for lookers-in. Hot item of the recent boat-race transmissions was the interruption of communication to Alexandra Palace when a workman accidentally cut a telephone cable; "dead" to audio pick-up from outside, the Palace was able to air its comments, however, by reading televised messages scribbled on paper and held up in front of the remote

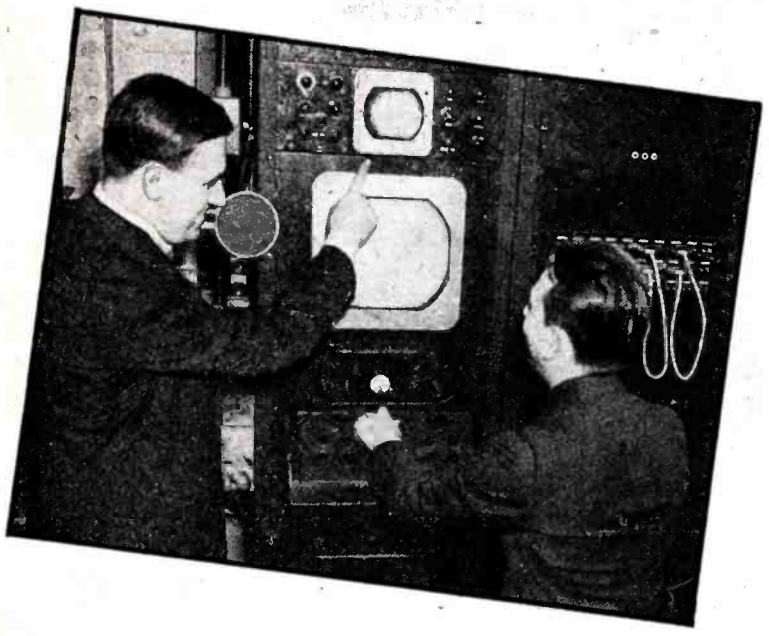
(Continued on page 116)

View taken during the televising of the repulse of a mock air raid on Alexandra Palace, London, nerve center of B.B.C.'s television service. Viewers thrilled to the sights and sounds of the defense preparations of the Territorial Army's First Anti-Aircraft Division; and then to the "aerial attack," as searchlights flashed, planes roared, and guns boomed.

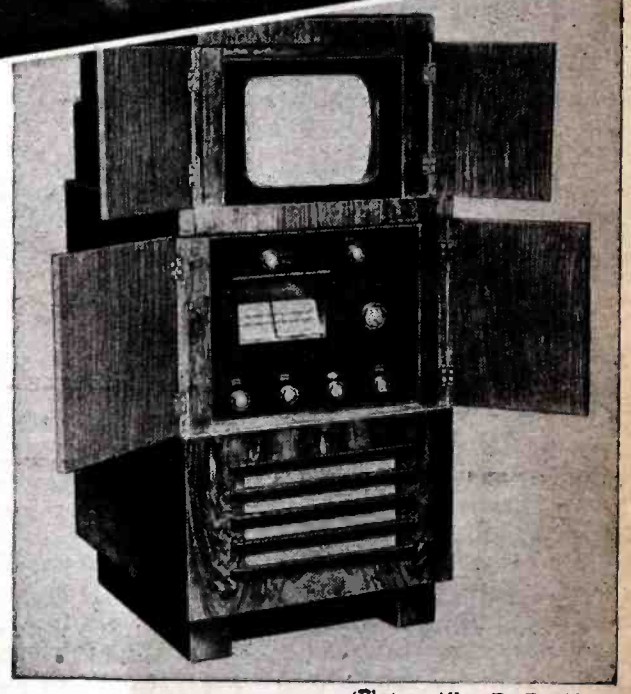


Sequence of operations in staging an N.B.C./RCA television "show."

TELEVISION PICTORIAL

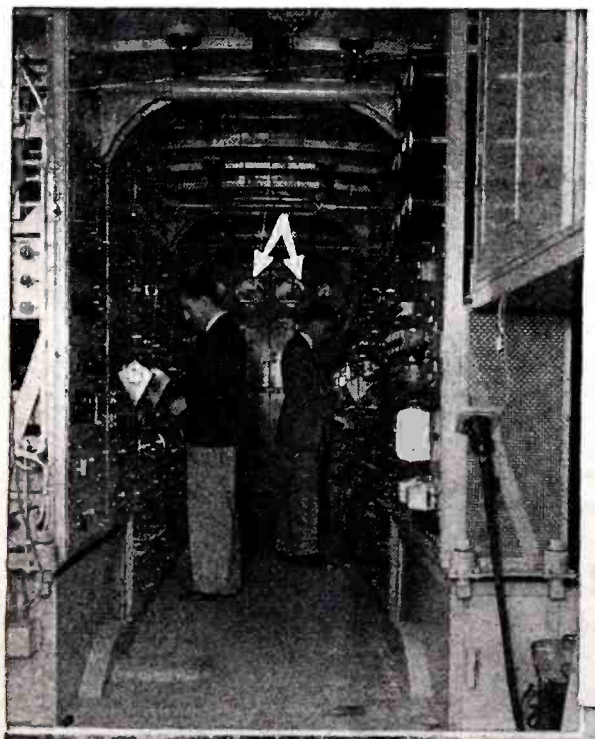


F. J. Bingley and B. E. Schnitzer, Philco television engineers, at the controls of a television transmitter. Mr. Bingley points to the small cathode-ray tube on which appears the modulated waveform of the high-fidelity picture. Below is the cathode-ray image-monitoring tube which is watched by the control engineer.

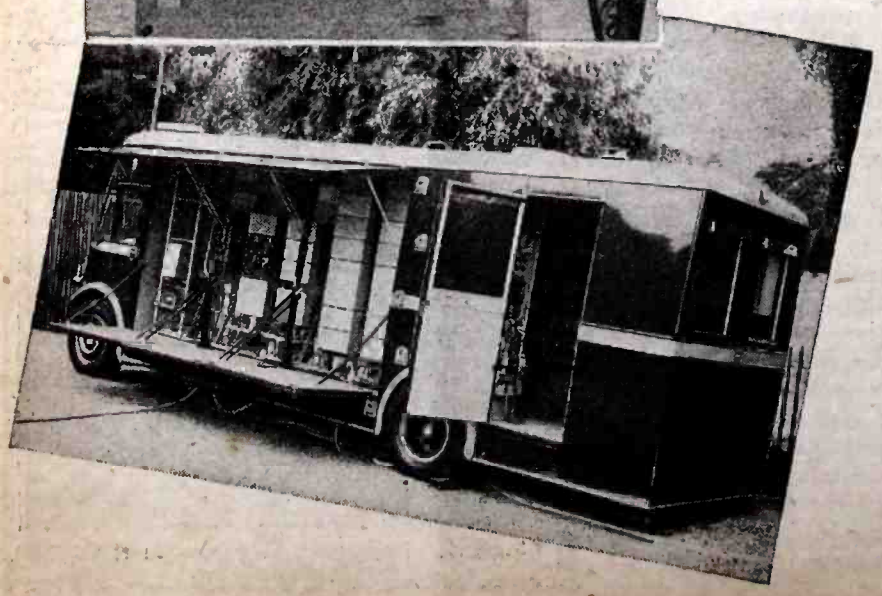


(Photos—Allen B. Du Mont)

This is a typical English combination broadcast and television receiver. The illustration above it is an unretouched photo of His Highness, the Emir Saud, crown prince of Saudi, Arabia, taken directly from the screen of a Cossor (English) television receiver located 50 miles from the transmitter. His Highness was a distinguished visitor at the Coronation. The British are using 405-line screen with 25 pictures-per-second, interlaced scanning. The average price, of something like 10,000 sets already sold in England is under $200, claims one writer.



← For spot broadcast pick-ups of television programs the British Broadcasting Corporation utilizes a fleet of 3 trucks. One contains the complete power supply unit, the second the control and monitoring room, and the third the 3½ meter, 1 kw. ultra-shortwave transmitter which relays the program to Alexandra Palace for retransmission. At the upper-left is an interior view of the control truck with arrows pointing to the monitoring screens; and below an interior view of one of the other trucks; the sideboards open for maximum accessibility to apparatus.

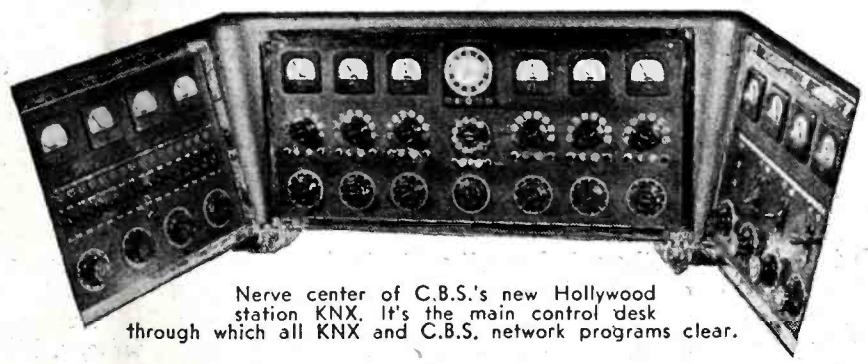


Cathode-ray tubes are not new! According to a display at the recent television show in the Technical Museum of Munich (Germany), a scientist named Dieckman published in 1909 a description of the television system illustrated above in which the reproducer consisted of—a cathode-ray tube! The pick-up system included a Nipkow disc equipped with tiny contact brushes instead of the usual holes.

MODERN BROADCASTING

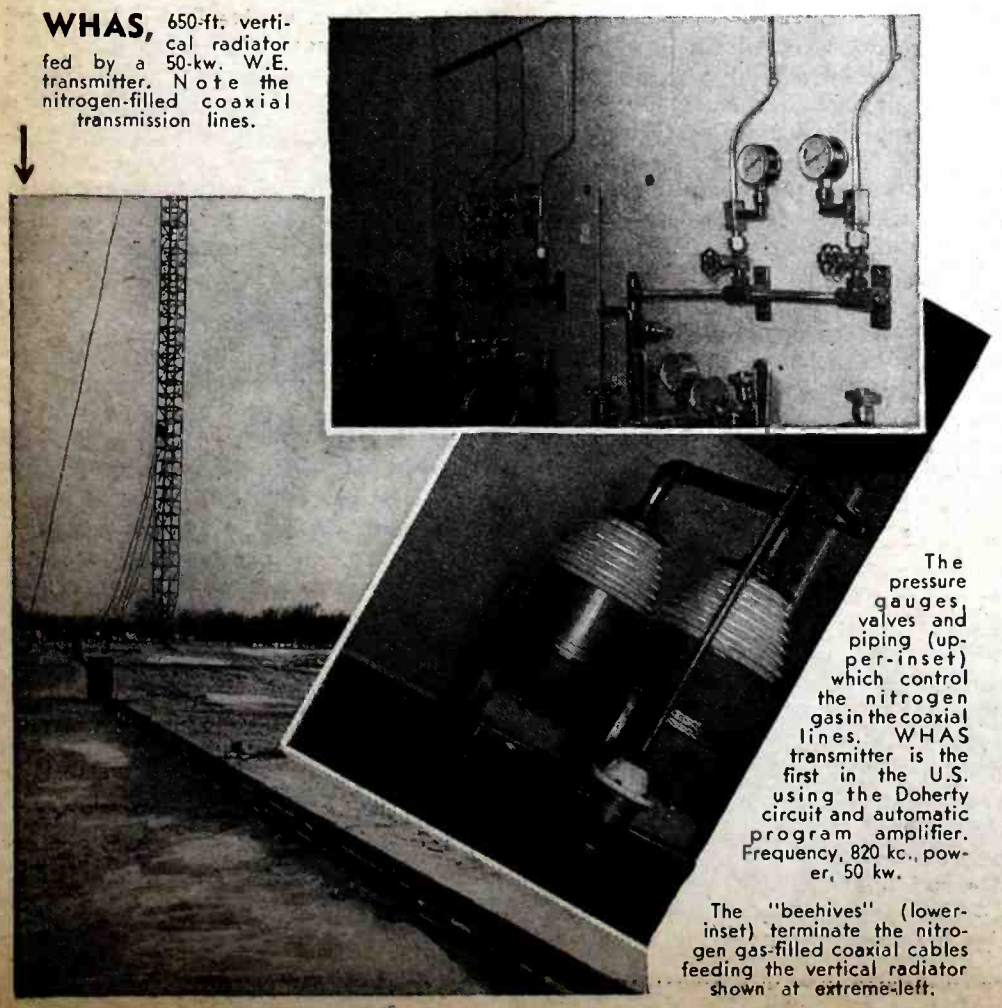
WMCA, "at the top of the dial," recently opened its 3,000-square feet of modern "ear-tuned" (acoustically treated) studios in New York City. Note (above) the design on the floor, each studio being enhanced by different symbols of broadcasting. WMCA broadcasts on a frequency of 570 kc., delivering 1,000 W. to its twin 350-ft. tower radiators.

KNX, the new C.B.S., $1,750,000 station in Hollywood, Calif. Above is one of the smaller studios in the ultra-modern broadcasting building. Particularly noticeable are the sloping walls which eliminate acoustical flutter, and the sloping glass panels of the control booths to eliminate reflections. Station frequency is 1,050 kc., with 50,000 watts. Loudspeaker (left of clock) is also a microphone!



Nerve center of C.B.S.'s new Hollywood station KNX. It's the main control desk through which all KNX and C.B.S. network programs clear.

WHAS, 650-ft. vertical radiator fed by a 50-kw. W.E. transmitter. Note the nitrogen-filled coaxial transmission lines.



The pressure gauges, valves and piping (upper-inset) which control the nitrogen gas in the coaxial lines. WHAS transmitter is the first in the U.S. using the Doherty circuit and automatic program amplifier. Frequency, 820 kc., power, 50 kw.

The "beehives" (lower-inset) terminate the nitrogen gas-filled coaxial cables feeding the vertical radiator shown at extreme-left.

KYW is Philly's new $600,000 Radio Center. Located at the terminal of N.B.C.'s television coaxial cable from New York, *2 full floors have been appropriately reserved for television!* KYW uses Westinghouse-designed equipment throughout and broadcasts on 1,020 kc. at 10,000 W., although application has been filed with F.C.C. for use of 50,000 W.

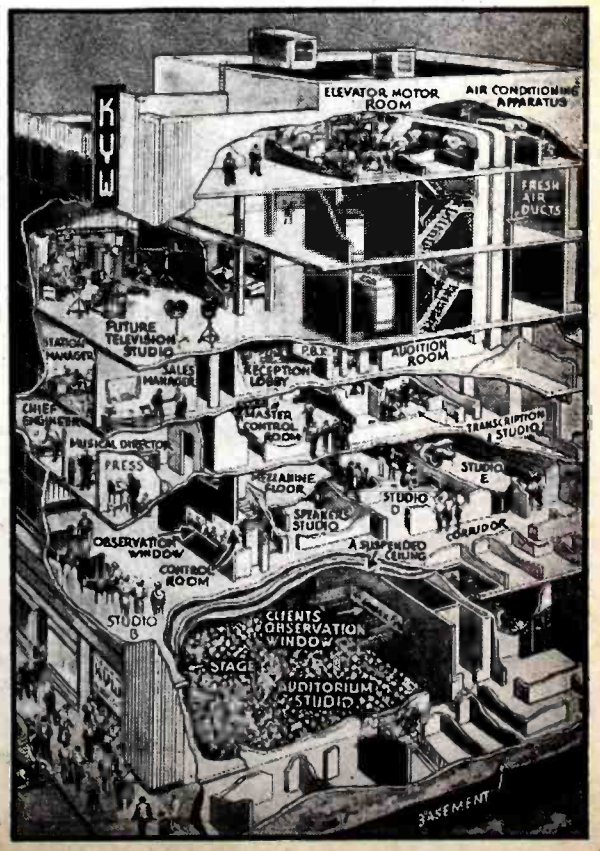


Fig. A. The $125 video receiver; 3-in. tube (image area, 1⅝ x 2½ ins. wide).

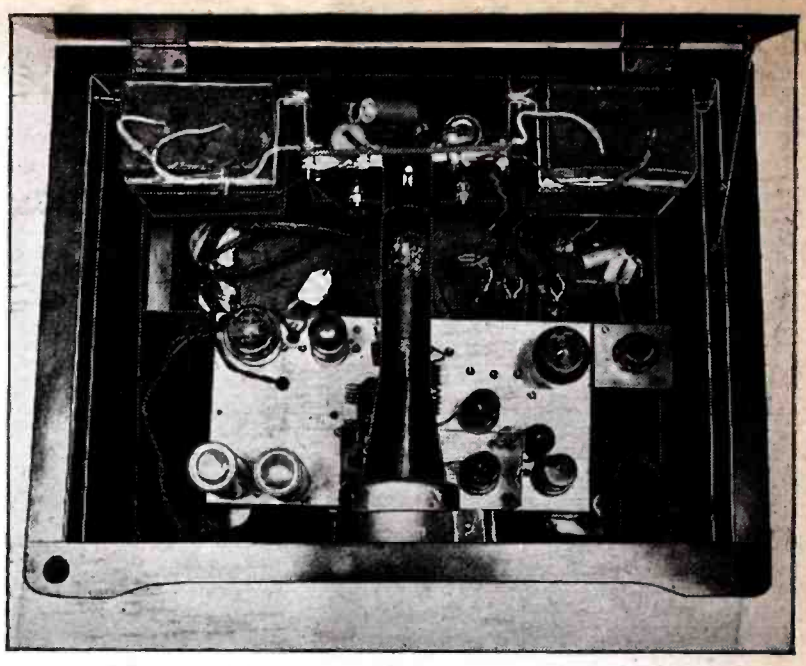


Fig. B. View inside the cabinet of an experimental model.

$125 TELEVISION RECEIVER NOW ON THE MARKET?

Service Men are now installing television-image receivers such as here described; television-sound receivers, though, are supplementary units. As tabulated elsewhere in this issue, only a limited number of experimental programs are on the air.

ROBERT EICHBERG

THE initial impetus which television needs to emerge from the laboratory and go into the home may be given by a new, moderately-priced receiver developed by Chief Engineer Louis W. Parker of Communicating Systems, Inc. As *Radio-Craft* went to press, executives of the company were announcing plans to have the apparatus on the market within 10 days, at prices of $125 and $175. It is illustrated in Figs. A and B.

The chassis used in the cheaper model is to be identical with that employed in the more costly one. In each set, it is an 11-tube T.R.F. job. Mr. Parker explained this, saying, "The reason for not using a superheterodyne circuit is primarily that a band width of 5 megacycles is very difficult to obtain with an intermediate frequency of 10 megacycles which is the usual intermediate frequency in television superheterodynes. The problem is comparatively easy at 46 megacycles and up, since 5 megacycles are only a small percentage of the original radio frequency if that radio frequency is high."

THE CIRCUIT AND ITS CONTROLS

The circuit consists of 2 stages of T.R.F., detector, and two stages of V.F. (video frequency) amplification. In addition there is a synchronism separator, an H.F. sweep circuit and an L.F. sweep circuit, the latter making use of the 60-cycle impulse from the power line. The power packs for the receiver and the C.-R. tube are separate units, though included in the price of the sets.

The sets have 7 controls (see Fig. C), one of which is left permanently set. This, located at the rear of the chassis, changes the *aspect ratio* of the image appearing on the screen of the C.-R. tube; that is, it changes the proportion of the picture's width to height. Once set so that the ratio is 3 high to 4 wide, the control may be left alone.

The others include 3 R.F. tuning controls, frequency controls for the high-frequency and low-frequency sweep circuits, and a control to regulate the degree of contrast between the light and dark parts of the image.

The $125 set is a table model, using a 3-inch, C.-R. tube, and it is in this set that the greatest degree of public interest has been shown, according to S. M. Saltzman and C. H. Sterenfeld, President and Vice-President of the company, respectively. Mr. Sterenfeld states that about 40 to 50 orders have already been received, principally for this model.

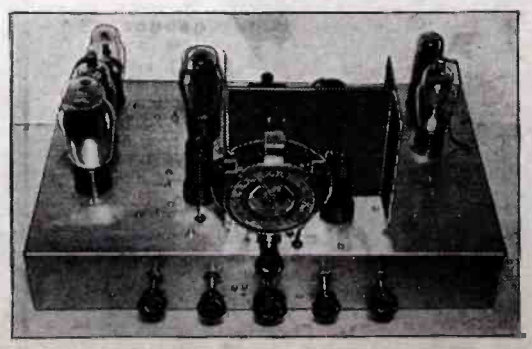


Fig. C. The tuning controls, l. to r.: Frequency control for H.F. sweep; next two and above, R.F. tuning; contrast control; frequency control for L.F. sweep.

The more costly set is a console, using a 5-inch tube. It is interesting to note that the tube is a type 905 oscilloscope tube, which is cheaper than the C.-R. tubes generally employed in television receivers, although it affords a slightly larger spot (hence, less fine detail) and shows a more markedly green image.

No sound reproducer is included in the receiver, this being explained as a way of keeping cost down. Mr. Sterenfeld states that users will be able to buy the necessary sound reproducers for about $10 to $15, or that they may use less expensive "converters" in conjunction with their broadcast receivers.

DEMONSTRATION REPORT

A demonstration witnessed by this reporter was highly satisfactory, though not sensational. While the size of the largest image shown (on the 5-inch C.-R. tube) was only a little over 3 by 4 inches, the pictures did have definite entertainment value for those who sat within 3 or 4 feet of the receiver, and although brilliance was not great, it was more than ample in the darkened room.

Company executives stated that their set did not conflict with RCA patents, and claimed that it was made under their own patents, though they were unwilling to disclose how many such patents there were, nor what they covered. It was definitely stated during the interview that the company is not selling and does not plan to sell stock; therefore, *Radio-Craft* readers are advised not to listen to any salesmen who

(Continued on page 119)

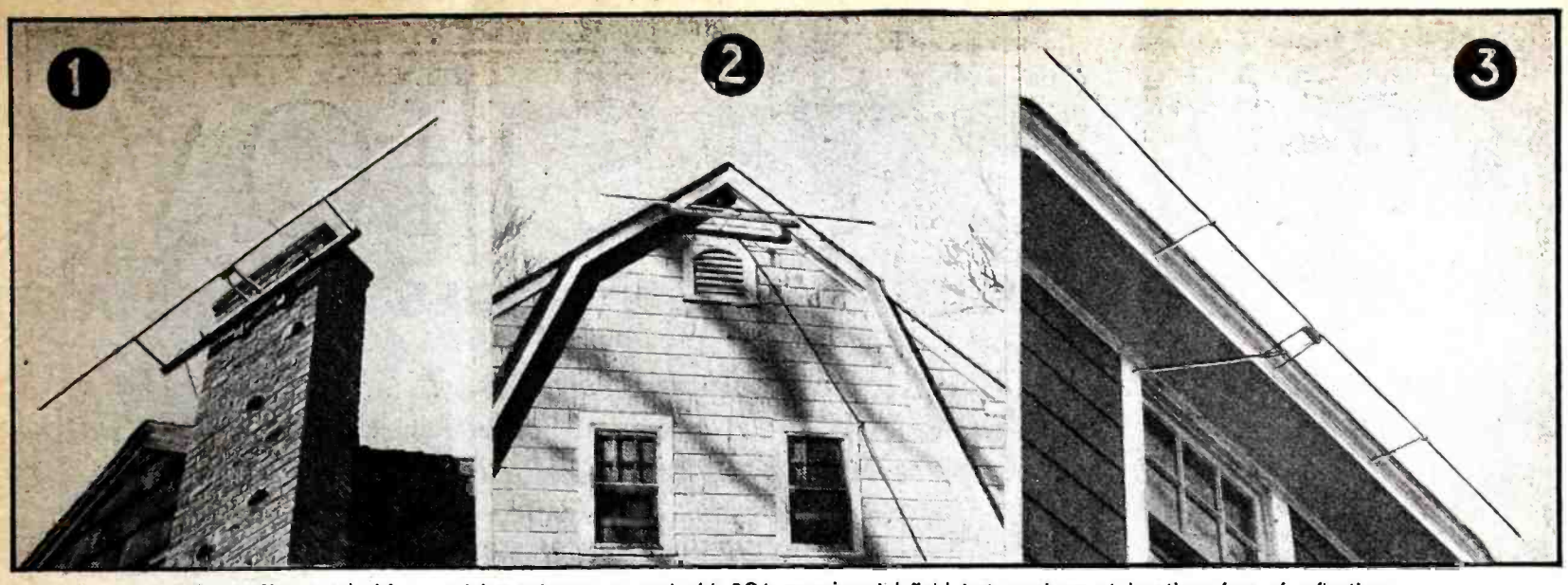


Fig. A. Simple television receiving antennas as used with RCA experimental field test receivers at locations free of reflections.

ANY TELEVISION ANTENNA FOR GOOD RECEPTION?

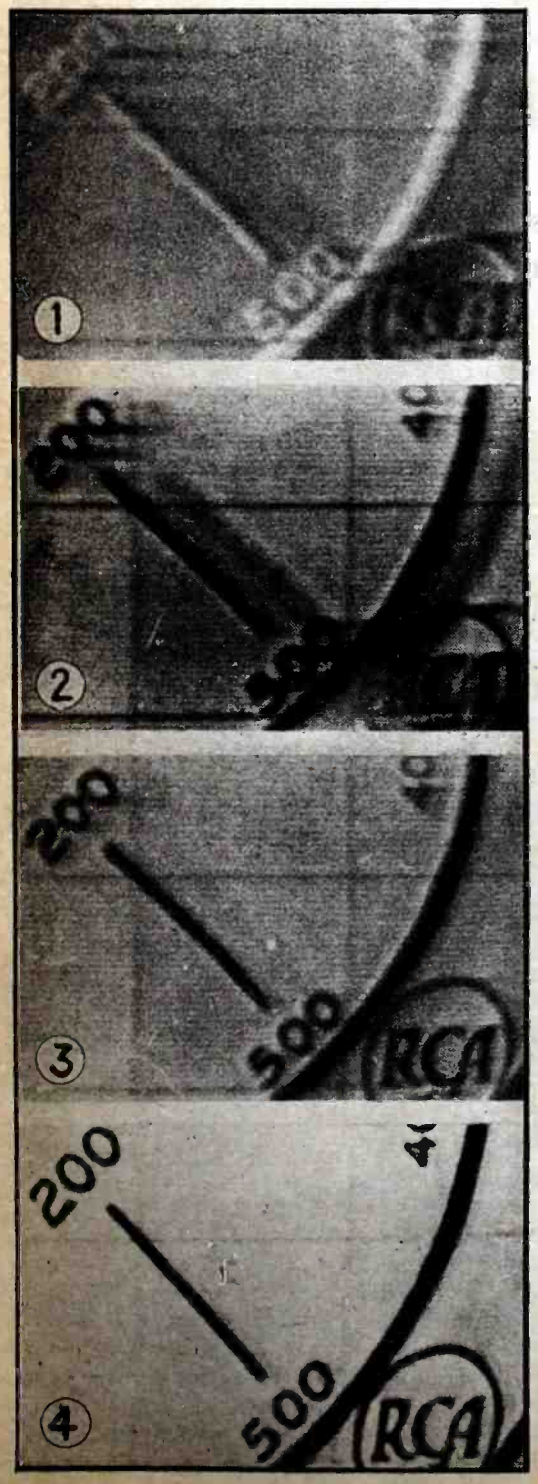


Fig. B. These figures illustrate the effect of receiving antennas on image reproduction.

The proper installation of television receivers will be an outstanding factor in keeping these instruments sold. Service Men will do well to read the following article which discusses a type of interference, not present in broadcast receiver installations, which a proper receiving antenna will mitigate.

STUART WM. SEELEY

IN BROADCAST-RECEIVER practice a simple wire of from a few feet to one hundred or more in length will suffice as a receiving antenna, and its operation is completely satisfactory if the received signal is sufficiently above the local and extraneous noise level. *A television receiving antenna will have to be erected with much more care and must conform to more complete specifications.*

This is true because of the introduction of an additional factor in visual reception not present in sound broadcasting. This factor is the necessity for preventing reflected waves, which have travelled a few hundred feet or more further than the direct wave, from entering the receiver. Fortunately this can be done in all cases, and quite easily in most cases. It is the object of this article to point out that the problem exists in visual reception, and to describe certain methods of meeting it which have been found effective.

SPACE WAVE REFLECTIONS

When reproducing a 441-line, 30-field per second picture, the cathode-ray spot travels across the screen of a 12-inch Kinescope at a speed of about 2½ miles per second. This is 1/75,000 times the speed of light or radio waves in free space. In other words the spot will move about 0.060-inch while a radio wave is traveling 400 feet. Therefore, if both a direct and a reflected wave arrive with comparable magnitude at the input terminals of a television receiver, and one has traveled 400 feet further than the other, *a double image will result.*

The displacement of the two images in such event will be about 1/16 of an inch and will cause blurring of all vertical lines in the picture. Actually such a condition results in even more complication than is immediately apparent from the above example. The reflected wave may have any phase with respect to the direct wave. Furthermore, each has its own side components, and those of the direct and reflected wave may be entirely different. Thus interference in the form of cancellation or reinforcement frequently causes a black line to be repeated as a white line or vice-versa. If the reflected wave travels 1,000 feet or more further than the direct wave a distinct double image will result.

Thus it is readily apparent that the antenna must supply a television receiver with one signal only from a desired transmission. In metropolitan areas, reflections from large buildings may give rise to several images and the problem of proper construction, location and orientation of the receiving antenna becomes extremely important. However, at *any* location an improperly-constructed antenna or antenna network and feed

(Continued on page 114)

A RADIO SCRIPT SHOW GOES ON THE AIR

Many RADIO-CRAFT *readers, including Service Men and others actively engaged in the field, have only a hazy idea of what takes place at a broadcast station in the preparation of a studio program. By courtesy of* Modern Advertising *magazine, therefore, we take you on a photographic tour through the whole story of "Girl Alone," an actual air program. First tested on the air, "Girl Alone" subsequently became the now 2-year-old, 5-a-week program, over the N.B.C. Red network via WMAQ, currently sponsored by Kellogg. See how it was created.*

The story for "Girl Alone" having been conceived, the first step is to choose a staff script writer. Ken Robinson (right), N.B.C.-continuity editor, and his assistant, Bill Murphy, select Fayette Krum.

Fayette immediately starts tapping out preliminary ideas. Not only at the office . . .

. . . but at home with her 2 cocker spaniels, she becomes herself a girl alone with an idea.

Shortly the idea takes concrete form as a script which she hands over to Ken Robinson.

Robinson confers with C. L. Menser, production director. And since the script clicks . . .

. . . a list of actors is turned over to Georgia Fuller who rounds them up for casting.

Assembled in a studio, the cast gets preliminary instructions from Howard Keegan (standing), production director assigned to the show.

After several rehearsals, Menser assigns the star role of Patricia Rogers to Betty Winkler.

A RADIO SCRIPT SHOW GOES ON THE AIR

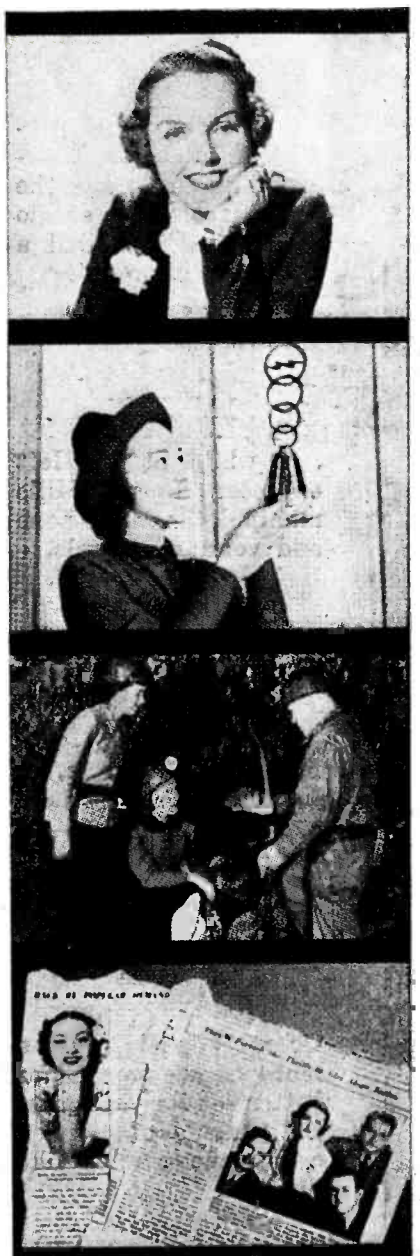
Finally the cast goes into action before the mike. Not yet over the air, however, for this microphone is merely piped to a loudspeaker . . .

. . . in a conference room, where N.B.C.'s planning board sits around a large table . . .

. . . listens, argues, and finally OK's "Girl Alone" for a station sustaining program.

Simultaneous with the planning board's OK, N.B.C.'s publicity department becomes active. First by taking news shots of the cast . . .

. . . then arty, theatrical shots of Betty Winkler . . .



. . . and Joan Winters, who plays the part of Alice Ames . . .

. . . and later, Betty again with the award for acting which she won at the 1937 Radio Ball . . .

. . . and Betty again with writer Fayette Krum doing research for a coal mine episode.

And the news stories flow constantly from the publicity department to the nation's press.

All this activity means that "Girl Alone" is on the air. Joan Winters and Ruth Bailey (right), who plays Virginia, read their lines.

And here John Walsh, who plays character bits, joins the ladies.

(Continued on following page)

A RADIO SCRIPT SHOW GOES ON THE AIR

(Continued from preceding page)

And all the while production director Howard Keegan directs the action from the studio control room behind a glass partition . . .

. . . while at his left engineer Berne Mills manipulates the tone and volume controls.

For sound effects, a sound box in the studio can play 3 discs—in succession or all at once.

Or more primitive methods are sometimes better — for example, the crackle of twisted cellophane sounds like fire . . .

. . . wooden pegs dropped on a table are a marching army . . .

. . . socking a rubber sponge is a sock in the jaw . . .

. . . 2 cocoanut half-shells make a horse on a hard road . . .

. . . 2 plumber's suction cups thumped on the chest make a horse on turf . . .

. . . twisting a bundle of straw means "something is astir in the underbrush" . . .

. . . thrusting a knife into a potato sounds like a stabbing . . .

. . . crushing a packing case sounds like smashing in a door . . .

. . . squeezing water-filled ear syringes into a bucket sounds like a cow being milked . . .

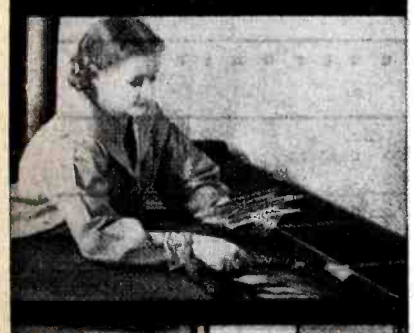
. . . and mixing a cake batter sounds like — mixing a cake batter!

After each broadcast the studio is silent for a while, and the cast uses it to go over the script for the following day's stint . . .

A RADIO SCRIPT SHOW GOES ON THE AIR

. . . argue about their lines . . .

. . . and try out effects. Left to right in these 3 pictures: Eileen Palmer (as "Red"), Raymond Johnson (as Ty Deyoe), Betty Winkler, John Walsh, Pat Murphy (as "Scoop" Curtis), and Joan Winters.

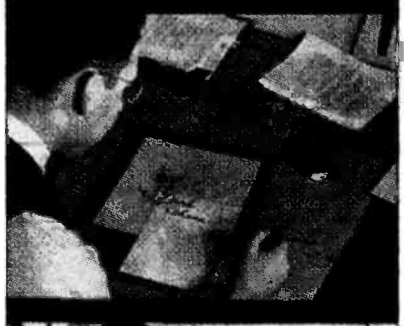


Symbol of the audience to the studio is the mail room. Here a staff of girls sorts the mail according to programs . . .

. . . codes according to state and county . . .

. . . tabulates listener response . . .

. . . and files the letters for forwarding to the clients.



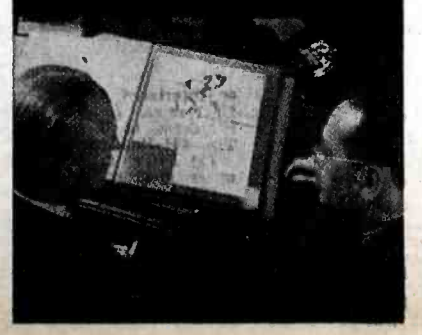
News from the mail room tells that "Girl Alone" is a success. So a sales portfolio is planned by the sales promotion department, and Gil Thrall of the art staff goes to work on page 1.

By the time Thrall assembles the last page in the leather portfolio binders . . .

. . . and Ken Carpenter, sales manager, and E. C. Carlson, sales promotion manager, give it a final once-over . . .

. . . and John Sample of the sales promotion staff assembles station coverage data . . .

. . . Ed Boroff, salesman, is all hopped up for the interview.



He presents the story . . .

(*Continued on page* 122)

U. S. TELEVISION STATIONS

(Experimental Broadcasters)

The following listing of United States Experimental Television Broadcast Stations has been corrected by the Federal Communications Commission (as to columns 1, 2 and 3) as of May 15, 1938. Remaining data is printed as supplied by courtesy of the respective organizations in response to a RADIO-CRAFT *questionnaire. All U.S.A. television stations are listed.*

Call Letters 1	Licensee and Location 2	Power (Watts) Video—Audio 3	Channel Audio—Video 4	Number of Lines—Frames 5		Scanning Sequence 6	Type of Scanning Equipment Transmitter—Receiver 7		Miles Radius 8
			2,000 to 2,100 kc.						
W9XAK	Kansas State College of Agriculture & Applied Science, Manhattan, Kans.	50 C.P. 7,500 7,500 (Note 1)	2,000-2,100 kc.	60	20	non-interlaced (Note 7)	Iconoscope	Kinescope	50 to 400 (Note 8)
W9XG	Purdue University, Lafayette, Ind.	1,500	2,000-2,100 kc.	60	20	scanning sequence progressive (non-interlaced)	disc	electronic	600
W9XK	University of Iowa, Iowa City, Iowa	100	2,050 kc. band 30 kc.	45	15	interlaced 3-spiral disc	(3-spiral scanning disc)		(Note 13)
			42 to 56 and 60 to 86 mc.						
W2XAX	Columbia Broadcasting System, Inc., New York, N. Y.	50 C.P. 7,500 7,500 (Note 1)	55-75 mc. 50-55 mc.	441	30	interlaced (odd number)			
W6XAO	Don Lee Broadcasting System, Los Angeles, Calif.	1 kw. 150	40-10,000 cycles 20-2,500,000 cycles	300	24	(Note 9)	electronic (Note 10)	electronic (Note 11)	20 to 40 (Note 12)
W3XPF	Farnsworth Television, Inc., Springfield, Pa.	250 1 kw.	10 kc. 2.5 mc.	441	30	interlaced (odd line)	electron camera	electronic	25 audio 3 video
W9XAL	First Nat'l Television, Inc., Kansas City, Mo.	300 150	47.0-47.5 mc. 41.5-46.5 mc.	441	30	interlaced 2-1	electronic	electronic 221 interlace	30 to 50
W1XG	General Television Corp., Boston, Mass.	500	none at present 60-2,500,000 cycles	441	30	interlaced odd line duplicate	Iconoscope	Kinescope	20
W2XBS	National Broadcasting Co., Inc., New York, N. Y.	12 kw. 15 kw.	R.M.A. (See Note 3) R.M.A. (Note 4)	441			e l e c t r o n i c		
W3XE	Philco Radio & Television Corp., Philadelphia, Pa.	10 kw. 10 kw.	60-10,000 cycles 0 to 4.2 mc. (Note 5)			interlaced	electronic, Philco camera tube		10
W2XDR	Radio Pictures, Inc., Long Island City, N. Y.	1 kw. 500	0-10,000 cycles 2 mc. (max.)	variable	24 & 30	progressive (non-interlace)	(mechanical and electronic)		15
W3XEP	RCA Mfg. Co., Inc., Camden, N. J.	30 kw. 30 kw.	(See Note 6)				(Note 6)		
W10XX	RCA Mfg. Co., Inc., Camden, N. J.	50 50	(See Note 6)				(Note 6)		
W8XAN	The Sparks-Withington Co., Jackson, Mich.	100 100	(No data as we go to press.)						
W9XUI	University of Iowa, Iowa City, Iowa	100	42-86 mc.	441	30	double interlaced	Iconoscope	Kinescope	
W9XAT	Dr. George W. Young, Minneapolis, Minn. (defaulted at hearing called for May 13, 1938)	500	WDGY (1,180 kc.) 15-30,000	45 & 125	15 &24	spiral multiple on 45, not on 25	m e c h a n i c a l d i s c		20
			(Note 2) 92 and 175 to 180 mc.						
W2XBT	National Broadcasting Co., Inc., Portable (Camden, N. J., & New York, N. Y.)	400 100	R.M.A. (Note 3) R.M.A. (Note 4)	441	30 (complete); 60 half-frames interlaced		e l e c t r o n i c		45
			(Note 2) 204 to 210 mc.						
W3XP	Philco Radio & Television Corp., Philadelphia, Pa.	15	60 to 10,000 cycles 0 to 4.2 mc. (Note 5)	441	30 (complete); 60 half-frames interlaced		Philco camera tube		10
			(Note 2) 124 to 130 kc.						
W3XAD	RCA Mfg. Co., Inc., Portable (Bldg. No. 8 of Camden plant)	500 500	(Note 6)				(Note 6)		

NOTES

(1) "C.P." is Construction Permit.
(2) "Group D" operation: any 6,000 kc. frequency band above 110 mc. excluding 400 to 401 mc.
(3) High-fidelity, according to R.M.A. proposed standards.
(4) According to R.M.A. proposed standards.
(5) Video frequency only, not both sidebands.
(6) System in use—experimental; a complete description of the basic method used in transmission is given in the Proc., I.R.E., Vol. 22, No. 11, November 1934, "An Experimental Television System."
(7) Studio and receiving equipment is designed to operate at 441 lines, 30 frames, either non-interlaced, or interlaced 2 to 1, or may be operated at 60 lines, 20 frames. However, only the 60-line pictures can be broadcast on the assigned channel of 2,000-2,100 kc. The 441-line picture is used.
(8) Fifty miles (primary), 400 miles (secondary) under good conditions.
(9) Approximately 1,000,000 persons on 50-cycle power and also 1,000,000 persons on 60-cycle power within 50 miles of W6XAO. (Interlaced scanning not possible of reception if receiver frequency differs by 1 cycle or more from that of transmitter.)
(10) Electrical: mosaic tube for direct pick-up. Special, for motion picture film.
(11) Cathode-ray tube with associated sawtooth sweep circuits; electrostatic or electromagnetic deflection may be employed.
(12) Proven range 20 miles (to cities of Long Beach and Wilmington).
(13) Estimated range, several hundred miles.

REMARKS

W9XAK—Approx. schedules, Monday and Wednesday, 7:00 to 8:00 P.M., C.S.T., also at odd hours. Synchronizing signals sent at the end of each line and at the end of each frame. Voice

(Continued on page 111)

TOMORROW'S TELEVISION SERVICING

Servicemen and Servicewomen who early become proficient in locating and overcoming the faults in television receiving and transmitting equipment will soon find themselves in the high-pay brackets of the art.

YOU see on the cover of this month's annual Television Number of *Radio-Craft* a composite view of students hard at work learning how to service the intricate equipment of a modern television set-up. Note that not only Service *Men* but also Service *Women* are looking toward television as a career.

And servicing is not the only phase of television's varied activities which will soon cause thousands of foresighted young folk to flock to this field of business like moths to a candle; as Dr. Alfred N. Goldsmith pointed out last month (see "Looking Ahead in Television Occupations," July, 1938, *Radio-Craft*), numerous opportunities for lucrative employment will be found in the manufacturing field, in transmitting stations, as camera men, in servicing, in supervisory capacities, as writers, and as directors, actors and musicians. His concluding remark is especially significant: "*Remember that television success will come rather as the result of a prolonged marathon of effort than from a brief gold-rush of enthusiasm.*"

(Photo—Midland Television)
Students learn how to service both receivers and transmitters.

Reproduction of cover painting.

Incidentally, it is especially significant that First National Television, Inc., in making available to *Radio-Craft* specially posed photographs to aid in making the cover illustration, called attention to the prominence of floodlights in one of the views, "To indicate the

(Continued on page 107)

$500,000 TELEVISION SYSTEM!

Radio-Craft *here presents what is believed to be the first published account of General Electric's plans for a 4-station semi-"network"; a "television relay station" is part of the system.*

DOMESTIC and foreign television systems are being investigated by engineers of one of the biggest radio and electrical manufacturing interests in the United States, preparatory to instituting (at the outset) a 4-station television system second to none; cash outlay—$500,000! The application is now in hearing in Washington (D. C.) before the Federal Communications Commission.

In filing its application, the company stated that it contemplated a 4-fold plan of development to "investigate on a broad developmental scale the type of apparatus, method of transmission and propagation characteristics" that will be necessary to properly broadcast television programs. One station will be located near Albany (N. Y.), 2 in Schenectady (N. Y.) and 1 in Bridgeport (Conn.). The Bureau of Air Commerce has already approved plans for erection of 150-ft. aerial towers at all stations.

In more detail, the plan is as follows:

Erection of a 10 kw. television broadcast station in the Helderbergs, 12.5 miles west of Albany and 13.5 miles from Schenectady. It will operate on frequencies of 44 and 50 mc. (believed to have been since amended to 66 and 72 mc.—*Editor*), with 10 kw. on the video channel and 3 kw. on the audio channel, for an unlimited period, day and night. Cost of transmitter, $70,000; of the studio, $50,000; voice transmitting apparatus, $20,000; antenna, $40,000; and land and buildings, $15,000. *It is expected that the Helderbergs station will serve the cities of Albany (capital of New York), Schenectady, Rensselaer, Cohoes and Troy, with a combined population of about 400,000.*

Erection of a second, 1st-class 10 kw. television broadcaster is planned for Bridgeport. Operation will be on 66 to 72 mc., with 10 kw. on the video channel and 3 kw. on the audio channel, for an unlimited period, day or night. This station, like the one in the Helderbergs, will involve an expenditure of $70,000 for the transmitter; studio, $50,000; voice transmitting apparatus, $20,000; antenna, $40,000; land and buildings, $15,000. *Bridgeport's television station will serve about 1,000,000 persons.*

Third station in the system is a 50-watt *television relay station* in Schenectady, to investigate the possibility of relaying programs from the studios of WGY to the big station in the Helderbergs. (Thus obviating the necessity for inter-station coaxial-type cable?—*Editor*) Concluding this semi-"network" is a 40-watt station in a building of the G.E. Co.'s Schenectady plant, to be used temporarily for transmission of television and synchronized-sound broadcasts to nearby experimental receiving points.

Note that these are only tentative plans and hence, subject to change to conform with F.C.C. recommendations, etc.—*Editor*

COMMERCIAL CATHODE-RAY TUBES

Ralph R. Batcher, radio engineer and electronic specialist, and Instruments *magazine have kindly made available to* RADIO-CRAFT *the listing of commercial cathode-ray tubes we here reproduce. Except for revises as of May 15, 1938, as indicated, this listing carries only the original correction date as of October 1, 1937. Here listed are nearly all the available cathode-ray industrial and television tubes.*

CHARACTERISTICS OF CATHODE-RAY TUBES

Type No.	Screen: Diam. inches	Screen: Decay Time & Color *Note 1*	Tube Length inches	Deflection Plates: No. of Pairs	Deflection Plates: Leads *Note 2*	Vacuum *Note 3*	Control Voltages: Max. anode volts E_a	Control Voltages: Focus electrode volts	Control Voltages: Control grid Volts at cut off	Filament: Volts	Filament: amps. *Note 4*	Base Type *Note 5*	Connections *Note 6*	Deflection Sensitivity: First plates *Note 7*	Deflection Sensitivity: Second plates	Deflection Sensitivity: Comp. Sensitivity *Note 8*	*Notes*
ALLEN B. DU MONT LABORATORIES																	
*24XH	2	N	7.6	2	C	Hard	600	20% of E_a	— 60	6.3	0.8	Octal	i	159	182	284	
*34XH	3	N	11.5	2	C	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	100	100	67	
*54XH	5	NW	15.5	2	C	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	112	112	38	
*34-8-HB	3	N	11.5	2	S	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	100	100	67	
*54-8-HB	5	N	15.5	2	S	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	112	112	38	
*54-8-H	5	XW	15.5	2	S	Hard	3000	25% of E_a	—120	2.5	2.1	5M	c	75	—	37	
*94-8-H	9	XW	21.0	2	S	Hard	3000	25% of E_a	—120	2.5	2.1	5M	c	90	—	30	
*34-7-T	3	NW	11.5	2	C	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	100	100	67	
*54-7-T	5	NW	15.5	2	C	Hard	1500	25% of E_a	— 60	2.5	2.1	7M	d	112	112	38	
*54-9-T	5	NW	15.5	2	S	Hard	3000	25% of E_a	—120	2.5	2.1	5M	c	75	—	37	
*144-9-T	14	W	26	2	S	Hard	6000	25% of E_a	—240	2.5	2.1	Special		150	—	25	
GENERAL ELECTRIC CO.																	
FP 58	7	N	23.0	2	S	Hard	6000	600	—	—	—	—	—	150	80	27	
GENERAL RADIO CO.																	
478 A	5	N	16.5	2	S	Gas	2000	—50 to — 400	—	.5 to .6	1.0±	Sp'l	g	100	105	50	9
528 A	7	N	22.0	2	S	Hard	3000	100 to 600	—250	2.5	2.0	Sp'l	f	110	110	35	10
528 B	7	F	22.0	2	S	Hard	3000	100 to 600	—250	2.5	2.0	Sp'l	f	110	110	35	10
687 P_1	5	N	16.5	2	S	Hard	1500	25% of E_a	— 40	2.5	2.1	5M	c	75	90	60	11
687 P_2	5	F	16.5	2	S	Hard	1500	25% of E_a	— 40	2.5	2.1	5M	c	75	90	60	12
635 P_2	3	N	11.5	2	C	Hard	1000	25% of E_a	— 40	2.5	2.1	7M	d	72	76	76	13
635 P_3	3	F	11.5	2	C	Hard	1000	25% of E_a	— 40	2.5	2.1	7M	d	72	76	76	14
HYGRADE SYLVANIA CORP.																	
H-7-2	3	N	11.5	2	O	Hard	1200	150 to 250	0 to —35	2.5	2.1	7M	d	95	89	77	
NATIONAL UNION RADIO CORP.																	
2001	0.9	N	4.7	2	C	Hard	500	100	— 90	6.3	0.6	Octal	i	355	255	510	
2002	2	N	7.6	2	C	Hard	600	20% of E_a	— 50	6.3	0.6	Octal	i	220	220	367	
2003	3	N	11.5	2	C	Hard	1200	25% of E_a	— 60	2.5	2.1	7M	d	88	94	77	
****RCA RADIOTRON DIV., RCA MFG. CO.**																	
*902	2	N	7.63	2	C	Hard	600	25% of E_a	— 80	6.3	0.6	Octal	i	116	134	193	
*903	9	N	20.75	0	O	Hard	7000	20% of E_a	—120	2.5	2.1	6M	a	—	—	—	15
*904	5	N	16.63	1	S	Hard	4600	20% of E_a	—140	2.5	2.1	6M	b	360	—	77	
*905	5	N	16.88	2	S	Hard	2000	20% of E_a	— 60	2.5	2.1	5M	c	110	134	55	
*906	3	N	11.88	2	C	Hard	1500	30% of E_a	— 70	2.5	2.1	7M	d	110	115	73	
*907	5	F	16.88	2	S	Hard	2000	20% of E_a	— 60	2.5	2.1	5M	c	110	134	55	
*908	3	F	11.88	2	C	Hard	1500	30% of E_a	— 70	2.5	2.1	7M	d	110	115	73	
*909	5	P	16.88	2	S	Hard	2000	20% of E_a	— 60	2.5	2.1	5M	c	110	134	55	
*910	3	P	11.88	2	C	Hard	1500	30% of E_a	— 70	2.5	2.1	7M	d	110	115	73	
*911	3	N	11.88	2	C	Hard	1500	30% of E_a	— 70	2.5	2.1	7M	d	110	115	73	
*913	0.9	N	4.7	2	C	Hard	500	100	— 90	6.3	0.6	Octal	i	254	363	510	
*914	9	N	21.75	2	S	Hard	7000	21% of E_a	—125	2.5	2.1	6M	j	273	348	39	
*1800	9	N,Y	21.38	0	O	Hard	7000	25% of E_a	— 75	2.5	2.1	6M	a	—	—	—	16
*1801	5	N,Y	16.13	0	O	Hard	3000	15% of E_a	— 35	2.5	2.1	5M	k	—	—	—	16
WESTERN ELECTRIC CO.																	
325	4.6	X	16.5	2	S	Hard	5000	—1500	—100	5.0	0.55	Sp'l	h	333	333	67	
326	7.1	X	22.0	2	S	Hard	5000	—1500	—100	5.0	0.55	Sp'l	h	200	200	40	
WESTINGHOUSE ELEC. & MFG. CO.																	
RC 590	7⅛	N	21¼	0	O	Hard	8000	100 to 1500	—250	2.5	2.0	435	f	—	—	—	16
RC 593	7⅛	N	22⅛	2	S	Hard	8000	100 to 1500	—250	2.5	2.0	435	f	290	290	35	

NOTE 1. N refers to screens having a normal decay period, where the fluorescence lingers for a period of the order of 1/20-second.

F refers to a screen with a rapid decay period—less than a few microseconds.

P refers to a screen with persistent characteristics, where spot glows for a portion of a minute after excitation is removed.

X indicates that N, F or P type screens are available as specified by purchaser. W: white trace on black (for contrast) available if specified. Y: Yellowish.

NOTE 2. C refers to tubes wherein one plate of each pair of deflection plates is common and is connected internally to the anode.

S refers to tubes with separate leads to each deflection plate.

NOTE 3. Hard tubes are evacuated to a high degree and focusing is not dependent on internal gas pressure.

NOTE 4. In gas focused tubes (see column headed "Vacuum") the filament current must be accurately adjusted to secure correct focusing.

NOTE 5. The designations M and S refer to medium and small sockets for glass receiving tubes. The numerals refer to the number of holes in the socket.

NOTE 6. The letters refer to the respective sketch designations in the diagram herewith.

NOTE 7. These values refer to the deflection voltage required to give one inch deflection at the maximum rated anode potential E_a (see column headed "Max. anode volts").

NOTE 8. These values refer to the deflection voltage required to give one inch deflection at an anode potential of 1 kilovolt.

NOTE 9. From Von Ardenne Laboratories, Berlin, Germany.

NOTE 10. Similar to the Westinghouse Type 593 tube.

NOTE 11. See RCA Type 905.

NOTE 12. See RCA Type 907.

NOTE 13. See RCA Type 906.

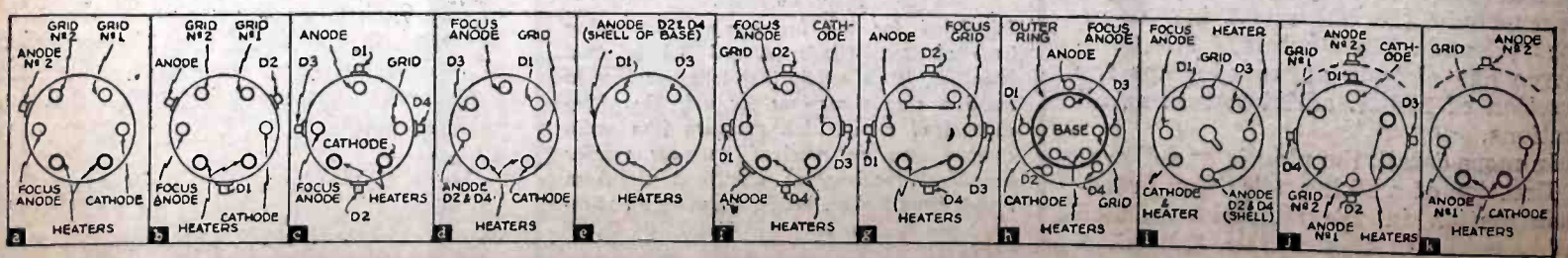
NOTE 14. See RCA Type 908.

NOTE 15. Arranged for magnetic deflection control only. Deflection sensitivity is stated in Ampere-turns per inch deflection.

*Indicates new text, as of May 15, supplied direct to Radio-Craft by respective manufacturers.

**The sensitivity figures in next to last column are based on the signal-deflecting-plate value, or the most sensitive one.

L. C. Waller



LATEST CONTINUOUS-FILM TELEVISION

The New York Times, *in reporting a demonstration, at Chestnut Hill, Pa., of this new Farnsworth telecine camera development, stated that "pictures with unusually good contrast and definition" were obtained on a 6 x 7 inch screen.*

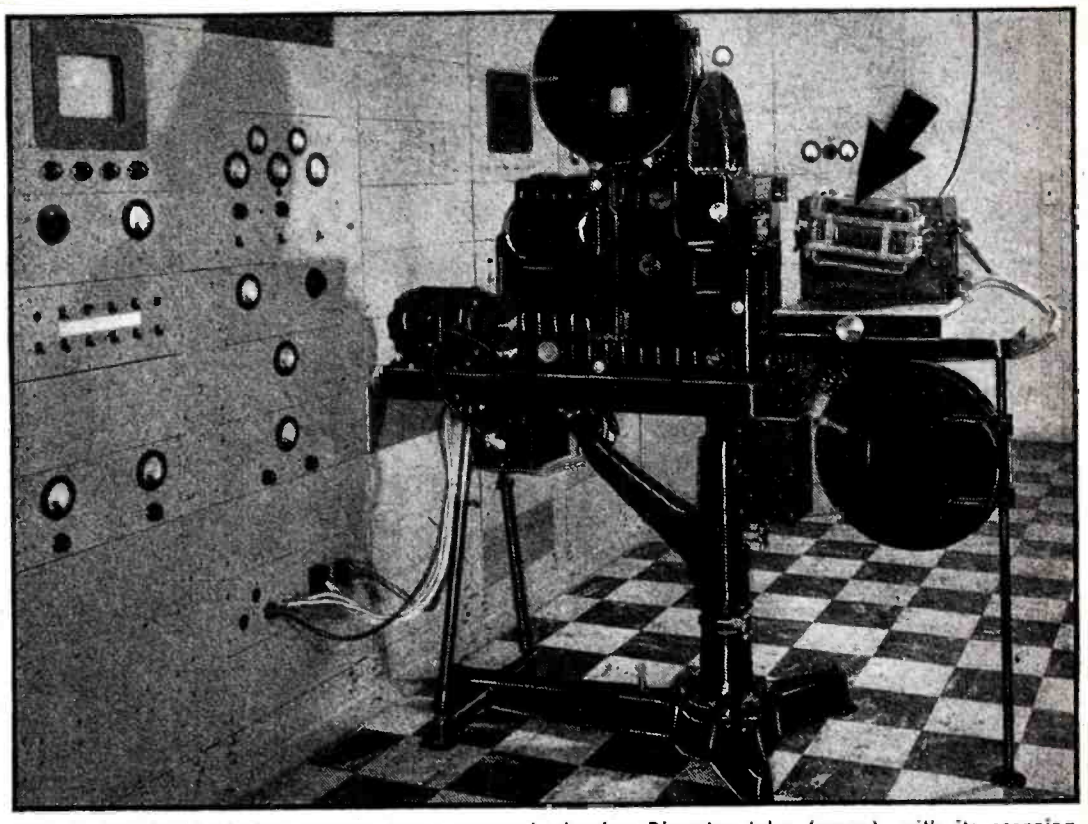


Fig. A. Telecine Projector—camera cover removed—showing Dissector tube (arrow), with its scanning and focusing coil system.

WE are thoroughly convinced that the transmission of motion pictures by means of film will always, and particularly in the beginning, constitute a substantial part of any television program.

This, of course, does not necessarily mean the transmission of motion pictures as they are now produced, but motion pictures made up of subjects—*especially adapted to television*—which will bring to the home a type of entertainment and education not otherwise available.

Such films can be readily transported from station to station, and transmitted without awaiting the time when suitable radio or wireline connections are available between stations for the relaying of television programs. We have, therefore, devoted a considerable amount of effort in the development of suitable apparatus for this purpose. This effort has been appreciably enhanced by the excellent adaptability of the Farnsworth High-Fidelity Dissector Tube for this phase of the art.

The development of a new model motion picture projector for telecine operation, including many novel features, has just been completed. (See Fig. A.)

CONTINUOUS-FILM PROJECTION

This projector is of the so-called "continuous," rather than "intermittent" type, and the film, therefore, passes through it at a constant rate of speed without interruption. (Continuous-film television has been described in past issues of *Radio-Craft.—Editor*) The projector focuses its picture upon the cathode area of a High-Fidelity Dissector Tube.

Continuous projection is accomplished fundamentally by 2 lens discs, each carrying a total of 24 lenses (see Fig. B) and rotating in opposite directions, but overlapping sufficiently so that at any instant 2 lenses are acting in conjunction with each other. These lens discs act both as an *optical compensator* and as a *projection lens.*

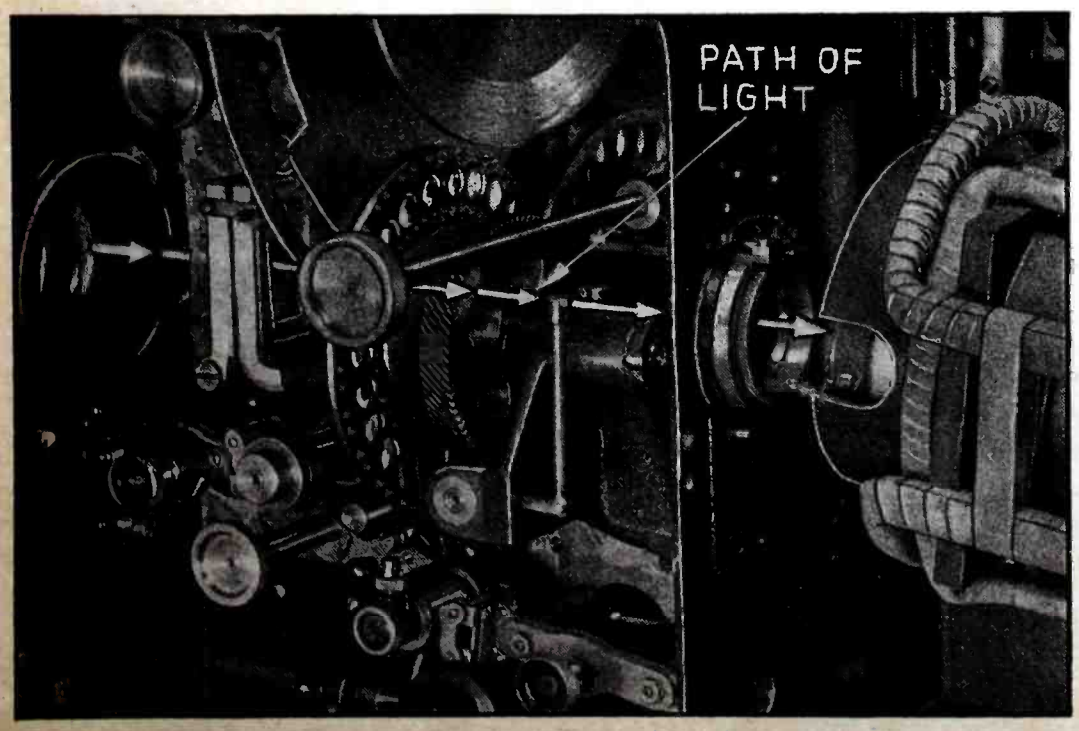


Fig. B. Optical path of Projector, showing condensing lens, film gate, selector discs, optical compensator (lens discs), auxiliary lens and Dissector pick-up tube.

A shutter is provided which masks all lenses except the 2 functioning at a given moment.

The projector is synchronized with the scanning system of the Dissector Tube, so that alternative frames are scanned 2 and 3 times respectively, providing an interlaced picture at a rate of 30 frames per second.

The transition period, i.e., the time required to change from frame to frame, occurs coincident with and during the "flyback" of the scanning system, during which no television signal is transmitted, so that this does not detract in any way from the excellence of the transmitted picture. The transition is accomplished in less than 1/600th of a second, as compared to approximately 1/120th of a second for the most rapid intermittent-type projector.

During transition, the image of the leading frame is momentarily superimposed upon the image of the trailing frame, which condition maintains for the small fraction of a second indicated.

Since the picture projected on the cathode surface is stationary and continuous, this projector can be adapted to camera tubes operating on the storage principle, as well as the dissector-type tube. However, the projector provides sufficient illumination, so that the storage-type tube is not essential, and more than ample illumination is obtained from a concentrated-filament incandescent lamp.

(Continued on page 112)

TELEVISION EXPERIMENTS

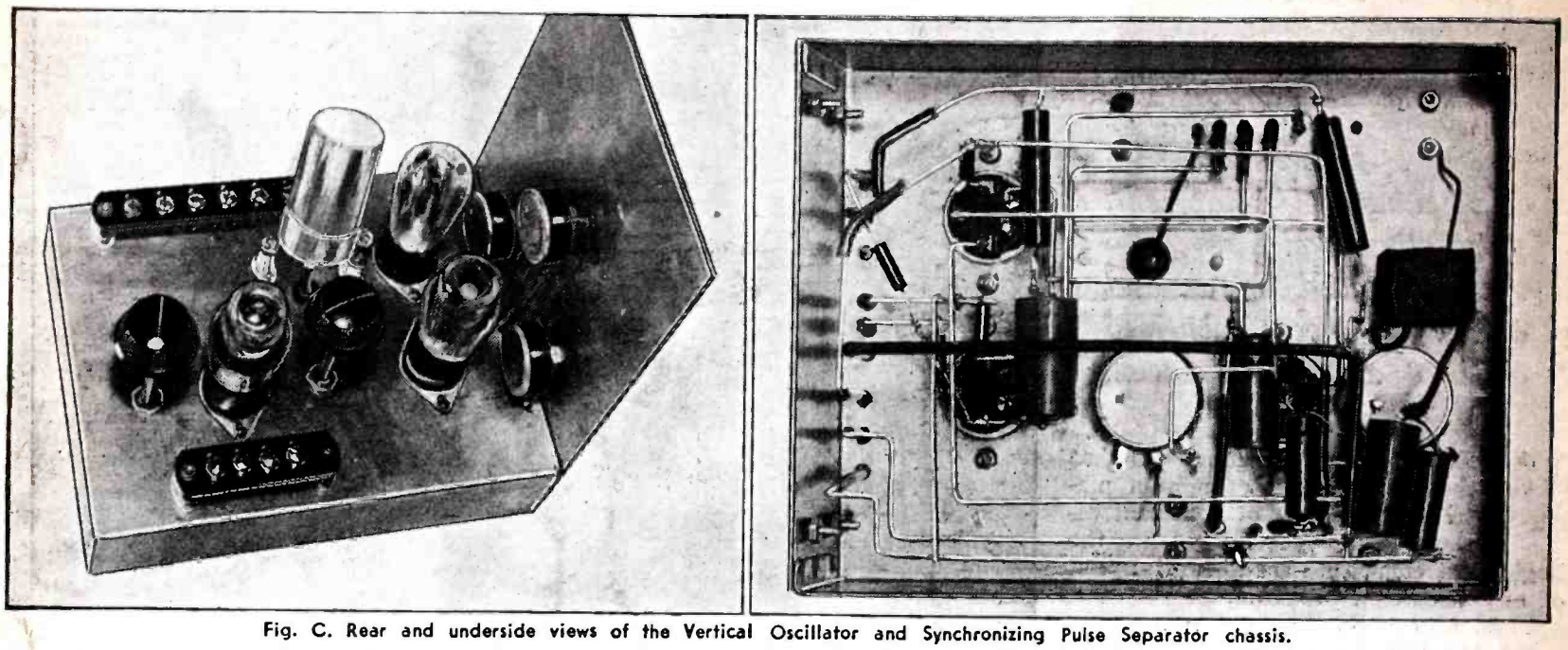


Fig. C. Rear and underside views of the Vertical Oscillator and Synchronizing Pulse Separator chassis.

Radio men who live within the service area of 441-line television broadcast stations are here given the first *really* inexpensive *set-up for experimenting with cathode-ray television reception. An ordinary service oscilloscope plus a simple 3-tube Vertical Oscillator and Synchronizing Pulse Separator are the "heart" of the system, which employs standard, manufactured instruments now on the market.*

RICARDO MUNIZ, E.E.

MANY important facts concerning television can be learned using the servicing 'scope you have right in your own shop or laboratory! (Ripley, please note.)

With commercial television practically here, it behooves the Service Man who really wants to stay "on top" to learn what makes the electrons go 'round in a modern, high-definition television[1] receiving set-up.

We can reduce the complexity of construction work tremendously by making use of a good servicing oscilloscope as the foundation unit of our set. As you know, the picture, or more properly, "image tube," which corresponds to the loudspeaker in a sound set (used in high-definition television), is a cathode-ray tube. The cathode-ray tube in your oscilloscope can be made to serve this function reasonably well.

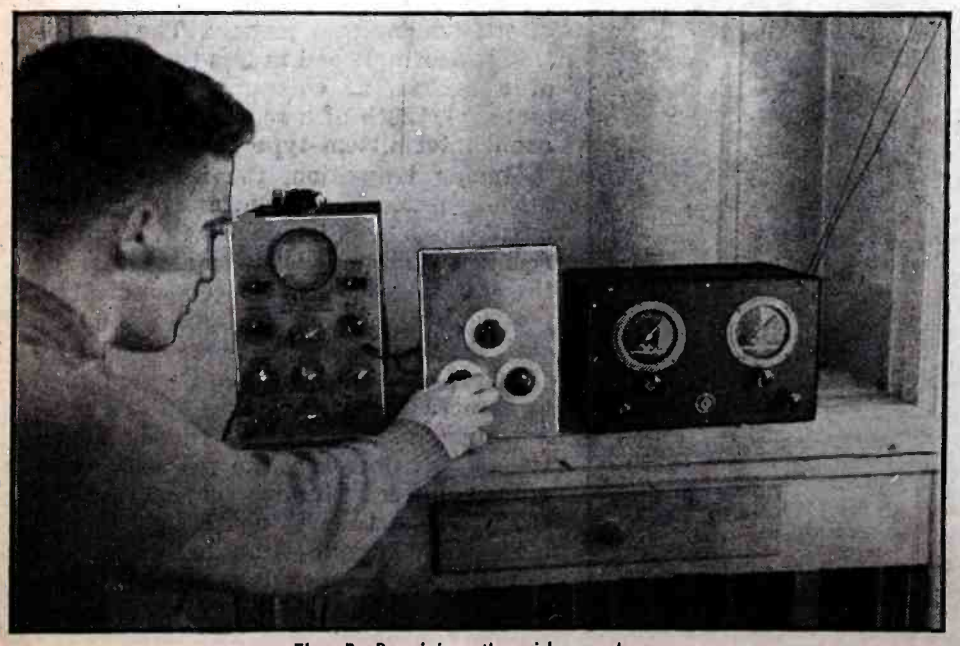


Fig. B. Receiving the video raster.

You have in your oscilloscope 2 deflecting amplifiers connected to the deflecting plates in the cathode-ray tube; you also have a single oscillator tube which is connected to the amplifier that goes to the pair of plates producing horizontal deflection of the cathode-ray beam. (This horizontal-sweep system can be adjusted to the "line scan"[2] frequency of the television transmitter and kept in step perfectly with it by applying the line synchronizing pulses to the oscilloscope terminal marked "External Synchronizing." The pulses are sent from the transmitter and received by the video receiver.)

THE SERVICE 'SCOPE

In order to adapt the *servicing oscilloscope* for television reception it will be necessary to provide one more oscillator. This oscillator when connected to the oscilloscope at the terminal marked "Vertical Deflection" will operate through the vertical deflection amplifier and swing the cathode-ray beam up and down. The vertical oscillator is readily tuned to the "frame" frequency[3] of the television transmitter, and is held in step by using the frame synchronizing pulses which are being received.

With this simple addition you can produce on the window of your 'scope a "raster" (the light-pattern produced by an unmodulated signal) exactly like the one being transmitted. It will have 441 lines interlaced, 60 frames per second, 30 complete images per second exactly like the transmitted raster. It will be kept steady and

[1]High-Definition Television:—Modern 441-lines per frame television using a wide frequency channel. Relatively fine detail is available in the transmitted image.

[2]Line Scan Frequency:—The frequency at which the horizontal sawtooth oscillator must be set so as to produce $441 \times 30 = 13{,}230$ lines per second.

[3]Frame Frequency:—The number of frames transmitted per second. With modern interlaced scanning 60 frames per second are transmitted and 30 complete images per second are obtained.

WITH A SERVICING 'SCOPE

properly centered by the synchronizing pulses which come with the television signal when it is received. (See Fig. D.)

It is now necessary merely to modulate the control-grid of the cathode-ray tube with the modulated television picture detail signal; the moving cathode-ray beam will "paint" a picture on the fluorescent screen. The control-grid of the cathode-ray tube controls the intensity of the ray and thus it controls the amount of fluorescent light which it will produce on any spot on the screen. The weaker the ray the less fluorescence it will produce, and vice versa. The actual speed of the flying spot on the screen of a 3-in. tube is about 1 mile per second.

The sound part of the television program can be received on an ultra-shortwave *receiver* like the Lafayette acorn-tube superhet. shown in Fig. B, or by means of an ultra-shortwave *converter* in conjunction with a regular broadcast receiver like the Detrola unit illustrated in Fig. A. Sound is on 49.75 megacycles.

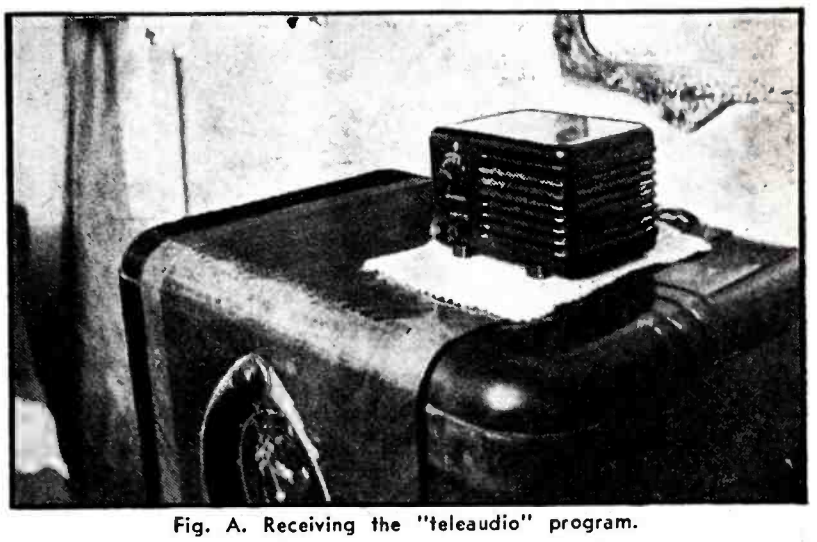


Fig. A. Receiving the "teleaudio" program.

SEPARATOR-OSCILLATOR UNIT

Now that we have our picture tube so easily taken care of, let us see what else is needed in order to get these pictures. We'll need a broad-band-pass radio set which will tune in the 46.5 megacycle television signals, and we'll need a separator for the synchronizing pulses. The separation is needed so that we can feed the pulses to the deflecting oscillators without any picture detail modulation mixed with them.

In Fig. C you see 2 photographic views of the small unit made by the author and containing both the vertical oscillator and the synch. pulse separator. You may want to build them on separate chassis or on a breadboard. The placement of parts is not at all critical. In this article we shall give you full details concerning the construction of this unit. (In a forthcoming issue, we plan to present complete construction details of a simple video-channel receiver.)

ANOTHER RADIO-CRAFT *"FIRST"!*

At the suggestion of Mr. Washburne, of Radio-Craft *staff, Mr. Muniz has investigated and found feasible the use of an* ultra-short-wave converter *to transfer the* audio *portion of a television program to a standard broadcast receiver; also, though reception of the* video *image will require a simple receiver of efficient design (to be described in a forthcoming issue), the video "raster" or unmodulated video pattern, it has been found, may be set up on* an ordinary service oscilloscope *by employing a Vertical Oscillator and Synchronizing Pulse Separator, as here described!*

The circuit diagram of the Vertical or Sweep Oscillator is shown in Fig. 1C. Use is made of a type 885 gas triode tube. The wave shape generated is a so-called sawtooth. This waveform is produced by slowly charging condenser C1 through the frequency control resistor R1, and then suddenly discharging it through the 885. The 885 acts as a short-circuit after being ionized by the synchronizing pulse applied to its grid. (See Fig. 1D.)

The circuit diagram of the Synchronizing Impulse Separator or "synch. pulse separator" is shown in Fig. 1A. It consists of an amplitude selector, pulse amplifier, and a pair of simple filters to separate the frame from the line synch. pulses. The amplitude selector is a 6H6G diode with cathode biased so that positive signal voltage applied to the plate must exceed a certain value before plate current will flow. Figure 1B shows the bias level required in order to pass only the pulse peaks. The 76 amplifies the pulses and feeds them to the pair of simple filters. The Frame pulse filter is a low-pass filter set somewhat above 60 cycles. The Line pulse filter is a high-pass filter set somewhat below 10,000 cycles. The filters are not at all critical because of the large difference

(Continued on page 113)

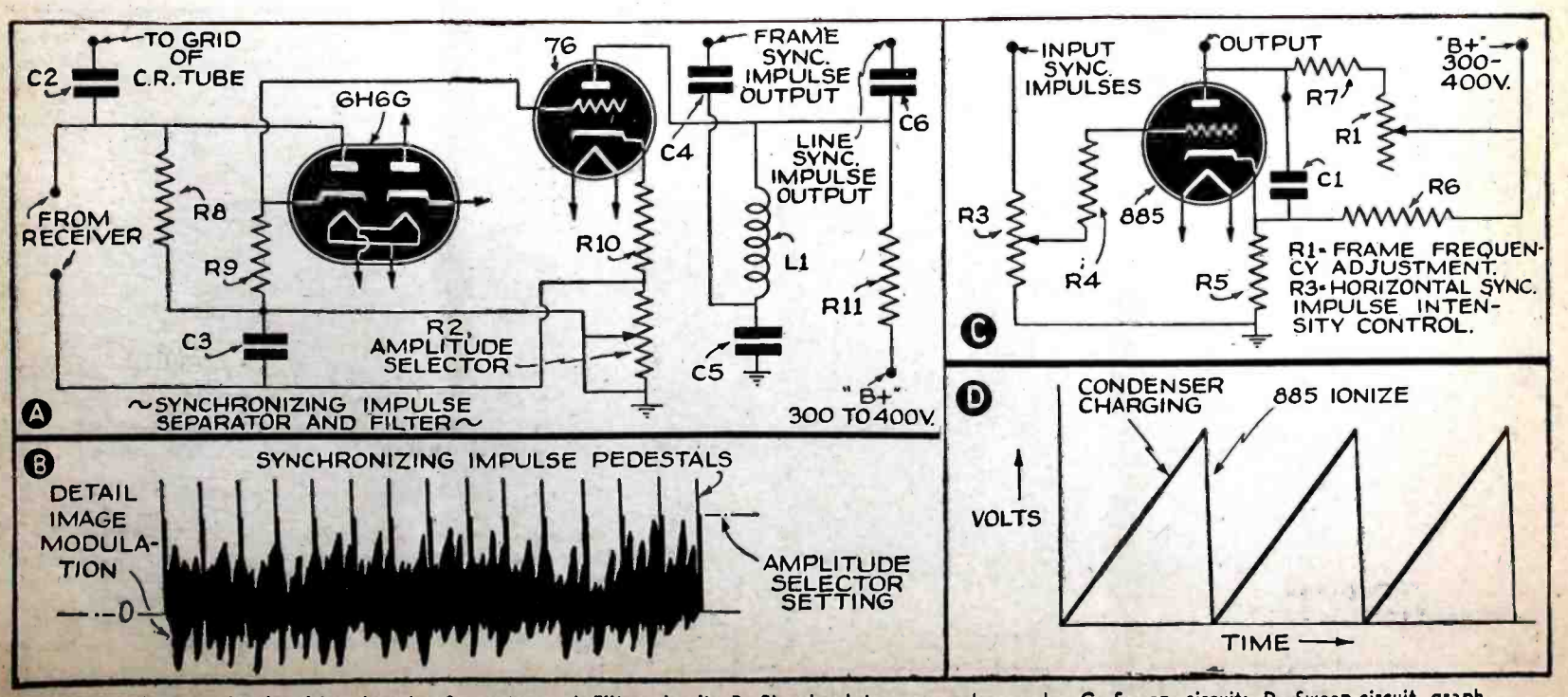


Fig. 1 at A—Synchronizing Impulse Separator and Filter circuit; B—Bias level to pass pulse peaks; C—Sweep circuit; D—Sweep-circuit graph.

BEGINNERS' 4-TUBE SUPERHET.

"VACATION PORTABLE"

H. G. McENTEE

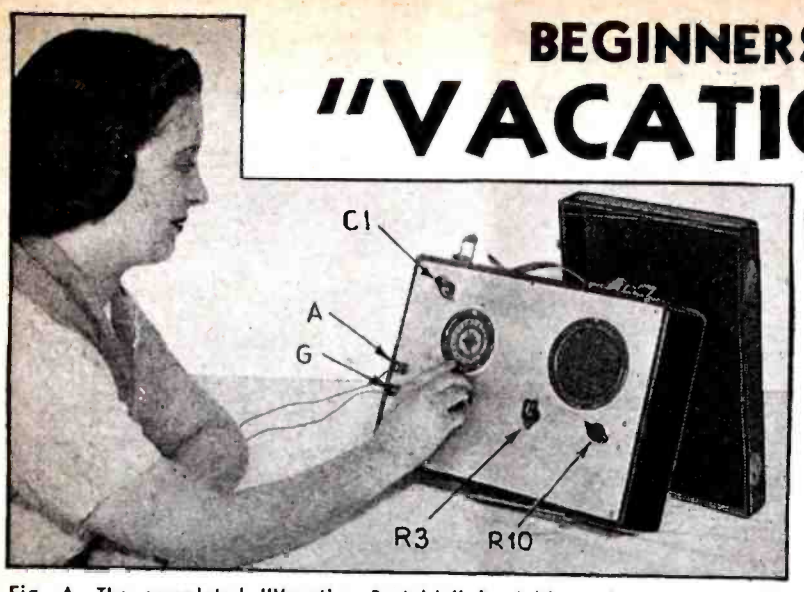


Fig. A. The completed "Vacation Portable" is stable and easy to operate.

Whether it is the call of the wilds or the wild waves that call, when you go far afield this summer, you still may have entertainment at the flick of a switch by taking along this compact and self-powered "Vacation Portable."

WITH the outdoor season once more here it is only natural that the experimenter's thoughts turn to portable equipment.

This effect is always produced upon the writer at this time of year and the result is usually a portable broadcast receiver of some description! Running true to form this year, the outfit shown herewith was produced. Due to a lack of time (and also energy, spring fever having set in!) it was decided to build a rather simple job with few frills and trick gadgets, which virtually always cause troubles that require tedious ironing-out. See Fig. A.

THE BATTERY PROBLEM

The superhet. circuit (Fig. 1) was selected since it is very little if any harder to get into operation than a T.R.F. job, and, the added sensitivity and selectivity are a big help in a small set. Batteries are used, of course, a size being chosen which is a compromise between long life and light weight. If the rig is to be used for any length of time, as for example, at a summer camp, it would be more economical to use large batteries. A plug arrangement could easily be worked out so that the portable batteries could be used for true portable use while the heavier-duty batteries could be plugged-in when the set was used in any one place for a fair length of time. The current drain is quite low, measuring only about 300 ma. on the filament batteries and between 10 and 15 ma. on the "B" batteries. The "C" battery, of course, has no drain on it, and lasts as long as its shelf life allows.

If all the tubes (except the 2nd-detector) are run with 3 V. minus on the grids, the "B" current will be about 15 ma. With 4½ V. grid bias this drops to about 10 ma., with, however, a considerable drop in output.

Since the case available offered a fair amount of space, a 5-inch speaker was decided upon, as it gives considerably better tone quality han the 3-inch size. Good tone quality made it imperative to use a P.M. dynamic speaker, and as a result the output sounds very respectable.

COIL SELECTION

Iron-core transformers and chokes are used throughout and contribute to compactness and high efficiency.

The tubes are all of standard types, the only concession to "the latest thing" being the use of octal base types. These are just as convenient and efficient as their older counterparts, and the extra lugs on the sockets are certainly useful.

The oscillator coil is beneath the chassis (see Fig. C) with the antenna and I.F. transformers above (see Fig. B). Although the parts are not excessively crowded, some care must be used in layout so that no parts interfere mechanically with each other.

The case used, which has dimensions as shown in the illustration (Fig. 2) is one which was intended to house one of the *Radio-Craft* analyzers. It may still be possible to get a ready-made case of this size. Otherwise, one may be quite easily made up, or the receiver can be adapted to fit whatever case is on hand.

Construction is straightforward and no unusual kinks should be encountered. Both panel and chassis are of 1/16-in. aluminum, the latter being bent after the desired bending lines have been deeply scribed in the surface. A

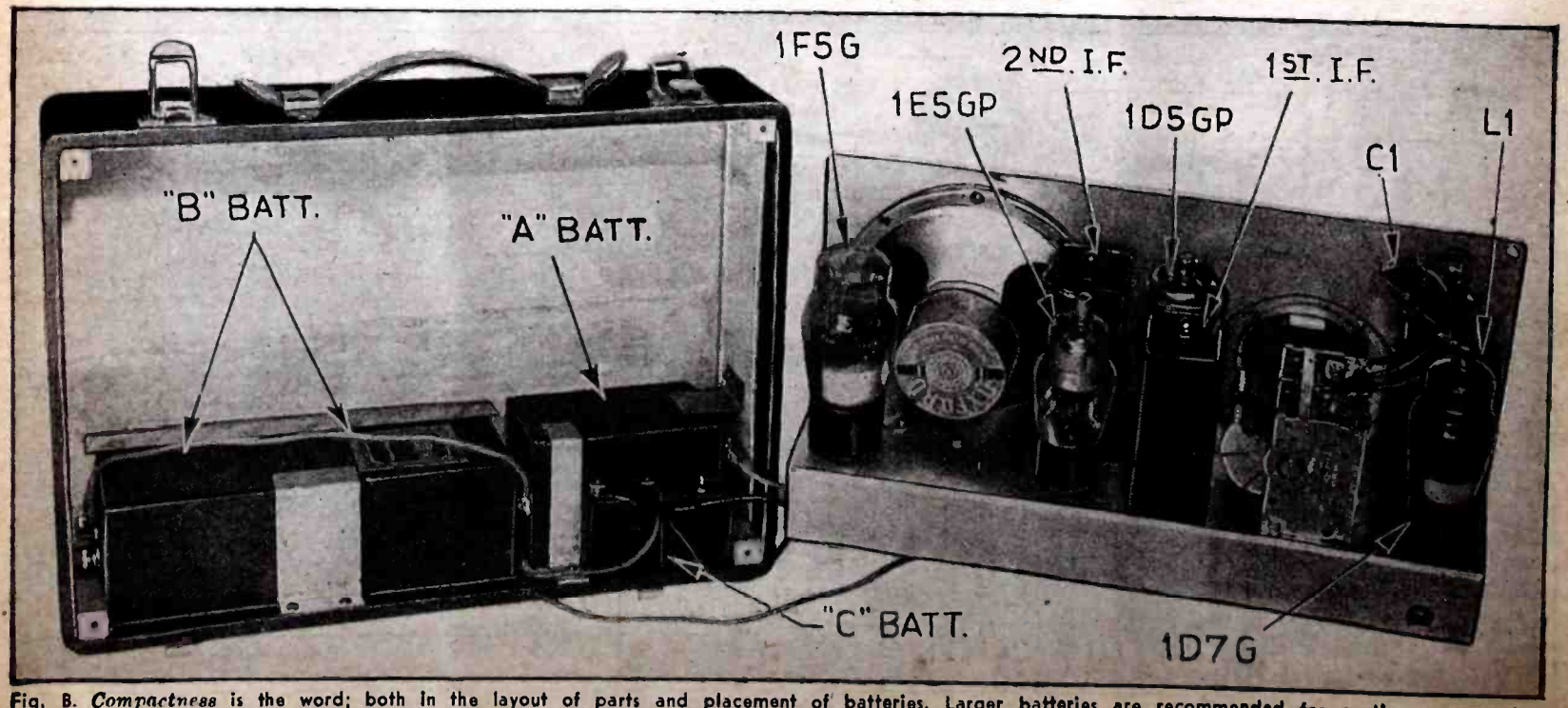


Fig. B. *Compactness* is the word; both in the layout of parts and placement of batteries. Larger batteries are recommended for continuous operation.

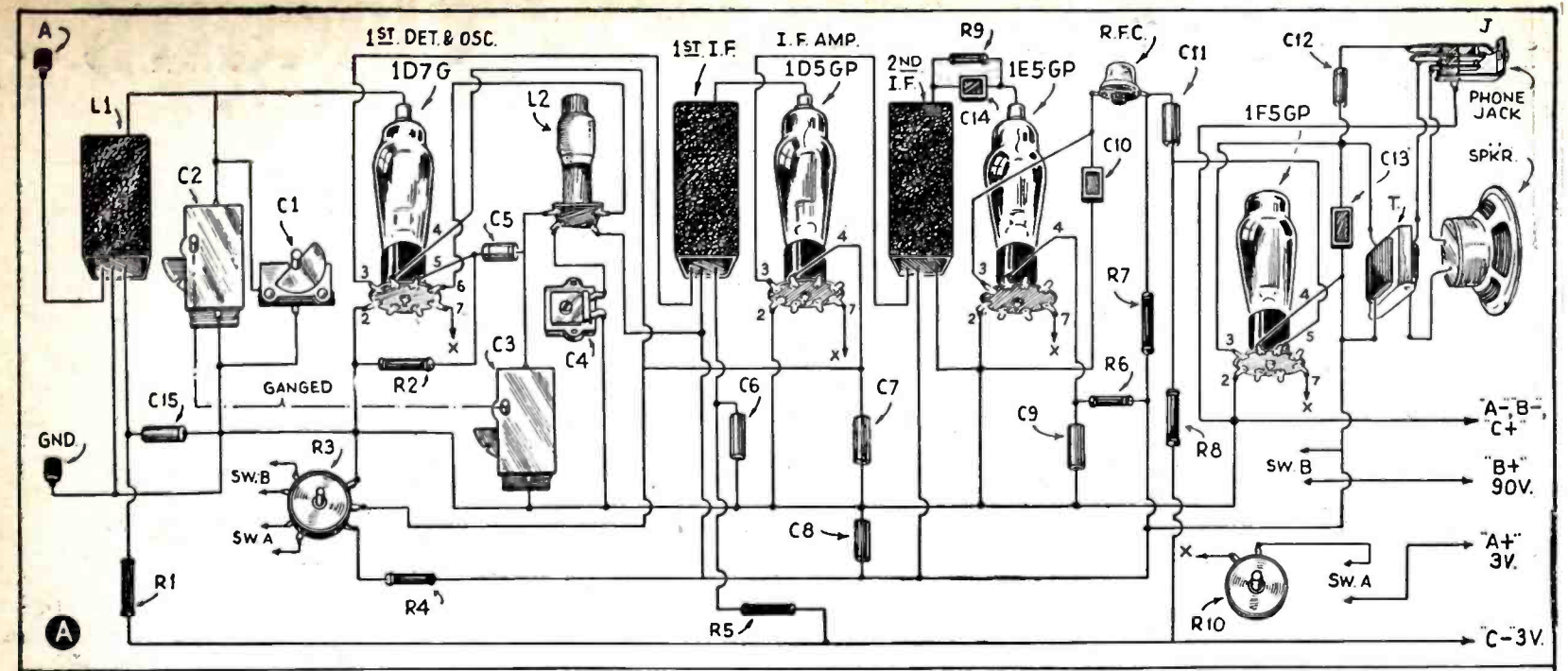


Fig. 1. The schematic (A) and pictorial (B) diagrams of the Beginners' "Vacation Portable." Refer to Fig. 2 for chassis layout specifications.

C1—50-mmf.	C9—0.25-mf.	R3—75,000 ohms V.C.	R10—6 ohms
C2, C3—2-gang, 350-mmf.	C10—500-mmf.	R4—10,000 ohms	L1—Antenna coil
C4—Padder	C11—0.25-mf.	R5—50,000 ohms	L2—Oscillator coil
C5—100-mmf.	C12—0.25-mf.	R6—1 meg.	J—Phone jack
C6—0.01-mf.	C13—0.004-mf.	R7—150,000 ohms	T—Output trans.
C7—0.25-mf.	R1—50,000 ohms	R8—0.5-meg.	R.F.C.—R.F. choke
C8—12-mf.	R2—50,000 ohms	R9—2 megs.	

nice grain finish may be imparted by applying powdered pumice and water to the surface in long, straight strokes. An alternate suggestion is to dip the pieces in a strong lye solution, which will impart the familiar satin finish. Either finish should be applied after all work of cutting and drilling is finished.

All components are mounted on the chassis except the speaker and antenna trimming condenser, which are fastened to the panel only. When all construction work is completed, wiring may proceed according to the diagrams in Fig. 1, A and B. Wiring should be very carefully checked when finished. Remember that a misconnection in a powerline-operated receiver usually means, at most, a little smoke or a blown fuse, but on a battery-operated receiver, a wrong connection very often means a new set of tubes and batteries.

Use rather heavy wire for the filament circuit, Nos. 14 or 16 being about the right size.

ALIGNMENT

If a powerful broadcast station is located nearby, the receiver may be lined up without the use of a signal generator, although use of the latter is recommended in any case. The I.F. transformers come from the manufacturer peaked at a definite frequency so that it is usually possible to get a strong signal through, after which it is only a matter of trimmer adjustment. During initial I.F. line-up a stronger signal will be obtained if the antenna is temporarily hooked directly on the grid of the 1D7G.

When I.F. alignment is complete, R.F. alignment may be taken care of. An R.F. trimmer condenser is brought out on the panel. A portable receiver is called upon to work with every conceivable type of "aerial" from the

(Continued on page 106)

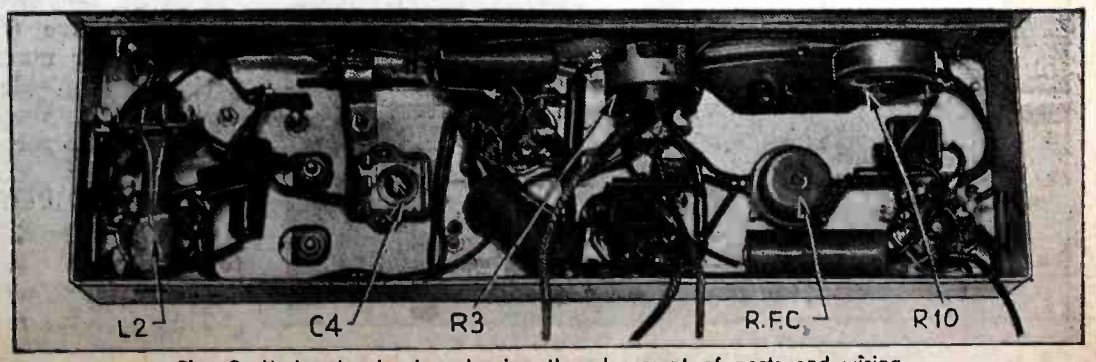


Fig. C. Under-chassis view showing the placement of parts and wiring.

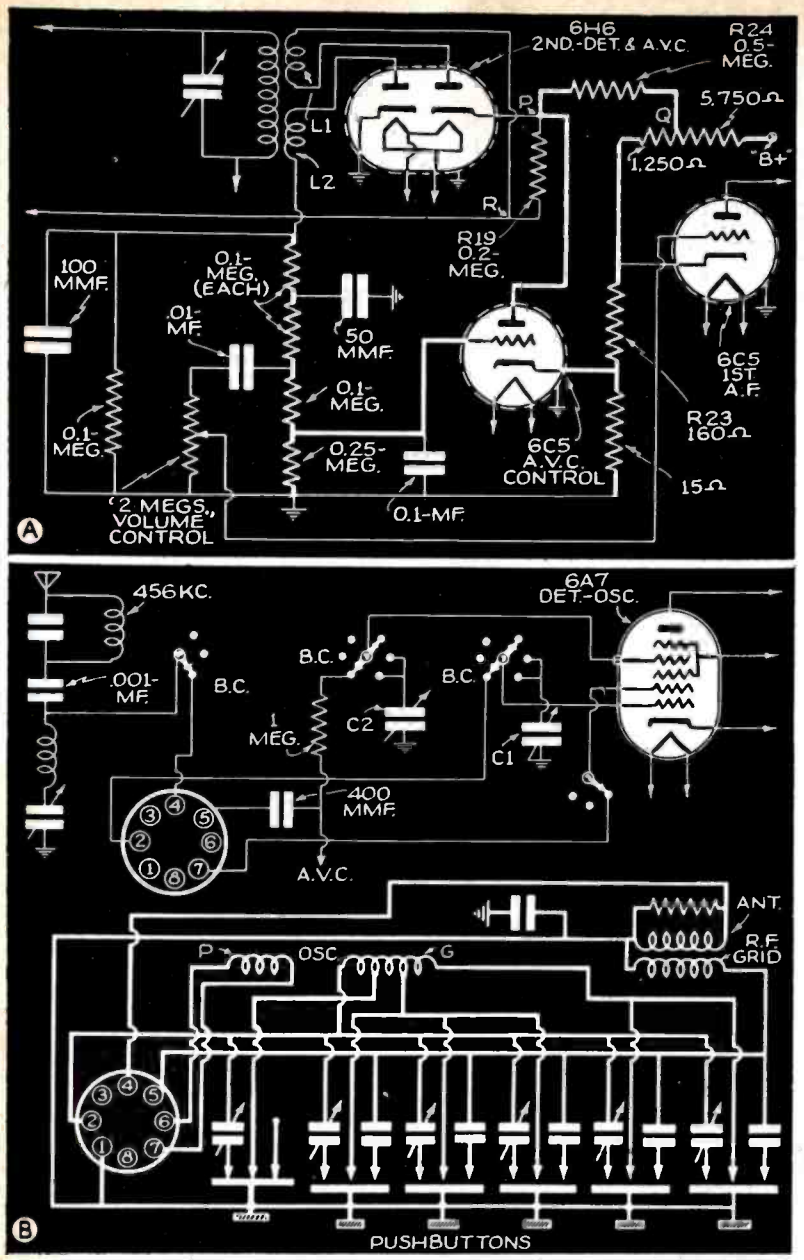


Fig. 1. Heavy lines in the circuits accentuate the points discussed in the text.

NEW CIRCUITS IN MODERN RADIO RECEIVERS

No. 11

The details of the modern radio receiver circuits that make them "different" from previous designs are illustrated and described each month by a well-known service engineer.

F. L. SPRAYBERRY

(1) TUBE CONTROLLED A.V.C. DELAY

Montgomery Ward (Airline) Models 62-303 and 62-433. *Unlike the straight valve scheme with a definite point of "threshold" or* release, *this circuit provides a continuous, regular delay mechanism.*

The ultimate A.V.C. voltage (see Fig. 1A) is formed by two voltages in series, one across R19, the conventional circuit, and another across R24, another voltage. Second-detector coil L2 supplies the rectified I.F. signal component and a bias voltage similar to, but less than, the ordinary A.V.C. voltage. This is the drop across the 0.25-meg. resistor and is supplied to the grid of the A.V.C. control tube. This allows a predetermined current to flow through R24, setting the potential at the A.V.C. control tube plate P at a definite potential. This is the reference voltage to which is added the drop developed across R19 by the action of coil L1 and the right-diode section.

Now for a small signal, there will be little bias applied to the 6C5 control tube and its regular cathode bias will allow a large current to flow in its plate circuit, including R24. Point P will, therefore, be somewhat negative with reference to Q. For a low signal there will be little additional voltage in series with this produced across R19. The voltage at R will, therefore, be just a little more than minimum bias for the controlled tubes. As the signal input increases, the bias for the 6C5 A.V.C. control tube increases, cutting the current through R24 so that point P becomes more positive, and at the same time the negative drop P — R increases to slightly over-counteract this former process.

Thus the true A.V.C. voltage at R is the sum of Q — P and P — R. The drop Q — P reaches a limit of zero at cut-off bias of the 6C5 control tube, while the drop P — R is proportional to the signal and will continue to increase. In this way the A.V.C. delay is extended into the greater part of the entire control range of the A.V.C. system.

(2) PLUG-IN PUSHBUTTON TUNER

Emerson Model AY. *Detachable pushbutton assembly simply plugged into a socket makes 6 predetermined stations tunable by pushing a button.*

Provided with the Model AY Emerson receiver is a pushbutton assembly (see Fig. 1B) which may be used at the option of the owner. Two band switch positions provide for short-wave (5.6 to 19 mc.) reception and broadcast reception for manual tuning, while a 3rd position disconnects the variable tuning gang and connects the plug-in unit with its fixed and adjustable condensers, and other coils suitable for them.

(3) IMPROVED DETECTOR FOR LOW-POWER CIRCUIT

RCA Models 95X and 95XL. *New suppressor connection to stabilize tube action and grid return method to eliminate degenerative effect.*

This detector refinement (as shown in Fig. 1C) permits

(*Continued on page* 109)

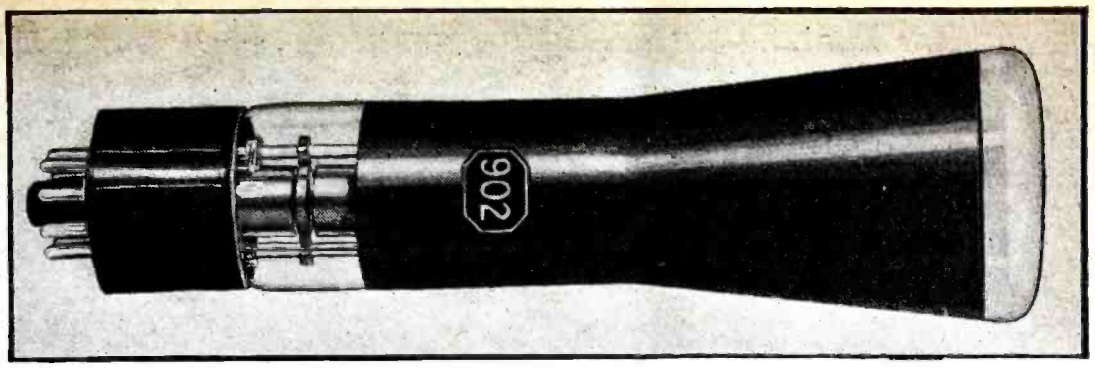


Fig. A.
Newest in cathode-ray tubes is this 2-inch unit. Electrostatic deflection both horizontally and vertically is employed. Overall length of this tube is 7½ inches.

R. D. WASHBURNE

NEW TUBES FOR TELEVISION AND RADIO

The tubes described this month cover a wide range of applicational fields.

NEW TUBE TYPES

902—A 2-inch Oscilloscope Tube
1851—High-gain Television Pentode
0A4G—Glow-Discharge Relay Triode
WL-629—Thyratron Control Tube

902 C.R. TUBE

FIRST on the list of tubes this month is a new low-voltage cathode-ray tube of the high-vacuum, electrostatic-deflection type. See Fig. A. This new tube, designated as the type 902, will be of interest to the radio engineer, Serviceman, amateur, and experimenter.

The 902 is small in size, has a 2-inch diameter fluorescent viewing screen and operates with an anode No. 2 voltage as low as 400 volts and as high as 600 volts. It is provided with two sets of electrostatic plates for deflection of the electron beam. The brilliant luminous spot produced by this new tube has a greenish hue. The 902 is electrically interchangeable with the 913, provided the anode No. 2 supply is 400 volts or more.

Because of its relatively low cost, small size, and its ability to produce a bright image at low voltages, the 902 is especially suited for use in portable oscillographic equipment.

The bulb of this tube, except for the screen surface, should be enclosed in a grounded metal case—preferably iron, to reduce the effect of extraneous fields. The fluorescent screen is of the phosphor No. 1 (medium-persistence) type. It has good visual properties as well as high luminous efficiency.

Terminal connections are shown in Fig. 1; characteristics data are given in Table I.

1851 TELEVISION AMPLIFIER PENTODE

Next on the list is the type 1851 television amplifier pentode, shown in Fig. B. It is intended for use by the amateur and experimenter in experimental television receivers.

This new pentode features extremely high grid-plate transconductance (9,000 micromhos). It is recommended for use in the R.F. and I.F. stages of the image amplifier as well as in the first stages of the video amplifier when several video stages are used.

When minimization of changes in input capacity and input conductance is not accomplished by leaving a portion of the cathode-bias resistor unbypassed, it will be found advisable to operate the 1851 with circuits heavily loaded by resistance and capacity. Although such circuits minimize the effect of the relatively small variations in tube capacity and conductance, they also cause some sacrifice in gain.

When the gain of these stages as well as that of the video stages is controlled automatically, it is recommended that the series-screen-resistor method be employed for obtaining screen-grid voltage. This method of obtaining screen voltage from the plate supply is satisfactory for the 1851 because its suppressor-grid practically removes the effects of secondary-emission phenomena. With this method, the screen-to-cathode voltage will rise as the control-grid voltage is varied from minimum to maximum. This rise of screen-to-cathode voltage above the normal maximum value is allowable because the screen and the plate current are reduced simultaneously by a sufficient amount to prevent damage to the tube.

Terminal connections are shown in Fig. 1; data, in Table II.

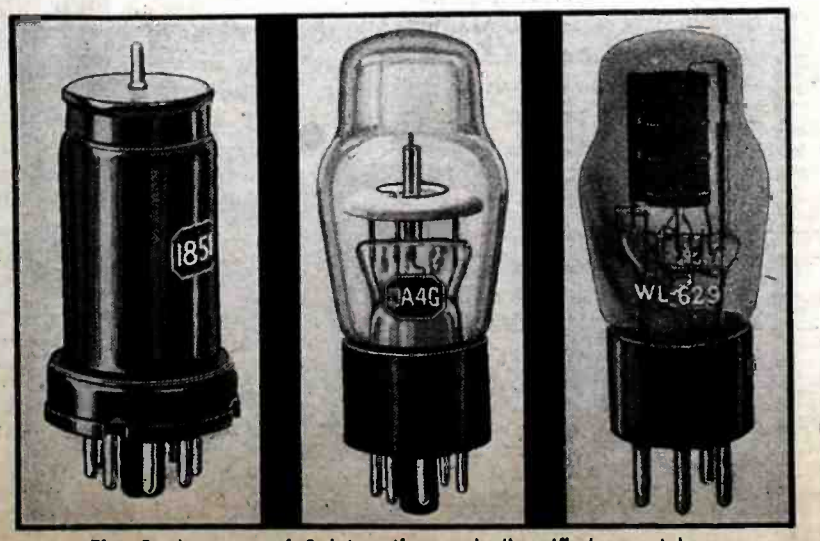


Fig. B. A group of 3 interesting and diversified new tubes.

0A4G GLOW-DISCHARGE RELAY TRIODE

An exceptionally useful tube, with many possible applications in the control of moderate amounts of current with medium voltage swing, is the type 0A4G glow-discharge relay tube, triode, shown in Fig. B.

The 0A4G is intended primarily for service as a relay tube and is designed especially for use in an electrical system for the remote tuning and control of line-operated radio receivers. It can be actuated by R.F. impulses generated under the control of the user and transmitted over the power line that supplies the radio receiver. Only a small amount of electrical energy is required to actuate the 0A4G. Being of the cold-cathode type, it does not consume power when the receiver is not in use. A remote-control system using the 0A4G provides a simple method for eliminating special cables and gives the user a large choice of control positions.

The remote-control capabilities of the 0A4G can be utilized by the ingenious experimenter in numerous ways.

Terminal connections are shown in Fig. 1; data, Table III.

WL-629 SMALL-THYRATRON TUBE

The rapidly increasing demand of industry for a small but reliable thyratron led to the development of the WL-629 shown in Fig. B. This tube has been designed to fit the need for a compact and inexpensive industrial-type thyratron for control purposes which would operate under any air temperature conditions.

The new WL-629 thyratron has been designed pri-

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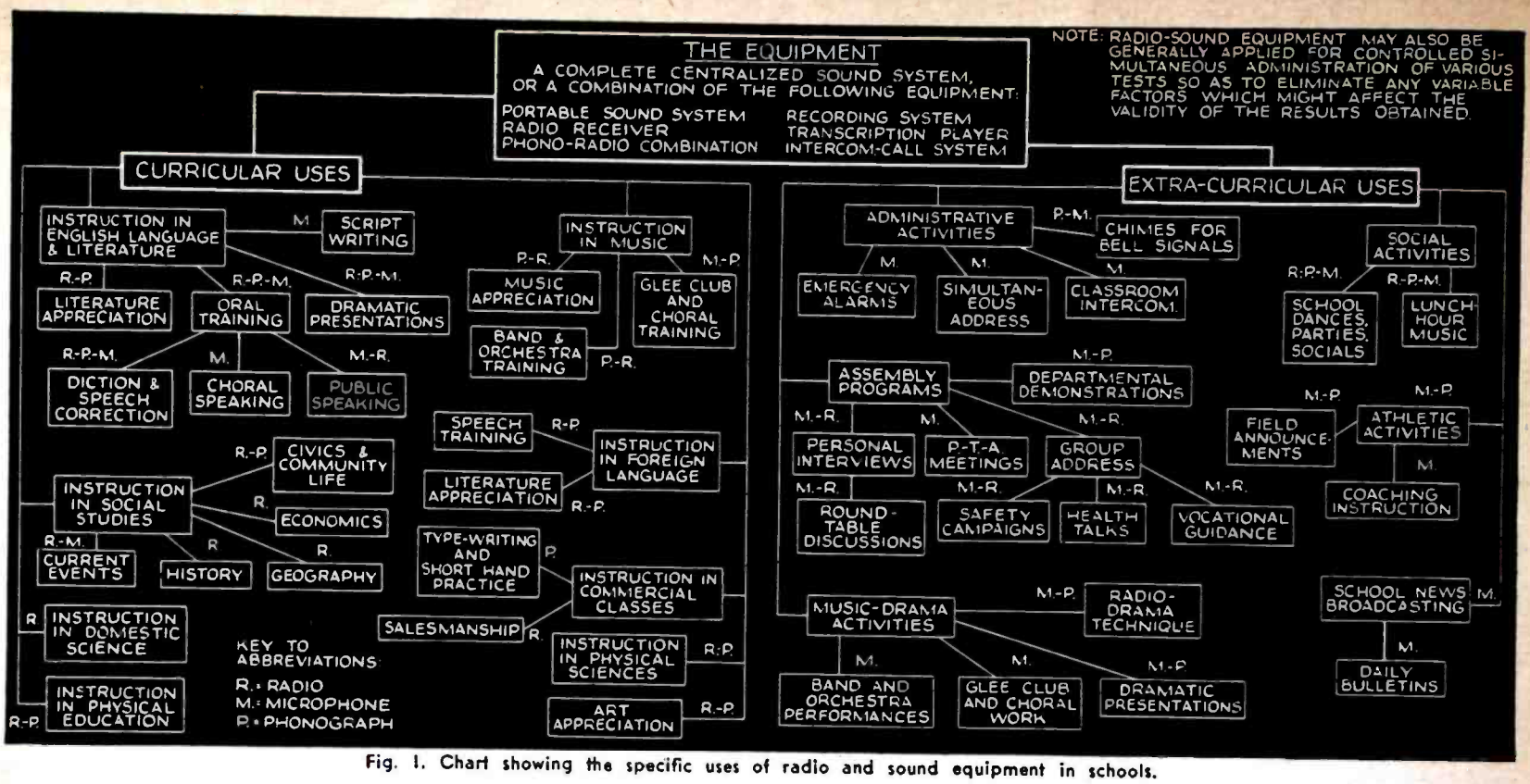

Fig. 1. Chart showing the specific uses of radio and sound equipment in schools.

WIRING SCHOOLS FOR SOUND

"Thousands of schools . . . will obtain their radio and P.A. equipment this very summer," says the author, a radio and sound engineer.

L. M. FEILER

Fig. A. The central control unit usually located in the principal's office. Note the radio dial.

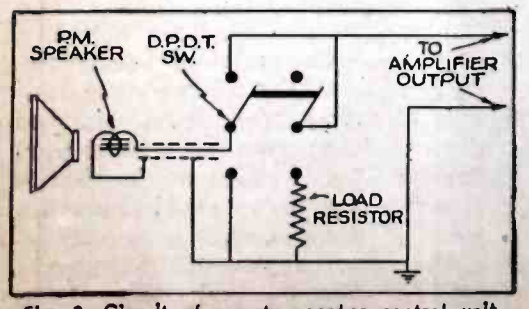

Fig. 2. Circuit of remote speaker control unit.

IN selecting proper equipment for a school radio sound system, the first requisite is a complete knowledge of the requirements to be filled by such equipment. The chart in Fig. 1 shows the many uses to which this type of equipment has been successfully adapted.

For the average high school installation, a central control unit is usually located in the principal's office, with loudspeakers in the classrooms, gymnasium, auditorium, cafeteria, etc. Provision is made for the selection of microphone, radio, and phonograph. The larger installations sometimes have several channels, allowing simultaneous selection of two or more programs to be reproduced by independent groups of speakers. A typical central control unit is shown in Fig. A.

After the complete requirements have been determined, it next becomes necessary to choose an amplifier, having sufficient power output for proper sound distribution, taking into account losses in lines, transformers, etc. The following power levels have been found to serve best:

Service	Power (Watts)
Classrooms	1
Study halls	2
Laboratory and lecture rooms	1
Small auditoriums	3 to 5
Large auditoriums	7 to 10
Small gymnasiums	3 to 5
Large gymnasiums	5 to 7
Cafeterias	5 to 10

CHOOSING THE LOUDSPEAKER

It is standard practice to use 6- or 8-in. permanent-magnet dynamic speakers for the classrooms. Complete units, housed in scientifically designed, attractive wall-mounting cabinets are available. Such units are designed to be especially effective in the frequency ranges which give most intelligible speech and music reproduction.

In the construction of the cabinets, only sound radiated from the front side of the speaker diaphragm is directed into space, since the speaker is enclosed in a rigid enclosure. This results in improved performance in the frequency range, extending from 400 cycles well up into the higher frequencies. Proper enclosure design and placement of absorption material effectively controls higher frequency resonance. The usual resonance in the 110- to 160-cycle range, which causes the familiar "boominess" in improperly-designed baffles, is entirely eliminated, because the rigid enclosure allows no uncontrolled mass of air to escape. This advantage further makes the location of the speakers entirely independent of surroundings.

Where cost is the deciding factor, baffles constructed of plywood are used. A neat job will result if the finished cabinet is sanded and then stained to match the woodwork in the rooms. This should be followed by 2 or 3 coats of "gymnasium floor finish" (spar varnish), rubbed down with steel wool, resulting in a hard glossy finish.

(Continued on page 127)

MICROPHONES EXPLAINED
FOR BEGINNERS

Fundamental principles of operation of every basic type of microphone in general use today are described. Construction details of high-quality units are illustrated.

THE 5 most common types of microphones used for P.A. systems and broadcast studio work are:—the *carbon, condenser, ribbon* or *velocity, dynamic* or *moving coil,* and *crystal.* Each one has its advantages and disadvantages and so we shall consider each type in the order named.

CARBON MICROPHONES

The carbon microphone depends for its operation on the varying resistance of a carbon element when subjected to varying pressure.

The usual arrangement of this type unit, for best fidelity, consists of 2 carbon buttons one on either side of the diaphragm. This metal diaphragm—in a properly-built carbon microphone—is stretched and air damped so that the effects of self-resonance vibrations are negligible, giving a reasonably uniform output at all ordinary audio frequencies.

This unit has the disadvantage of a background noise called "carbon hiss," which is caused by the passage of current through the granules. It has a high maintenance factor and must be handled with care. On the other hand it has the advantage of a very good power output level of -30 db., together with low output impedance, making it possible to have the microphone some distance from the amplifier. See Fig. 1, A and B.

CONDENSER MICROPHONES

The diaphragm of the condenser microphone constitutes one of the plates of a variable air condenser, while the back plate, which is separated from the diaphragm by a film of air about 1/1,000-in. thick, acts as the other plate. See Fig. 1C. Capacity variations of this condenser, in series with coupling condenser C, develop minute A.F. voltages which are then amplified by a 1- or 2-stage "head" amplifier. In actual practice, the condenser and head amplifier (or "preamplifier") are all housed in the same case and the whole unit is called a condenser microphone.

After the signal leaves the head amplifier, it has about the same output level as that of a double-button carbon type. The same principle of stretching and damping the diaphragm is applied to the condenser type as is used in the carbon microphone, thus giving about the same fidelity of output. However, there is a noticeable absence of background hiss, and the ruggedness of the unit is a decided advantage.

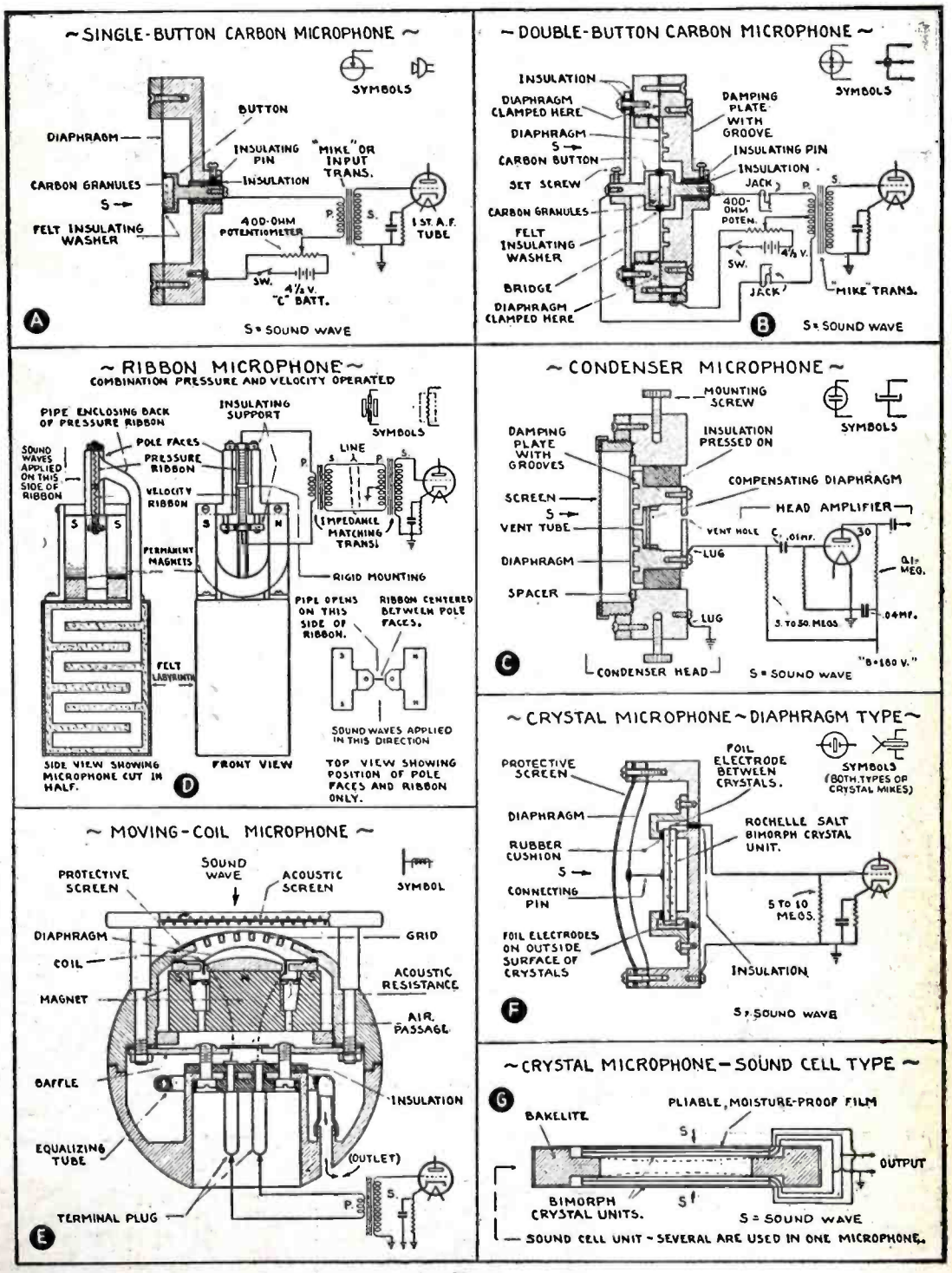

Fig. 1

RIBBON OR VELOCITY MICROPHONES

The ribbon-type microphone is so named because the armature is a light corrugated ribbon of aluminum alloy. See Fig. 1D. This type is also called a velocity microphone because the voltage induced in the ribbon is proportional to the instantaneous velocity of the air in the sound wave. The aluminum ribbon is suspended in the field of a permanent magnet and when sound waves strike the ribbon it vibrates, cutting the magnetic lines of force.

Whenever a moving conductor cuts lines of magnetic force, an electromotive force is induced in the conductor. Thus in this case we will have set up in the ribbon a small e.m.f. whenever it vibrates. Since the mass of the ribbon is extremely low, an excellent frequency response is obtained, extending well beyond the upper limits of the regular stretched-diaphragm-type microphone.

(Continued on page 118)

HOW TO MAKE A COMBINED HEARING-AID AND INTERPHONE

Something new! An Electric Hearing-Aid, Detective-phone and Inter-office Telephone—all in one unit. New "audio A.V.C." circuit eliminates blasting on loud sounds.

C. W. PALMER, E.E.

AIDS to the hard-of-hearing have achieved quite useful results in the past, especially those devices which depend on electronic means for sound magnification. In many cases people who imagine they are "stone deaf" find that they have no difficulty carrying on a conversation by using a "hearing-aid" having tubes and batteries.

Amplifiers have been developed and employed in offices, churches, theatres, and such places where near-deaf people may have need for hearing-aids. Permanent installations have been put in many theatres and churches while portable units are used by many thousands in their daily work. Hearing-aids are also used to permit near-deaf people to hear radio programs from radio sets which are operating at normal room volumes. It also aids thousands of handicapped business men and executives (as shown above) to carry on their business same as usual.

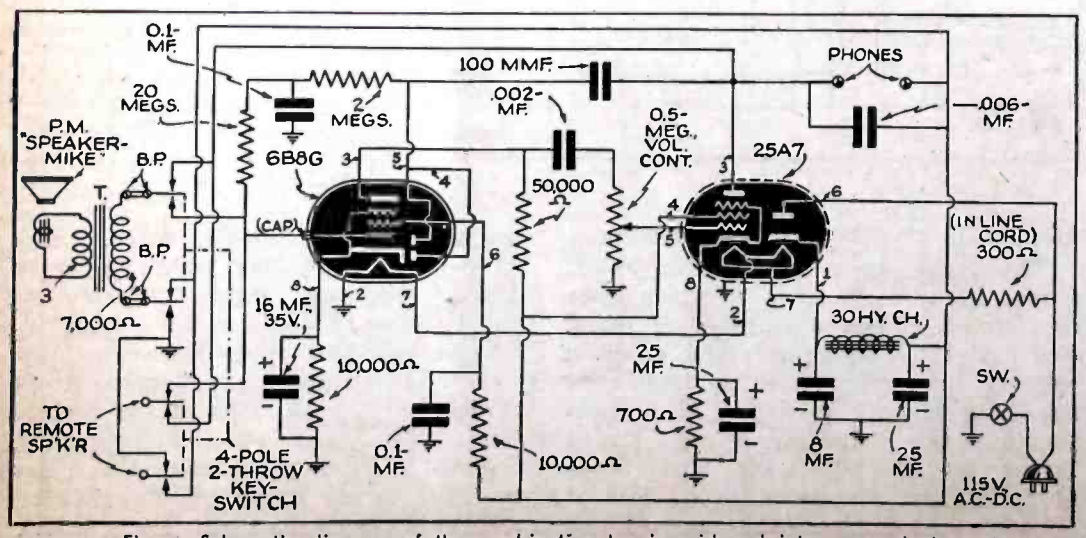

Fig. 1. Schematic diagram of the combination hearing-aid and intercommunicator.

Where operation is desired in homes and offices the electric light lines can be used to advantage to conserve batteries (used in the usual type of pocket hearing-aids). Vacuum-tube amplifiers can increase the sound level to any desired value, and with low background noise.

The unit here described and illustrated (see Fig. B) incorporates the advantages of small size, adequate gain, low background noise and last but not least, it includes *audio automatic volume control.*

AUDIO A.V.C.

This "audio A.V.C." circuit permits weak, far-away sounds to be built up to the full extent of the amplifier, while loud noises and sounds are cut down to the level controlled by the position of a volume control which may be set by the user to suit the condition of his hearing. This A.V.C. action is very similar both in circuit and action to the A.V.C. systems used in modern radio receivers, except that instead of acting on R.F. or I.F. amplifiers, the gain control circuit is in the audio amplifier of the unit under description.

In designing the circuit (see Figs. 1 and 2) of this hearing-aid, advantage was also taken of several other factors

or applications which may logically be incorporated without much additional expense to the maker and yet greatly increasing the usefulness of the device.

INTERPHONE

First, a switch has been included permitting the permanent-magnet or "P.M." speaker to be connected to the output of the amplifier, using it as a speaker instead of as a microphone. This changes the unit into an effective audio-type *interphone* or inter-office telephone and several of these units can be used, for 2-way or "talk-back" operation, in an office or factory in just the same way as any of the commercial interphones now being made and sold.

DETECTIVE-PHONE

The permanent-magnet dynamic speaker has been mounted in a small box which can be detached from the amplifier and connected at a distance from the main amplifier, thus permitting the unit to serve as a "detective-phone"—by hiding the small microphone box in a room to be "watched."

HEARING-AID

The microphone may also be used at a distance from the amplifier when used as a hearing-aid, permitting the amplifier box to be placed in a desk drawer or other suitable place with only the microphone in view. Or, when listening to a radio program, the microphone can be placed near the radio loudspeaker, while the amplifier, with its volume control, can be placed next to the user's favorite easy chair.

Other applications equally as useful will, no doubt, be discovered by anyone using this versatile device.

THE CIRCUIT

An examination of the circuit in Fig. 1 shows that 2 tubes supply the action of 4 normal tubes—2 amplifier stages, 1 rectifier for power supply and 1 diode for A.V.C. rectification. The two tubes supplying this unusual combination of actions are a 12A7 pentode-diode and a 25A7 pentode-rectifier. The 12A7 pentode is the 1st A.F. stage, following the 3-inch permanent-magnet speaker which is applied as a dynamic microphone. This pentode is coupled to the pentode section of the 25A7 which acts as the 2nd stage of the 2-stage amplifier, feeding into either the hearing-aid phone or a bone-conduction unit, whichever is preferred by the hard-of-hearing person. A portion of the signal in the plate circuit of the 25A7 is fed back through a condenser to the diode section of the 12A7 where rectification takes place. The rectified signal is filtered through a resistance-capacity network and fed back to the grid-circuit of the 12A7 pentode section, thus changing the grid bias on this input tube.

The diode section of the 25A7 tube supplies the rectification necessary for plate supply of the two tubes. The filaments of the two tubes are connected in series in the usual A.C.-D.C. practice. A low-resistance filter choke and two electrolytic condensers filter the rectified output to reduce hum level to a very low value.

Mechanically, the amplifier is built on a small aluminum chassis and is kept as small as possible for reasons of portability.

The permanent-magnet dynamic speaker is mounted in a separate box of the same cross-sectional dimensions as the amplifier box, but just deep enough to enclose the unit without the coupling transformer which is mounted on the amplifier chassis. This coupling transformer has a 3-ohm winding to match the voice coil of the speaker, and a 7,000-ohm winding to give a large voltage step-up and high impedance for feeding into the grid of the tube, yet sufficiently low to permit use in the plate circuit of the 25A7 pentode when used as an interphone.

The actual positions of the parts can be best determined in actual construction, as the spacing is very definitely limited and changing even one or two parts will prevent the dimensions shown from being used.

The illustrations show in general how the parts are laid out and will be a useful guide to the constructor in making a similar unit. The unit is housed in a small wooden box of the indicated dimensions (see Fig. 3). This box can be made from several empty cigar boxes or from any suitable thin wood. The outside can be painted, stained or—as in the original model—covered with leather. The latter makes a neat appearance which is also durable.

In wiring the unit, care must be taken to keep grid and plate leads separated and far away from any of the A.C. wiring, in order to keep the hum level at a minimum. Wire the circuits which pass through the chassis, first, then add the various condensers and resistors required. The following parts were used in the original model of the unit.

LIST OF PARTS

One Utah 3-in. permanent-magnet dynamic loudspeaker;
One speaker coupling transformer—midget type, 3 ohms to 7,000 ohms;
One Arcturus type 12A7 tube;
One Arcturus type 25A7 tube;
One midget-type low-resistance 30 hy. choke;
One Cornell-Dubilier midget tubular 8 mf. 200 V. electrolytic condenser;

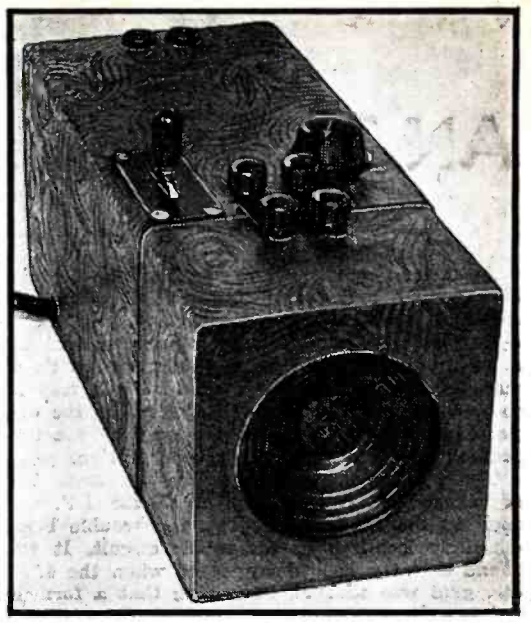

Fig. B. Appearance of the hearing-aid. The 3-in. P.M. dynamic speaker is also the microphone.

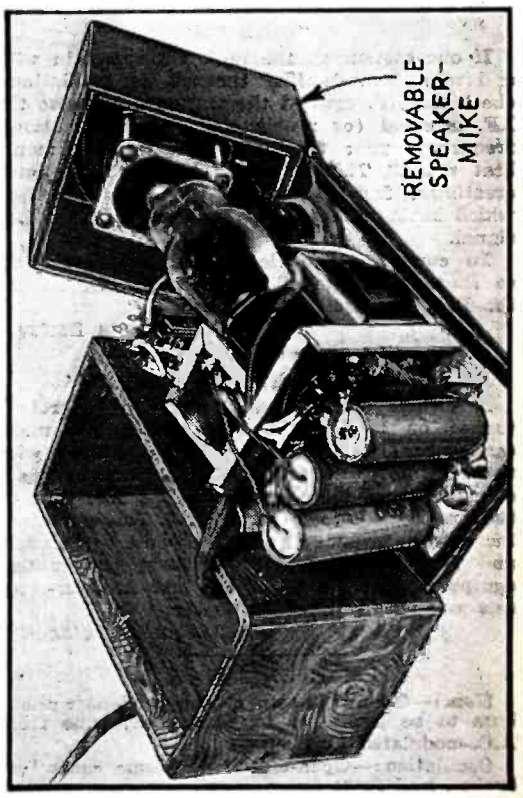

Fig. D. The hear-aid chassis out of its container.

One Cornell-Dubilier midget tubular 16 mf. 200 V. electrolytic condenser;
One Cornell-Dubilier midget tubular 25 mf. 35 V. electrolytic condenser;

(Continued on page 123)

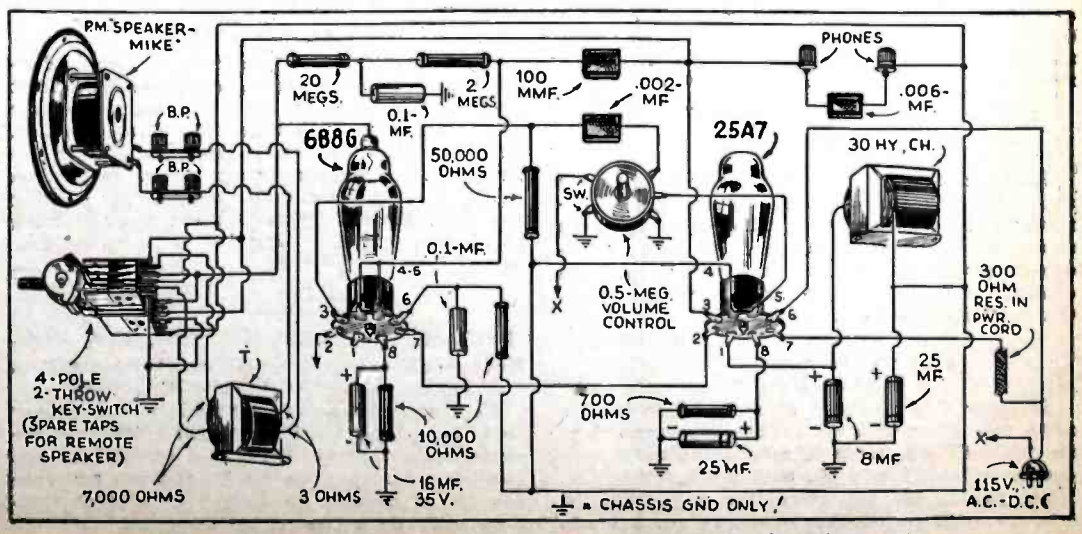

Fig. 2. Pictorial diagram of the compact hearing-aid and interphone unit.

OPERATING NOTES
ANALYSES of RADIO RECEIVER SYMPTOMS

PHILCO 38-14T

An intermittent hash or roaring noise, which completely obliterates any received signal may be caused by the shorting of the high-frequency condenser at an audio rate. An ohmmeter will not show up the condition as the inherent inertia or time lag of the meter movement will not respond to fast current impulses. Disconnecting the suspected condenser is about the only satisfactory method of determining its true condition.

The symptoms were puzzling at first. The signal generator was applied to the I.F. and then to the 1st-detector grid, the trouble being definitely localized in the mixer circuit. It was found that the hash disappeared when the 6A8G osc. grid was shorted, indicating that a form of noise modulation in the grid circuit was responsible for the distortion, this modulation being generated by the shorting condenser.

Filings or punctured mica will cause this fault.

WILLARD MOODY

"BIRDIES"

If one station on the radio set comes in with a birdie (sounds like the set is oscillating) check the I.F. against the station's. If twice the I.F. is equal (or nearly equal) to the station's frequency, your trouble is "I.F. 2nd-harmonic beat notes." This is caused by the 1st-detector creating a 2nd-harmonic of the received station which beats with the oscillator to form an I.F. signal.

To cure this trouble shift the I.F. slightly so as to eliminate all beat notes, then realign the R.F. and oscillator sections.

LOUIS DENOV

ATWATER-KENT 165, 185, 525

If circuit oscillates when volume control is turned on full, replace the double 250 mmf. condenser (Atwater-Kent part No. 33630) with two 250 mmf. bakelite condensers. This condenser connects from the plate of the 58 I.F. tube to the circuit diode plates of the 2A6. This condenser increases in capacity enough to cause this trouble and is difficult to locate without proper test equipment. Nearly all of the late Atwater-Kent sets use this type of condenser.

EUGENE MCCULLOCH

EMERSON MODEL 26

Hum:—Open grid-return filter condenser allows hum to be impressed on grid of .47 tube from A.C.-modulated bias supply.

Oscillation:—Open-circuited volume control or broken lead from antenna coil to volume control resulting in high gain and regeneration in the R.F. amplifier. Open cathode or screen-grid condensers in the R.F. stage. Coupling between R.F. and detector grid wires.

To completely eliminate oscillation when the volume control is at maximum and the antenna is disconnected, increase the cathode condenser to 0.2-mf. and the screen-grid filter of the 58 R.F. to the same value. Also, shunt the screen to ground with a 16 mf., 200 V. unit.

The control-grid lead of the 57 detector should be re-routed directly to the top of the gang condenser. A shielded wire is used, of course. The shielding is soldered to the tuning condenser frame and to the tube shield compartment.

WILLARD MOODY

CROSLEY SETS

We have found on the Crosley Fiver, Firestone and other sets similar to these, that are manufactured by Crosley, that what appear to be a noisy tube, loose connection or burred condenser plates are all due to improper ground connections on the tuning condenser rotor shaft. Ground with small piece of flexible wire.

EUGENE F. WILLIAMSON

MOTOROLA 75

Recently this receiver, after being in service for a few years with no trouble was repaired by an "expert," who replaced a defective buffer condenser 0.01-mf., 1,600 V., with a 0.1-mf., 600 V. After paying the bill which was not small, the customer had trouble-free operation for 3 weeks when the set was brought to me "dead." The trouble was easily spotted. The replacement had broken down and caused a complete short of the transformer. By putting in the proper replacement this set operated beautifully and should give long, trouble-free service in regard to this particular repair. There is a moral to this little story that all Service Men should abide by. Don't try to put something over on a customer. He eventually learns and the harm to your business, to say the least, is great.

W. B. HEATH

CANADIAN WESTINGHOUSE 512

After trying all the usual tricks, a most annoying and baffling source of oscillation in a Canadian Westinghouse 512 Series receiver was finally found to be due to an open connection between the No. 1 base-pin and shell of the 6L7 tube. The trouble was discovered simply by jabbing a screwdriver between a scraped spot on the 6L7 shell and the receiver chassis.

DeFOREST CROSLEY 851

(Using Old-Style Glass Tubes)

When replacing these tubes with the later-style tubes having a different shape, don't waste time trying to rehabilitate the weird and wonderful tube shields for use with the new tubes. Place them firmly in the ash-can and substitute "goat" shields of the correct size. After you have adjusted this matter you will frequently find that reception is extremely weak and distorted. Plug your analyzer into the 1st audio stage. If there is little or no plate voltage and zero grid volts, look at red resistor (25,000 ohms, on rear resistor strip). This will be slightly charred, the result of an extremely leaky or shorted A.F. bypass condenser. Replace both resistor and condenser, the latter with a 0.25-mf., 400-V. unit.

SERVICE MEN—

What faults have *you* encountered in late-model radio sets? Note that *Radio-Craft* will consider your Operating Notes provided they relate to CHARACTERISTIC *(repeatedly encountered)* faults of a given set model. Payment is made after publication of the Operating Note.

STEWART-WARNER MODEL 33K "KING"

When the complaint is the common one of noisy, erratic or intermittent reception, always check for defective mica condensers. Also check for carbon resistors which have (usually) *increased* in value; one 500-ohm resistor recently tested had increased to 2,000 ohms! Also bond the rotor of the variable condenser to ground (chassis) with flexible insulated wire.

MARCONI 83

When the 3/16-in.-wide copper ribbon dial-drive cable breaks, as it often does within a short time in this set, a quick and excellent repair is effected by using a thin strip of soft leather, readily obtained from shoe repairers. Stretch the leather for a minute before using. It is then advisable to ground dial assembly by bonding bracket support, directly behind tuning shaft, to chassis.

G. ROGAL,
Paris, Ont., Can.

STEWART-WARNER 1845, 1855, 1865, 1866

Magic Keyboard Operating Data (Including Data on the Automatic Frequency Control)

We frequently receive complaints of improper operation of the Magic Keyboard Mechanism because dealers, Service Men and owners are not familiar with what the mechanism can and cannot do, or because of failure to read instructions, they do not set it up correctly.

For satisfactory Magic Keyboard operation, the following points must be carefully observed by everyone using, demonstrating or selling the Keyboard receivers.

(1) Often the mechanism is not locked up tightly enough after setting it up, thus the settings change as the set is used. After the last button has been released by pushing in and pulling out the set-up knob, turn the set-up knob to the left. The dial pointer will go to the left end of the dial scale. After this, keep *forcing* the set-up knob in the counter-clockwise direction. Force it just as hard as it is possible to do by hand.

(2) All automatic tuning receivers should be operated on a *good outside antenna* to give maximum signal strength. An inside aerial, while it may permit satisfactory reception for a manually tuned set will not provide sufficient signal to properly operate the A.F.C. during automatic tuning.

(3) Buttons should be set only to *nearby, powerful stations*, since Automatic Frequency Control cannot function properly unless the signal strength is good. Weak or fading stations should be tuned manually. If the user insists on setting up weak stations, he should be advised that automatic tuning of these stations is not as satisfactory as manual tuning.

(4) Before setting up, turn the receiver on for at least 20 minutes so that all parts are at their normal operating temperatures.

(5) In the Models 1865 and 1866, the tone control *must be in one of the first 3 positions* when stations are being set up. The 4th (fully-clockwise) position, broadens the tuning and so *must not be used during set-up.*

(6) After a button has been set-up and released, do not push this button again until the mechanism is locked up. *Do not try to check the setting of the buttons by pushing them in before being locked,* as this will change their setting.

(7) Tune very carefully when setting the stations, making use of the visual tuning indicator. When releasing the last button by pushing in the set-up knob, do not turn the set-up knob. Push it straight in or you will destroy the setting of the last button.

(8) Do not set more than one button to the same station. When this is done, and if one, and then the other button is pushed, the mechanism will hum and the clutch will slip. The same thing may happen when the set is tuned manually to a station, and then the button for that station is pushed in. This difficulty causes no harm if another button is pushed to release the mechanism. Set up buttons from left to right, i.e., the right-hand buttons should be set up last.

STEWART-WARNER CORPORATION

ARVIN—618, 618A, 628, 628CS, 638, 638CS

Complaint, hum:—Locate ground lug on 6Q7G tube socket. This lug is fastened to the chassis by a rivet which attaches the 6Q7G socket to the chassis. Bend this lug over and solder to the chassis. Recheck for hum. If soldered properly the hum level will be very satisfactory.

ARVIN—818, 828, 828AT, 838AT, 838CS, 848CS

Complaint, hum:—Unsolder the 250,000 ohm plate resistor of the 6F5G tube from the "B+" terminal (lug on the 16-mf., 300-V. electrolytic condenser). Connect this resistor to the first tap down from "B+" on the voltage divider resistor, R87. This voltage tap supplies the potential for the 6A8G anode grid. Recheck for hum. This should reduce hum to a satisfactory level.

ARVIN—1427

Some of the 1427 models drift from one station to another 10 kc. off frequency. To cure, check the lower padder condenser strip to see whether it is a porcelain or bakelite base type. If this lower condenser strip is of the bakelite type, it should be replaced with one having a porcelain base.

NOBLITT-SPARKS INDUSTRIES, INC.

(Continued on page 119)

NEW ULTRA-FLEXIBLE P.A. AMPLIFIERS

A tiny preamplifier, and a tiny power amplifier, combine to produce a "clean" output of 20 watts.

McMURDO SILVER

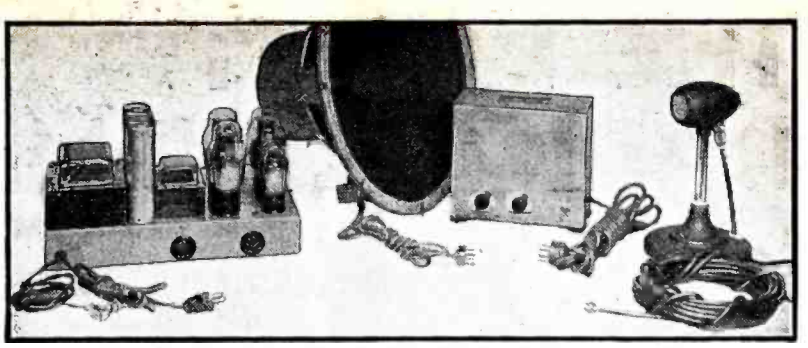

Fig. A. Complete ultra-flexible Public Address amplifier.

THERE are today a number of Public Address amplifiers available for almost any type of installation. Some are good, and excellently designed, and some produce only the raucous sounds heard in many a poor installation. In the main, price and maker's reputation are the best guide to quality. In the search for simplicity, however, *user's convenience* has been noticeably neglected, and the usual installation generally consists of microphone or other input devices, a single amplifier unit embracing all functions of pre-amplification, voltage amplification, power amplification, volume and mixing control, and maybe tone control, which then feeds a combination of loudspeakers.

In many cases this multi-function single amplifier unit is an excellent choice, but it does not possess certain very desirable features of inherent flexibility which permit it to cope with many specialized installations. For example, if it is split up into separate units of *preamplifier* and *driver*, power amplifier flexibility is tremendously improved.

Under this desirable condition, volume and mixing controls can be located where most convenient, can be duplicated at as many positions as desired, and power output and number of speakers may be easily increased or decreased through adding or removing power amplifiers and speakers whenever this becomes desirable or necessary. Through such amplifier handling the very maximum of flexibility may be had for each individual installation, which can easily be altered without obsolescence at any future time and definite design benefit of isolation of preamplifier and power supply circuits obtained.

(Continued on page 112)

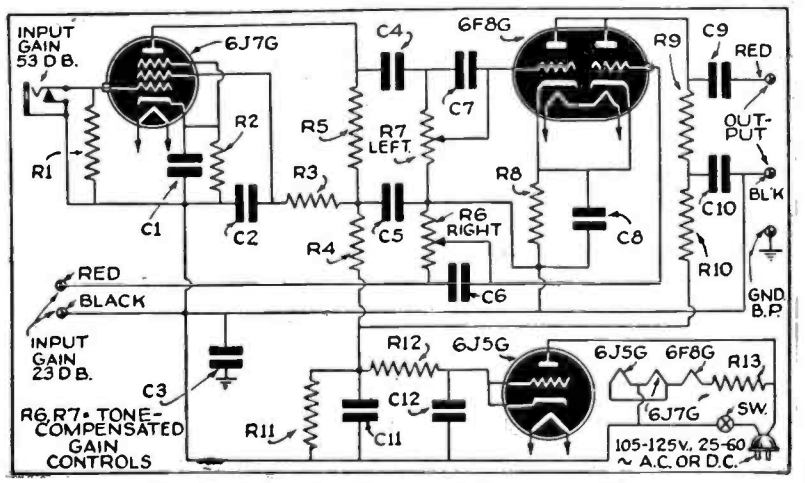

Fig. I. Schematic diagram of the preamplifier.

R1—2 megs.	R6 —1. meg.	R11—20,000 ohms	C3—0.1-mf.
R2—3,600 ohms	R7 —1. meg.	R12—4,000 ohms	C4—0.003-mf.
R3—1½ megs.	R8 —1,200 ohms	R13—165 ohms	C5—0.25-mf.
R4—20,000 ohms	R9 —20,000 ohms	C1 —5 mf.	C6, C7—100 mmf.
R5—0.25-meg.	R10—20,000 ohms	C2 —0.25-mf.	C8—5 mf.

RADIO WITTIQUIZ

FREE — A 1-year subscription to RADIO-CRAFT *to each person who submits a Wittiquiz that in the opinion of the Editors is suitable for publication in* RADIO-CRAFT. *Read the following Wittiquizzes; can* you *spot the correct answers? Now send in your idea of one or more good Wittiquizzes.*

(99) A *voice coil* is—

(a) A funnel-shaped piece of metal that directs sound from a magnetic speaker (sometimes called a horn). (b) A low-resistance coil placed at the apex of the cone in a dynamic speaker. (c) Certain vocal cords surrounding the Adam's apple.

AUSTIN METCALFE,
Sask., Canada

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(100) *Electrons* are—

(a) Small germs which jump from the hot filament in a vacuum tube to the plate because the plate is more comfortable. (b) Held for the purpose of putting persons into public office. (c) One of those particles projected from the cathode of a vacuum tube.

(101) Is a *trickle charge*—

(a) The state tax which we pay when we buy something? (b) A small electric charge to maintain the voltage of a storage battery? (c) The money that we pay for electricity that is lost due to a leaky filter condenser in a radio set?

JOHN PÉNAZ

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(102) A *static machine* is—

(a) A stabilizer device used in a radio set to minimize the effects of static. (b) A machine which produces electromotive force by friction. (c) Any person who is a gossiper.

(103) The *hydrometer* is used—

(a) To measure the gravity of the solution of a storage cell. (b) To test a condenser. (c) In the construction of radio test instruments.

(104) *Thermal agitation* is—

(a) A term used in connection with the measurements of heat units. (b) The heating of the I.F. transformer which broadens the frequency response. (c) Free electrons moving around at random continually in any conductor, producing tiny electron currents. (d) The heat produced in vacuum tubes, which is responsible for the blue glow which is emitted in proximity to the tube electrodes.

(105) A *solenoid* is—

(a) An electromagnetic relay used in television to keep the sawtooth waveform in synchronism with the incoming signals. (b) A byproduct of the celluloid industry. (c) The choke coil used in the rectifier circuits of test instruments. (d) A helix consisting of a number of turns through which current flows.

CLEO JONES

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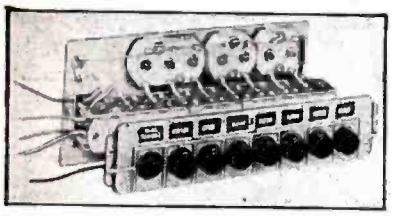
(106) In radio reception the so-called *mixer* simply is—

(a) The 1st R.F. tube in a 3-stage tuned-radio-frequency receiver. (b) A studio master control man who mixes two or more separate programs on a pair of lines simultaneously. (c) The 1st-detector, in superhet.-type receivers, which detects at the same time the out-

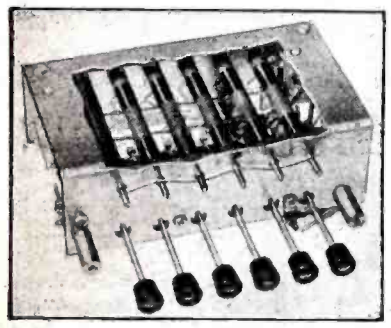
(Continued on page 124)

THE LATEST RADIO EQUIPMENT

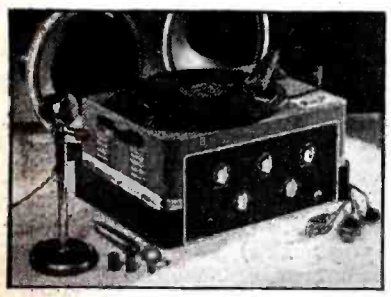
Manufacturers are invited to utilize these columns to bring improvements and new devices to the attention of technicians interested in every phase of Radio, Electronics and Public Address.



Button-tuner uses trimmers. (1640)



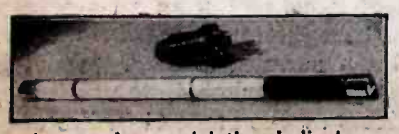
Button-tuner uses individual oscillator coils. (1641)



Combined turntable and 25-W. P.A. system. (1642)

Five-meter converter gets television signals. (1643)

Latest hi-fi set and remote tuner. (1644)



Inexpensive modulation indicator. (1645)

PUSHBUTTON "TRIMMER-IN" (1640)

(Meissner Mfg. Company)

UNLIKE preceding types of push-button tuners which tuned-in stations independently of the set's tuning condenser, this new unit requires the set's regular tuning condenser (left set at minimum wavelength), and then "trims-in" any one of 7 pre-set stations. An additional button reverts the set to manual tuning. This attractive unit mounts either vertically or horizontally; and may be used on either T.R.F. or superhet. receivers.

INDUCTANCE-TUNED PUSHBUTTON TUNER (1641)

THE PBH tuner is an automatic device designed for a superheterodyne receiver with an I.F. of 456-465 kc. This unit consists of 2 circuits, antenna and Colpitts oscillator, adjustments being made from the front; *both* circuits are tuned *simultaneously* by a single adjustment. The use of individual oscillator coils for each pre-set station instead of trimmer condensers, eliminates frequency drift. Inductance padding is provided which permits 3-point alignment crossover over the band. High-gain coils are used.

The unit has 6 buttons and provides band coverage as follows: Buttons 1 and 2, 1,630-945 kc.; buttons 3-4-5-6, 1,070-540 kc.

25-WATT SOUND SYSTEM (1642)

(Allied Radio Corp.)

NOT ONLY is it designed to operate with highest efficiency from either a 6-V. storage battery or any 110-V., 50/60 cycle source, but furthermore, this new sound system includes a turntable which (presumably) may be operated on the same current supplies.

The basic circuit incorporates 4 high-gain stages using 2—6J7G, 3—6N7G, 2—6L6G, 2—0Z4 tubes. Features include: inverse feedback, 2 universal microphone input channels, dual phonograph input, separate volume controls for phono and microphone input, dual tone controls, built-in power supply, multiple speaker selector switch. A special crystal microphone and two 12-in. P.M. dynamic speakers complete the set-up.

"TELEVISION" CONVERTER (1643)

TO RECEIVE ultra-high frequencies in the wavelength range of 4.75 to 12 meters, the 25 to 63 megacycle converter here illustrated has just been released. This range of course includes the spectrum of ultra-H.F. experimental television broadcasters; the high-fidelity audio channel of these stations thus can be heard on standard broadcast receivers!

Incorporates 3 metal tubes and operates on A.C.-D.C. supply. Connects to the antenna and ground post of ANY broadcast receiver and should be a real money-making item for Service Men. Planetary reduction drive affords finer tuning. Multiple switch automatically connects antenna to either converter or receiver as desired. Tested by *Radio-Craft*, this instrument functioned quite perfectly; was originally designed to receive the high-fidelity audio programs of W8XWJ.

REMOTE-CONTROLLED HIGH-FIDELITY RECEIVER (1644)

(McMurdo Silver Corp.)

THE "ORPHEON," states the manufacturer, is a super-highfidelity T.R.F. radio receiver designed for that portion of the public interested only in the fine tone quality available from a few local stations (say, within 100 miles), in the frequency range of 500 to 1,650 kc. This range, you will note, includes the special high-fidelity channel between 1,520 and 1,600 kc. The peri-dynamic loudspeaker and 20-W. amplifier are located in the large Chippendale-styled console while the tuner unit, which may be placed at any convenient location in the room for remote tuning, is housed in a compact "jewel box" cabinet (dial graduations are "movie projected" onto a little window). The large console will also accommodate an automatic record-changer for those insisting upon a complete phono-radio installation.

INEXPENSIVE MODULATION INDICATOR (1645)

KNOWN as the Modulite, the device here shown has been designed as an inexpensive means of correcting over-modulation in ham transmitters. Modulite is a ½-in. glass tube, 12 ins. long, lined with a fluoroscopic material identical to that in a cathode-ray tube, and filled with inert gases and mercury. The bombardment of positive ions and the presence of ultra-violet resulting from ionization of the mercury cause the lining material to fluoresce, the rise and fall of the glow indicating relative modulation. Green glow indicates modulation is OK; red glow, over-modulation.

Over-modulation is instantaneously indicated by a red glow inside the tube above the higher band, and may then be easily corrected by the "ham."

The Modulite performs work hitherto accomplished only by means of oscilloscopes and other expensive equipment far outside the average ham's reach.

COMPACT VELOCITY MIKE (1646)

(Amperite Company)

IN SPITE of its small size, this velocity-type microphone—said to be the smallest complete unit ever made — is complete with output transformer, cable connector and switch, and also has the output (−70 db., open line) of the large velocity. It can, therefore, be used on all high-gain amplifiers.

Frequency response range is 60 to 7,500 c.p.s., ± 2 db. Can be used for speech or music and is obtainable in either low impedance (model ACL) or high impedance (model ACH). Although designed to fit the standard ⅝-27 microphone stand, it also makes an excellent hand microphone. The case is of molded rubber, trimmed with chrome. Size of head: 1¼ x 2⅜ x 1⅜ ins.

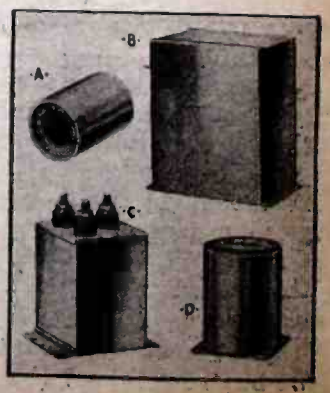
VACUUM THERMO-COUPLE (1647)

HERE illustrated is a thermo-couple which consists of a thermo-junction and a heater filament mounted in an evacuated glass bulb. These thermocouples are available in 2 types: the contact-type and the separate-heater type. In the contact-type the thermo-junction is in electrical contact with the heater element. This type can be used (with a suitable D.C. millivoltmeter) for measurement of D.C. and A.C., of any frequency up to 20 megacycles. In the separate-heater type the couple is separated from the heater by an insulating bead which, though it insulates the

Small velocity mike contains transformer and switch. (1646)

Sensitive thermocouple in evacuated tube. (1647)

New line of multi-matching transformers. (1648)



More parts available to television constructors. (1649)

2 circuits electrically, still maintains good thermal contact. This last can be used to great advantage for ultra-highfrequency measurements.

TRANSFORMERS FOR CLASS B USE (1648)

OF THE 3 additions to an already popular line of multi-matching transformers 2 of them are drivers for coupling a 500-ohm line to any class B grids. Their ratios are from 1:0.75 to 1:3.15, from primary to ½-secondary. One of them will handle 15 W.; while the other, 30 W. The third unit is used for coupling 6L6's as drivers to any class B grids. This unit also has a special tertiary winding to give 16.6 per cent reverse feedback to the 6L6's thereby making it possible to use their high-gain characteristics without the poor regulation which is inherent in these tubes when used as drivers. Ratios are from 1.5:1 to 3.5:1 and available with an audio capacity of 30 W.

NEW TELEVISION PARTS (1649)

(RCA Manufacturing Co., RCA Parts Division)

WITH the new television parts just announced, and other standard parts already available, it is now possible for the amateur experimenter who is equipped with sufficient technical knowledge, to assemble his own kinescope (television receiving tube) deflecting circuits for use in experimental television receivers.

The new parts listed for sale include (see photo) a deflecting yoke (A), 2 power transformers (B), a vertical-scan output reactor, vertical- and horizontal-scan oscillation transformers, a horizontal-scan output transformer, 2 power supply condensers (C), and a power supply reactor (D).

"HAM" TRANSMITTER FOUNDATION UNITS (1650)

THE FOUNDATION unit illustrated herewith makes possible efficient, compact and easy assembly of 600-W. amateur transmitters. All parts associated with the R.F. amplifier proper are joined together in one compact unit. It is a self-supporting unit mounted to a front panel which is of the standard rack and panel size. The unit illustrated is a class C R.F. amplifier.

NEW A.C.-OPERATED SERVICE OSCILLATOR (1651)

(Weston Electrical Instrument Corp.)

THIS 4-tube unit is equipped with a unique circuit providing *automatic amplitude control* at any required level from 1 microvolt to 100,000 microvolts (multiplier switch has x10, x100 and x1,000 settings). Its output characteristics are independent of any fluctuations in the 110-120 V., 60-cycle A.C. line. The new oscillator covers all frequencies from 50 kc. to 30 megacycles on the following 6 bands: 50-200 kc., 200-600 kc., 500-1,800 kc., 1.8-6.0 megacycles, 6.0-18 mc., and 18-30 mc. The 2-speed, direct-reading, 330° dial has 6 frequency scales, each of which averages over a foot in length; each scale is individually calibrated (in hundredths), with hand-drawn scale divisions. The manufacturer guarantees the accuracy of this instrument as being to 0.5 per cent of the indicated frequency on 3 I.F. and broadcast wavebands, and to 1 per cent on the 3 short-wave bands. The attenuator scale is calibrated directly in microvolts. Unit provides an R.F. output modulated at 400 cycles, continuous wave (C.W.) output, and audio frequency output at 400 cycles. A wobbler jack permits frequency-modulated input to the unit.

SOUND DEMONSTRATION KIT (1652)

SUITABLE experiments in sound waves of high frequency enable the student to secure a better understanding of the principles of wave motion (especially with regard to its optical analogs, in reflection, interference and diffraction, which assume such importance in, for instance, television). In all, about 30 experiments, both qualitative and quantitative, can be performed with the apparatus here illustrated.

High-frequency, sinusoidal sound waves are generated by a compressed-air whistle. The sound waves, after reflection, diffraction, etc., are located by a special pick-up and amplifier unit for visible indication on a cathode-ray oscilloscope.

This kit has been designed *only* for use by schools, colleges, etc.

NEW REMOTE CONTROL MEETS ANY CAR-RADIO NEED (1653)

THERE are 4,000,000 cars equipped with radio sets which are constantly being transferred to other cars. Heretofore, each transfer required a new control with an escutcheon kit to match the new panel. This new unit is claimed to eliminate this bothersome and expensive condition. For it is 100 per cent universal in every way, which is to say, its controls can be maneuvered to fit any panel opening in any car and its gearing arrangement provides all the necessary step-down ratios used in modern auto-radio receivers. These self-contained ratios are: 6:1, 8:1, 10:1, 12:1, 16:1, 20:1.

Escutcheon plates and knobs are available to match the trimmings of all cars.

NEW "DYNOPTIMUM" TUBE CHECKER (1654)

(Radio City Products Co.)

THIS tube checker—termed the "dynoptimum" by its manufacturer—it is stated tests all tubes under R.M.A. specified voltages and loads as approved by all tube manufacturers. This includes ballast tubes as well. Other tests provided are: hot inter-element short and leakage between all individual elements, hot cathode leakage test. It also tests each section of full-wave rectifiers, duo-diodes and other multi-purpose tubes. The unit employs a 3-in. scale d'Arsonval meter with an accuracy of 2 per cent. The scale is of the direct-reading "good-bad" type, colored for easy readibility.

NEW A.C.-D.C. OZONATOR (1655)

THIS "Hom-O-Zone" is an item with which the smart radio Serviceman can do considerable business; its transformer steps up the A.C. line voltage to a potential at which sparks will jump across multiple gaps (a D.C. model is available to accomplish the same result). This results in the production of ozone (O_3 or concentrated oxygen); the air of a room, by having thus become ozonated, is clarified of its content of impurities (tobacco smoke, odors, etc.).

A really handsome and utilitarian model is the type C Hom-O-Zone shown on pg. 120. It contains no moving parts; actually performs as claimed. Manufacturer states device *will not* create radio interference.

AUTOMATIC AND PORTABLE RECORDER-REPRODUCER (1656)

AN outstanding development in recording machines is shown on pg. 120. Among its *several* unique and important features are the following:

Switching from recording to reproducing, and vice versa, is accomplished in this machine automatically.

Also, the amplifier is automatically altered in its characteristics to suit the well-known individual and respective requirements for recording and playback!

The manufacturer further claims that the special belt-driven recording motor enables musical recordings to be made without wows or flutter. The recording mechanism allows any type of material to be cut. The loudspeaker, housed in the lid, may be removed for placing in the most advantageous location. Case measures 15 x 15 x 10 ins. high; weight of machine, about 35 lbs.

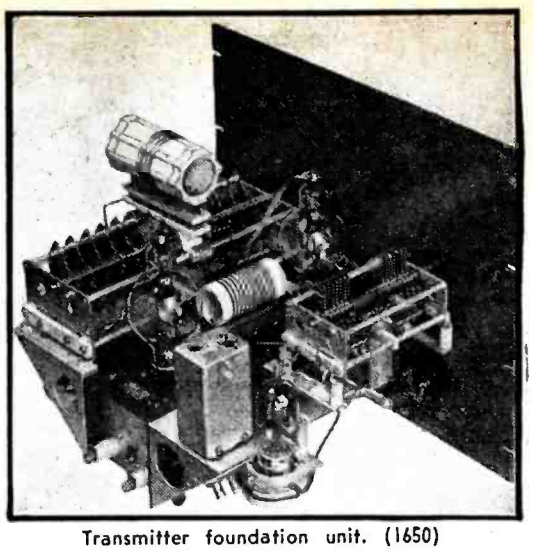
NEW RESISTORS (1657)

(Clarostat Mfg. Co., Inc.)

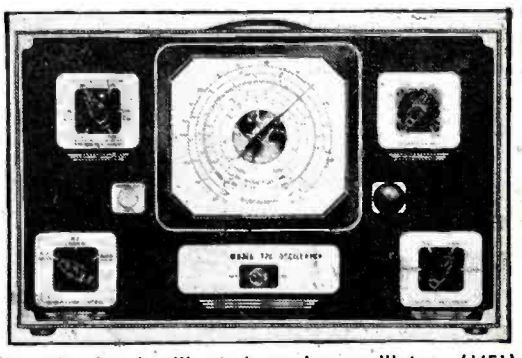
WIRE-WOUND fixed power resistors with a choice of 2 coatings have been announced; see photo-item A on pg. 120. Where dependable service even in the face of frequent overloads is required the *inorganic cement* type of resistor is recommended; the resistor may be operated at red-heat without blistering, cracking or deterioration. Resistance values, 1 to 50,000 ohms, and 10 and 20 W.

The *varnish-coated* wire-wound resistor affords maximum protection against extreme humidity as well as acid vapors or salt spray. This coating withstands continuous operation at greater power input than its watts rating, without the slightest deterioration. Resistance values, 1 to 50,000 ohms, and 5 and 10 W.

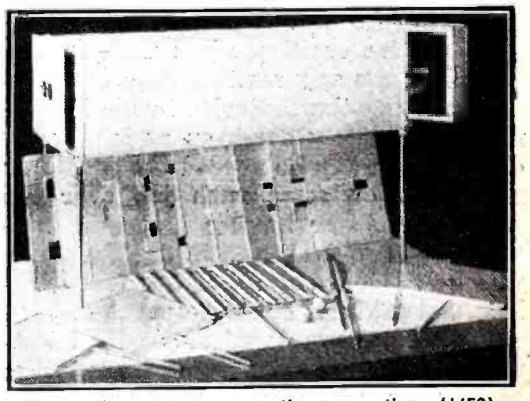
(Continued on page 120)



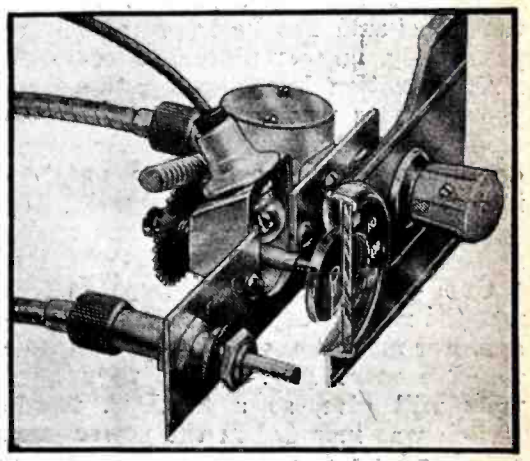
Transmitter foundation unit. (1650)



Versatile hand-calibrated service oscillator. (1651)



Kit to demonstrate acoustic properties. (1652)



New all-ratio auto-radio remote control. (1653)

A *"dynoptimum"* tube checker. (1654)

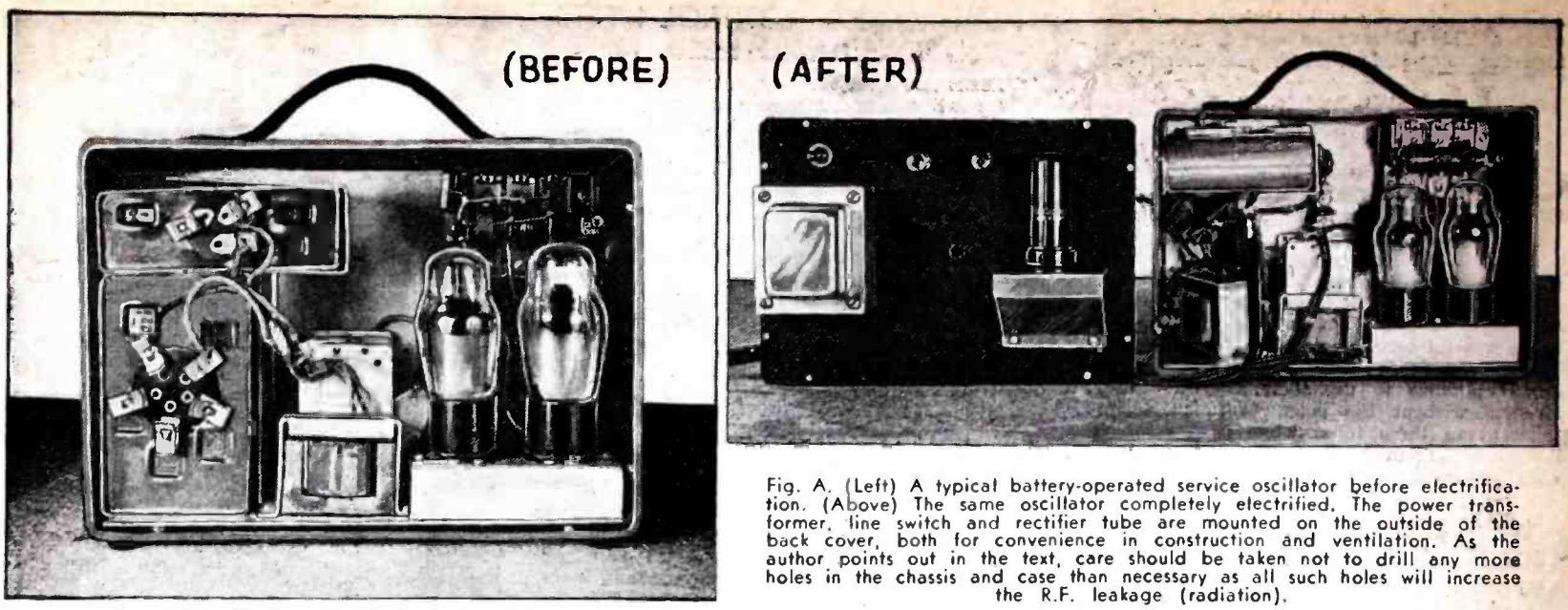


Fig. A. (Left) A typical battery-operated service oscillator before electrification. (Above) The same oscillator completely electrified. The power transformer, line switch and rectifier tube are mounted on the outside of the back cover, both for convenience in construction and ventilation. As the author points out in the text, care should be taken not to drill any more holes in the chassis and case than necessary as all such holes will increase the R.F. leakage (radiation).

ELECTRIFYING THE SERVICE OSCILLATOR

The utility of battery-powered service oscillators may be greatly increased at slight cost by modifying them for electric light line operation.

L. L. HOTSENPILLER

EVERY owner of a battery-operated service oscillator has undoubtedly had the aggravating experience of finding the batteries in his instrument completely dead, or at least way down, just when he needed the oscillator most, say on some rush job over the week-end. After having had this happen innumerable times we decided there was no reason why all of our test oscillators should not be A.C.-operated.

Since the large majority of all battery-operated oscillators use much the same tube layout and mechanical arrangement of parts, it was thought that it should not be hard to convert practically any oscillator to complete A.C. operation by following the same procedure as was used in our conversion of sets from battery to A.C.-D.C. operation. However, further analysis indicated the possibility of shorting the A.C. line. To avoid this a power transformer was included in our list of parts.

One other important improvement was the raising of the R.F. output voltage. For many tests it is often desirable to have more R.F. output than 22½ volts will give, so a S.P.D.T. toggle switch was included in the power pack to afford us the choice of either 22½ or 90 volts plate voltage. The switch can not be left on the high-voltage tap permanently as the R.F. output and leakage will be too high for work on some receivers. This maximum output voltage is extremely useful while making selectivity or A.V.C. measurements, or when working on badly aligned or extremely weak receivers. A pilot light should definitely be included in the oscillator when converted as this will eliminate the tendency to leave the instrument running overtime, and what is more important it should be possible to arrange some method of illuminating the dial scale. This improvement alone is worth the trouble of electrifying the oscillator, especially if you ever align car sets without removing them from the car (and who doesn't do this occasionally?).

List of Parts

Two 5-prong sockets;
Two National Union tubes;
One Allied power transformer;
One Radolek 30 henry choke;
Two Solar 8 mf. filter condensers;
One I.R.C. 10,000 ohm resistor, 2 watts;
One I.R.C. 20,000 ohm resistor, 2 watts;
One I.R.C. 25,000 ohm resistor, 2 watts;
One S.P.D.T. toggle switch;
Four Cornell-Dubilier 0.1-mf. condensers, 200 volts.

The circuit changes necessary are relatively few and are quite simple (see Fig. 1). The battery-operated tubes, usually type 30's, are replaced by 56's. The bias on the A.F. oscillator tube should be adjusted until the best A.F. waveform is secured. This can be done either by listening or by viewing the output wave with an oscilloscope. A value of 3,000 ohms is suggested for the A.F. bias resistor. No changes need be made in the R.F. oscillator circuit, the grid and plate leads merely being moved from the old 4-prong socket to the 5-prong socket of the 56 tube, the cathode of the 56 being grounded. The old filament switch is also to be replaced with a toggle switch in the A.C. line.

The exact placement of parts will depend upon the individual job. In general, though, the filter condensers, the choke and the voltage divider may be mounted in the discarded battery compartment, while the rectifier tube and the power transformer can most conveniently be mounted on the back of the instrument case. Figure A shows a typical oscillator before and after conversion. It is necessary to mount the rectifier tube on the outside of the box, due to the excess heat developed by the 5Z4. Care should be taken not to drill any unnecessary holes in the chassis as all such holes will increase the R.F. leakage. The above details should be adequate.

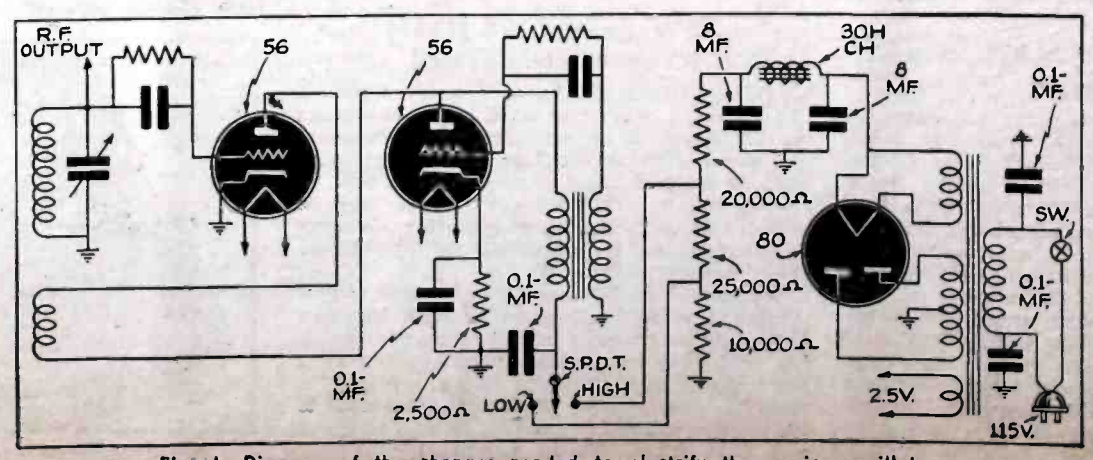


Fig. 1. Diagram of the changes needed to electrify the service oscillator.

Service Men may write, requesting answers to specific service questions. Address inquiries to Service Editor. For questions answered by mail, a service fee of 25c per question is made. Only questions of wide interest can be published.

SERVICING QUESTIONS & ANSWERS

Queries. . .

(62) John C. Wurst, Ochlochnee, Ga.

(Q.) I have in my shop one G.E. radio set model F-65 and one G.E. model E-76. Both of these set-circuits oscillate when the I.F. is peaked. When the I.F. is detuned enough to stop oscillation, the sensitivity is completely lost. Regardless of tuning or what-have-you, when the volume is only part of the way on, an audio feedback is present, but is absent when the control is on full or almost off. The squeal and feedback are present on the grid of the 1st A.F. tube. I have tried changing every tube, so that is "out". I have checked every coil, condenser, and resistor. All voltages check apparently correct. When the I.F. is detuned enough to get rid of the squeals, the audio feedback is present only on the two middle points of the tone control. I have checked and replaced all parts of this control except the switch. I even as a last resort, tried replacing some of the condensers and even the filter condenser. What is at fault?

(A.) In the G.E. models F-65 and E-76, oscillation, when the I.F. transformers are properly aligned, is overcome by redressing the leads in the I.F. amplifier. Clear all leads away from the plate leads of the 6A8 and I.F. 6K7 tubes. Dress these leads close to the chassis. A further remedial measure is to install an I.F. plate filter *within* the shield of the 1st I.F. transformer. This I.F. plate filter should consist of a 2,500-ohm carbon resistor connected in the "B+" circuit of the 1st I.F. primary and a 0.05-mf. bypass (400 volt) condenser from the coil side of the resistor to ground.

(63) Dave Jarvis, Blythe, Calif.

(Q.) I have in my shop an RCA receiver model R-76. The filter condensers were out so I replaced the entire condenser block. Now it works OK with the exception of the A.V.C. system. While the set is playing, if a crash of static no matter how weak comes in, it cuts out the whole signal for about ¼-second. All voltages read OK and I have tried putting the volume control in the 1st audio stage. This makes an improvement but isn't satisfactory.

(A.) In your letter you write that since the condenser block in an RCA R-76 receiver was replaced, the A.V.C. system has been faulty. The trouble described is unquestionably due to the time constant of the A.V.C. circuit, which has been altered, in all probability, with the condenser block replacement. We suggest following-through the A.V.C. circuit of the receiver with respect to all capacities. If possible, check the capacity of condensers connected from cathode of A.V.C. tube to chassis, from cathode to resistor junction in grid circuit, and from A.V.C. grid-return to chassis. These capacities are respectively, 0.5-mf., 0.1-mf., and 10. mf. Check also, the R.F. 1st-det. and I.F. grid filter condensers.

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(64) H. J. Preshinger, Geraldine, Montana.

(Q.) Two years ago I sold 3 General Electric model C-75 2-volt receivers; this model is a 7-tube receiver. Two of these sets were sold on the Flats, about 12 miles from the Highwood Mountains and the other in the foothills. ALL of these sets have a "s-h-h," that sounds like a gentle wind blowing through them. But the set sold in the foothills has become worse and it is now very objectionable. New tubes and all new batteries do not cure the trouble. All "B" batteries are Layerbilt type and the "A" is an Air Cell 600. The receiver works fine—all but the hissing, or s-h-h, noise in it. I have tested this set and gone over it thoroughly, and can find nothing wrong. Can you suggest anything that could be done to remedy the trouble?

(A.) From your description of trouble experienced with a G.E. C-75 receiver, it would seem that the "shush" or resonance hiss is due to insufficient antenna pick-up. We suggest a long aerial, erected as high and clear as possible, and a good ground connection.

Should this procedure fail to solve your difficulty, alignment of the receiver is in order. Check also the I.F. grid filter condenser connected from the I.F. secondary-return to chassis. An open-circuit in this unit will produce the condition stated.

---

(65) C. F. Long, Cresson, Pa.

(Q.) I have a Majestic model 181 in my shop with a noise condition that I cannot find; with the volume control full on, a very light tap on the set will make a loud noise in the output.

And I am almost sure the trouble is in the R.F. end of the set. The tubes have been checked for loose elements, and the socket prongs tightened up. I have removed the coil, and unsoldered each wire on the coils, to check for a break or poor soldering.

The voltage and current on each tube is OK and will not show any meter flicker when the

(Continued on page 121)

READERS' DEPARTMENT

Readers are invited to make this page their meeting place for the interchange of ideas and a frank discussion of problems and experiences, particularly those which affect the Service Man.

GRAND LEDGE, MICHIGAN

Gentlemen:—

Regarding the condenser tester by Mr. Chapman of Melfort, Sask., in the April, 1938, issue.

While the panel layout is fine, I believe Mr. Chapman has made an error which could cause considerable trouble, i.e., using bleeders to reduce the voltage at the normally high-voltage end of the supply. Mr. Smith's training taught me that this would overtax the rectifier tube and probably damage one or all of the following: the bleeder used to reduce voltage, the transformer or the choke.

I would suggest a bleeder with 5 or 6 adjustable taps and the total resistance to be of a value to allow a current flow of 15 to 30 ma.; approximately, 25,000 ohms, and the taps to be used for the various voltages.

Also note Mr. Chapman uses a single range, 0-10 ma. meter. It would be bad when testing a condenser having a leakage as high as 100 ma. on the initial voltage application. I would suggest shunts for additional ma. ranges such as 50—100—500 ma.

H. E. BECKER

MELFORT, SASK., CANADA

Gentlemen:—

I am in receipt of your inquiry of March 19 regarding condenser tester together with letter from Becker Radio Service of Grand Ledge, Mich. (Reprinted above—*Editor*)

Since I sent the article in question to your magazine, I have been doing some further work on the condenser tester. I found that what Mr. Becker says is quite true. The system I outlined at first puts a load on the power supply components which makes it necessary to use a power pack of very high output. This, of course, does away with the matter of compactness which is one of the essentials to make the outfit practical.

I reconstructed my tester and upon reading Mr. Becker's letter I find that the voltage divider system which he suggests is exactly what I found was necessary. When I reconstructed it I made use of several resistors in series which, of course, is the equivalent of the tapped voltage divider he suggests.

I regret that I had not discovered this error before sending my article in to you. I am enclosing herewith circuit diagram (see Fig. 1) with corrections which is for your benefit if you wish to use it for correction in publication.

The suggestion Mr. Becker makes in regard to the additional meter ranges is a good one and I am also including this in the corrected circuit diagram.

A. JAS. CHAPMAN

(Continued on page 125)

(Photo—Atlas Sound Corp.)

"Ringling Bros., Barnum & Bailey Circus" was more than just the name of a world-famous entertainment troupe to Kirk Fritz of Brooklyn, N. Y. To Kirk it meant dollars and cents—when he sold the circus on the idea of using Atlas *weatherproof* (marine-type) loudspeakers which could be hung outdoors and operated in all kinds of weather; and wherever ruggedness was needed. This feature helped Kirk sell the circus the entire associated sound system!

ARVIN MODEL 6 AUTO-RADIO SET

5-tube superheterodyne; pushbutton tuning (no dial at all); range, 1,540 kc. to 510 kc.; output, 3.3 watts; battery drain, 5.7 amperes.

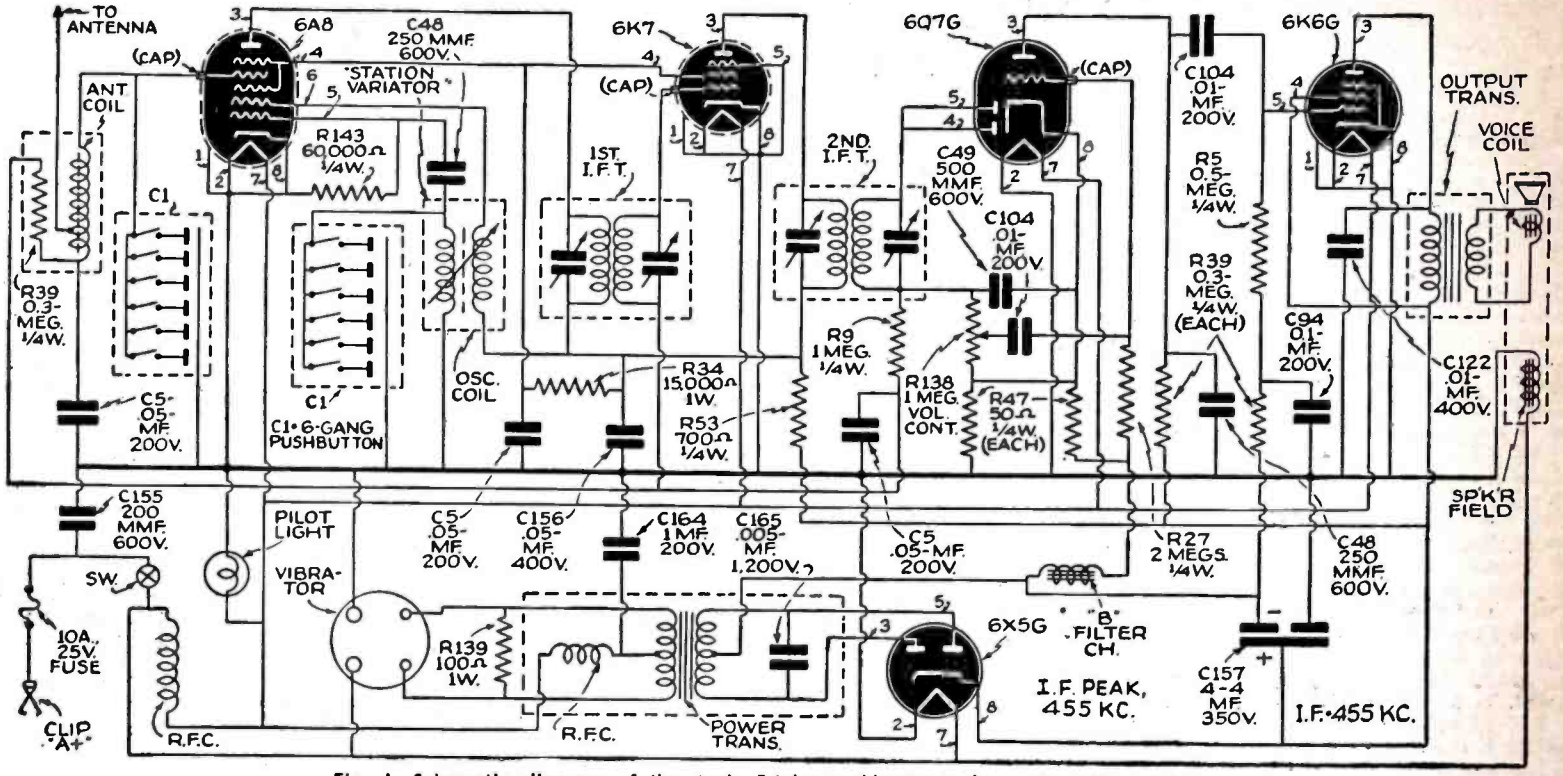


Fig. 1. Schematic diagram of the Arvin 5-tube pushbutton-tuning auto-radio receiver.

BALANCING INSTRUCTIONS

(1) Connect the balancing oscillator to the grid cap of the 6A8 tube through a 0.002-mf. condenser. Place a 0.2-meg. resistor between the grid cap of the 6A8 and the grid clip which normally fits on the cap of the 6A8 tube. This will maintain the grid bias on the tube during alignment.

(2) Adjust padders 1, 2, 3, and 4 for maximum output, at 455 kc.

(3) Rotate the Varíator shaft to its midpoint position;

(4) Reading from left to right the pushbuttons cover the following frequencies:

Button No.	Frequency Range	Oscillator Padder No.	Antenna Padder No.
A	1550-1050	5	6
B	1350-850	7	8
C	1350-850	9	10
D	1100-650	11	12
E	1100-650	13	14
F	950-510	15	16

Pushbutton frequencies are adjusted by the padder screws directly above and below each individual pushbutton. For example, suppose a station operating on 1400 kc. was desired; this is within the range of button A only.

a. Connect a balancing oscillator to the set antenna terminal through a 50 mmf. dummy antenna.

b. With an input frequency of 1400 kc., adjust padder No. 5 to resonance. Adjust padder No. 6 for maximum output. Follow the same procedure for any of the other buttons, always selecting a frequency within range of the respective buttons.

(5) Final adjustment of the antenna padders should be made with the receiver installed in the car connected to the car antenna.

SOCKET VOLTAGES

Normal filament voltage is 5.8 V. Plate voltages: 6A8, 190 V.; 6K7, 190 V.; 6Q7G, 120 V.; 6K6G, 187 V.; 6X5G, 215 V. A.C. Screen-grid voltages: 6A8, 90 V.; 6K7, 90 V.; 6K6G, 190 V. Cathode voltages: 6Q7G, 2V. Anode grid (1500-600 kc.); 6A8, 18.8 V. Grid bias: 6A8, 2.2 V.; 6K7, 2.2 V.; 6Q7G, 2 V.; 6K6G, 15 V.

POINT-TO-POINT RESISTANCES

All readings taken to ground unless otherwise specified; speaker connected and tubes in sockets.

6A8

Cathode	0 ohm
Screen-grid to "B+"	15,000 ohms
Plate to "B+"	700 ohms
Anode to "B+"	1.2 ohms
Oscillator Grid	60,000 ohms
Control-grid	2.3 megs.

6K7

Cathode	0 ohm
Suppressor-grid	0 ohm
Screen-grid to "B+"	15,000 ohms
Plate to "B+"	700 ohms
Control-grid	2 megs.

6Q7G

Cathode	50 ohms
Diode Plate	1. meg.
Control-grid	1.7 meg.
Plate to "B+"	0.8-meg.

6X5G

Cathode to "B+"	0 ohm
Plate	470 ohms

6K6G

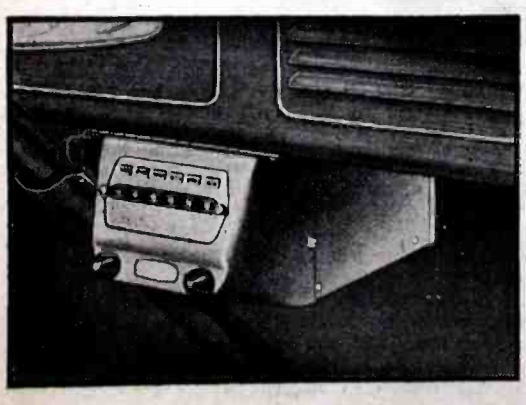
Cathode	0 ohm
Control-grid	800,000 ohms
Screen-grid to "B+"	0 ohm
Plate to "B+"	500 ohms

6X5G

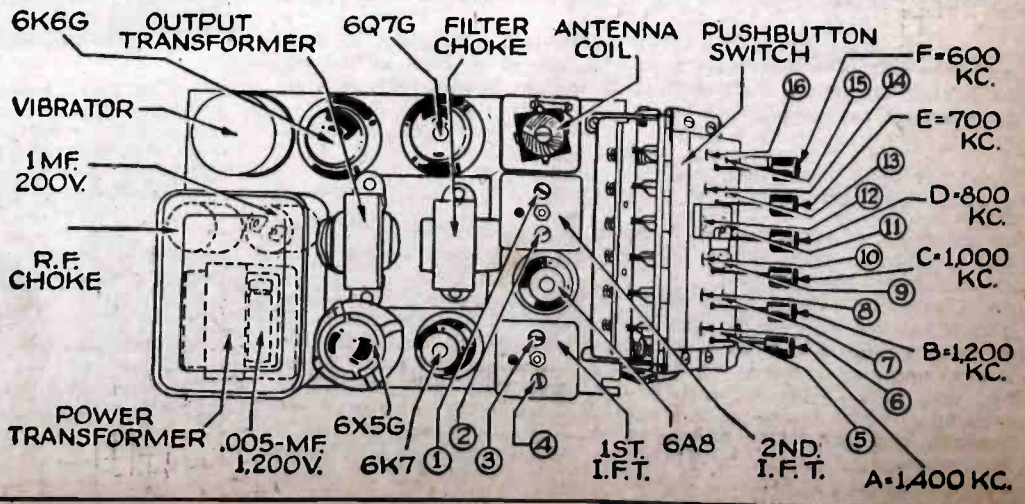
Plate	475 ohms

COIL, TRANSFORMER AND SPEAKER RESISTANCES

Antenna Coil Primary	1.1 ohms
Antenna Coil Secondary	1.7 ohms
Oscillator Variator Primary	1.2 ohms
Oscillator Variator Secondary	2.3 ohms
1st I.F. Transformer Pri.	12 ohms
1st I.F. Transformer Sec.	12 ohms
2nd I.F. Transformer Pri.	12 ohms
2nd I.F. Transformer Sec.	12 ohms
Output Transformer Pri.	500 ohms
Output Transformer Sec.	1.1 ohms
Power Transformer Pri.	250 ohms
Power Transformer Sec.	255 ohms
"B" Filter Choke	220 ohms



Above—Model 6 installed under dash. Right—Fig. 2; chassis view showing location of parts and trimmers.



EMERSON MODEL AZ-196 (CHASSIS AZ)

6-Tube superheterodyne; 2-bands (540 to 1,730 kc., 5.6 to 18 mc.); pushbutton tuning; "Miracle" Dial and Tone Chamber; A.V.C., power output, 5 watts.

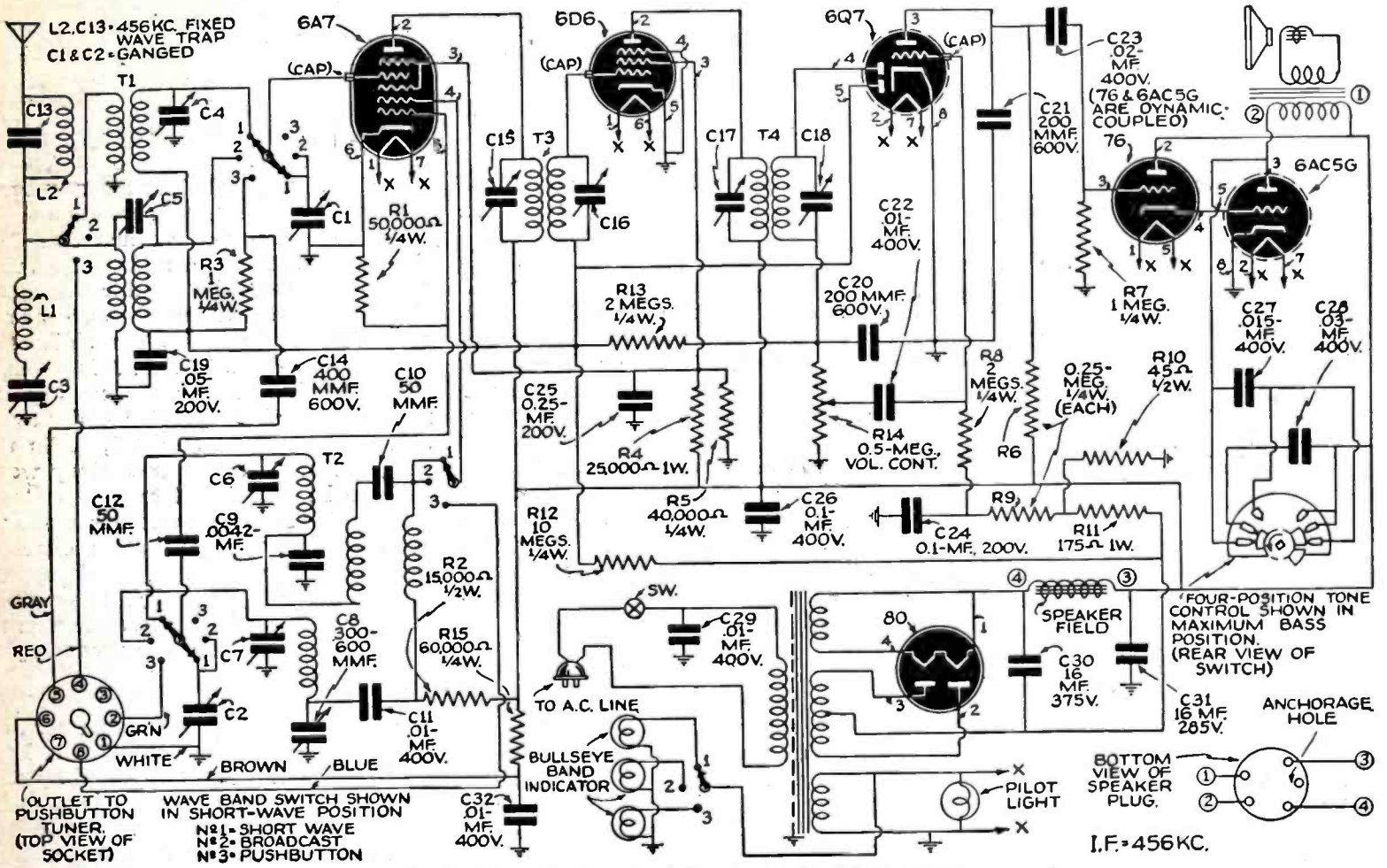


Fig. 1. Schematic diagram of Emerson Model AZ-196 receiver.

ALIGNMENT

To align the I.F. Channel, turn tuning condenser to minimum capacity, then feed 456 kc. through a 0.02-mf. condenser to the grid cap of the 6A7 and adjust the 4 I.F. trimmers for maximum response. To adjust the wavetrap, feed 456 kc. to the antenna through a 200 mmf. condenser and adjust the trimmer screw (rear screw beside the variable condenser).

To align the short-wave band, set the dial to 15 mc. Feed 15 mc. through a dummy antenna (400-ohm resistor), and adjust the S-W oscillator and antenna trimmers for maximum response.

To align the broadcast band, turn band switch to "broadcast" and set dial at 60. Feed a 600-kc. signal into the set through a standard dummy antenna (or a 200 mmf. condenser). Adjust the broadcast series padder condenser for maximum response. Rotate dial to 140 and feed a 1,400-kc. signal into the set. Adjust broadcast oscillator and antenna trimmers for maximum response. Repeat all operations.

ADJUSTMENT OF STATION BUTTONS

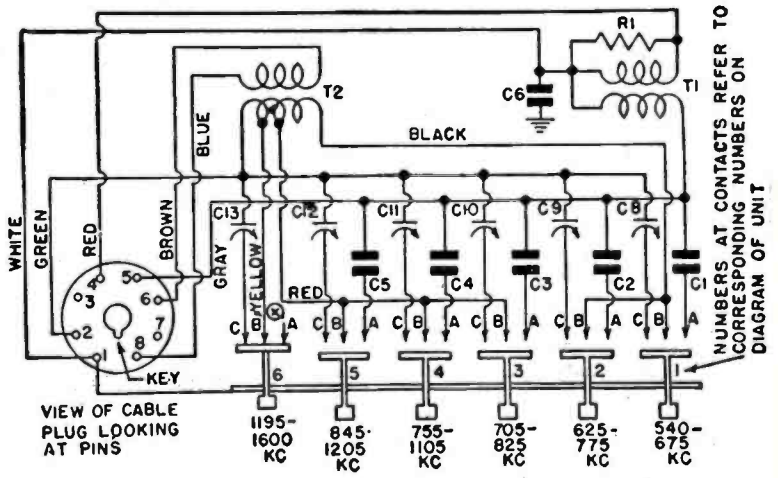
To align station buttons refer to Fig. 2 for frequency ranges; wait at least 15 minutes, after turning set on, to attain a uniform temperature. Turn waveband switch to broadcast reception and adjust station selector knob for desired station. Then turn waveband switch to "automatic" position. Outside-of-cabinet adjustment is provided by respective buttons having slots into which a thin coin will fit.

VOLTAGE ANALYSIS

Readings should be taken with a 1,000 ohms/volt meter. Voltages listed are from point indicated to ground (chassis). All readings except cathodes, heaters, and "B+" at rectifier were taken on 250-V. scale. Line voltage for these readings was 117.5 V., 60 cycle, A.C.

Tube	Plate	S.-G.	Cathode	Osc. Plate	Fil.
6A7	227	78	0	165	6.3 A.C.
6D6	227	78	0	—	6.3
6Q7G	105	—	0	—	6.3
76	227	—	11.5	—	6.3
6AC5G	213	—	0	—	6.3

"B+" at the 80-tube's filament—300 V.; Voltage across field—75 V. Grid bias for all tubes is developed across resistors R10 and R11. The total voltage should be 11.5 V. Voltage measured across R10 should be 2.25 V. To check bias on 6A7 and 6D6 tubes, measure the values of R12, R13 and R14. See schematic.



⊗THERE IS NO MICA CONDENSER CONNECTED TO LUG 6A

SCHEMATIC SHOWS ONE BUTTON DEPRESSED, AND SHOWS CONNECTIONS TO GIVE FREQUENCY RANGES INDICATED.

Fig. 2. Schematic of the pushbutton tuning unit. Each pushbutton has its own frequency band from which the station for which it is to be set must be chosen.

TUNING UNIT PARTS VALUES

C1, 250 mmf. mica;
C2, 180 mmf. mica;
C3, 120 mmf. mica;
C4, 75 mmf. mica;
C5, 50 mmf. mica;
C6, 0.001-mf., 600 V. tubular;
C8, C9, C10, C11, C12, C13 (write to factory);
R1, 3,000-ohm, 1/4-W. carbon resistor.

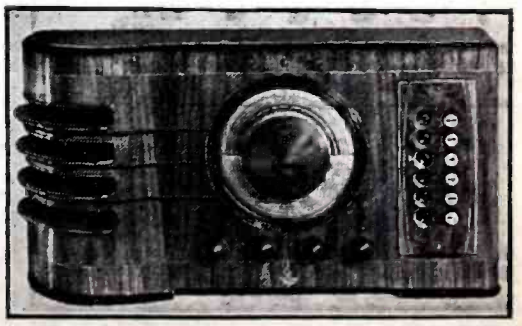


Fig. A. Model AZ-196 receiver with "Miracle" Dial and Tone Chamber.

RADIO SERVICE OF CAPACITY, INDUCTANCE AND

A factory technician tells you how to make important measurements—including ratios—*with just an A.C. voltmeter*

GEORGE

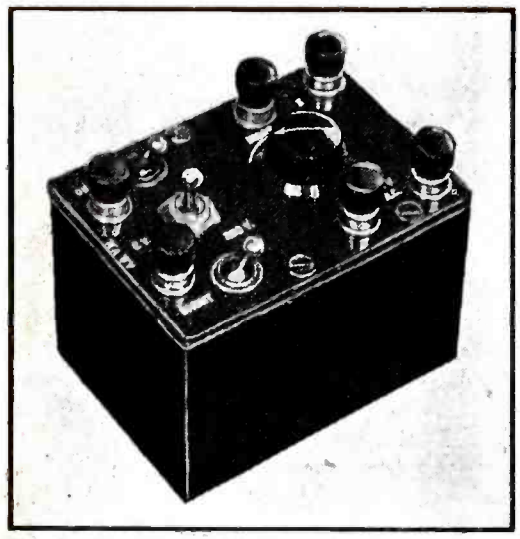


Fig. A. The completed instrument mounted on panel and in case.

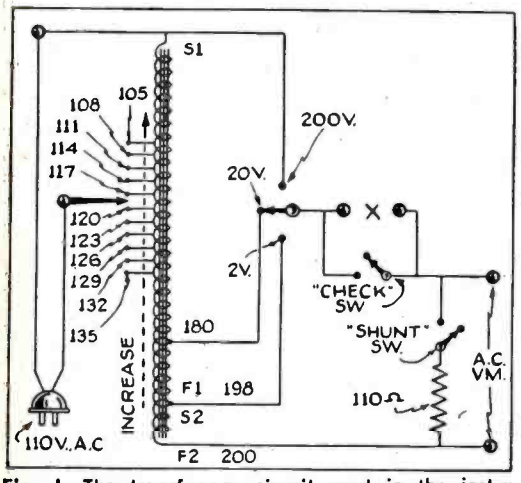


Fig. 1. The transformer circuit used in the instrument illustrated above.

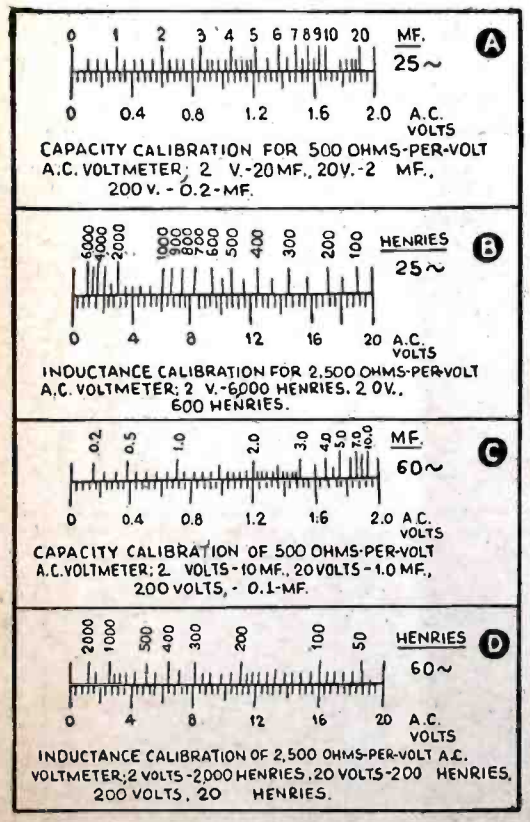


Fig. 2. These scales are shown as if the A.C. voltmeter calibration were uniform over its entire length. Actually the rectifier-type voltmeter will have its calibration crowded at the low-voltage end and expanded at the center.

THE purpose of this article is to emphasize how many useful measurements may be made by the radio Serviceman using only a modern rectifier-type A.C. voltmeter and a small testing transformer. For service purposes, extreme accuracy is not essential. Speed and convenience of measurements are the most important factors. For this reason the simple ohmmeter circuits are the most popular with Servicemen for measuring resistances. Capacity measurements can be made with the same degree of accuracy and convenience.

Inductance measurements can be made just as simply and conveniently, but a correction factor may be desirable. *The ratio of all kinds of audio and power transformers can also be determined with very little effort.*

CAPACITY MEASUREMENTS

With a rectifier-type A.C. voltmeter, having a sensitivity of 500 ohms-per-volt and full-scale at 2, 20 and 200 volts, and a small transformer capable of supplying up to 2 milliamperes A.C. with good regulation at these voltages, condensers may be measured over a range from 0.01-mf. to 20 mf. With the addition of a simple shunt, measurements may be made up to 200 mf. The foregoing values are for 25-cycle operation. On 60 cycles the range would be from 0.003-mf. to 100 mf. With other meter sensitivities and meter scales, other ranges and capacity measurements could be made.

DEGREE OF ACCURACY

An experimental check on the calibration of such a meter, indicates that an error of plus or minus 10 per cent may be expected at either end of the meter scale and an average error of plus or minus 3 per cent may be expected over the center part of the scale. This check was made on the usual service-type, 3-inch meter.

The transformer circuit used is shown in Fig. 1. It will be noted that an *auto-transformer* is used to secure ample capacity with small space. The primary of the transformer is tapped in 3-volt steps to secure the proper output voltage on line voltages varying from 105 to 133 volts. The secondary is tapped at 2, 20 and 200 volts, to supply the necessary full voltage for each of the voltmeter scales.

Terminals are provided for the A.C. voltmeter and terminals are also provided to connect the capacity to be measured. A switch is connected across the binding posts marked X. When this switch is closed, the line voltage control may be adjusted to give full-scale reading of the meter. The purpose of the shunt shown in the diagram will be explained later.

In the above circuit, if a condenser is connected across the X terminals, the transformer will cause a current to flow through the condenser and the A.C. voltmeter in series. The greater the capacity, the greater will be the current and deflection of the meter. The calibration of such a meter and circuit is given in Fig. 2A, for 25 cycles and Fig. 2C for 60 cycles. If the meter scales available are not 2, 20 and 200, as in this case, the transformer secondary would have to be redesigned to give voltages equal to the full-scale voltages available. In this case, the calibration chart or scale would not be affected by the change in voltage directly. The calibration scale would depend inversely on the meter resistance and the frequency of the test voltage.

If the meter had a sensitivity of 1,000 ohms/volt instead of 500 ohms/volt, the capacity calibration numbers in Figs. 2A and 2C should all be divided by 2.

In order to extend the range of measurements to higher values for measurements of electrolytic condensers, a shunt is provided to vary the resistance of the meter without changing the scale. The shunt reduces the sensitivity of the voltmeter of the 2-volt scale from 500 ohms/volt to 50 ohms/volt, thus multiplying the capacity calibration by 10. This shunt further means that the circuit will draw more current from the tapped transformer. Accordingly the 2-volt section of the transformer has been made capable of carrying greater current than the balance of the secondary. The shunt should not be used except on the winding designed for it.

MEASURING ELECTROLYTIC CONDENSERS

In measuring electrolytic condensers, only the 2-volt tap of the transformer and scale of the meter should be used; 2 volts A.C. is low enough that it is harmless to any electrolytic condenser and enables an approximate measure of its capacity to be made. It should be noted that this method of measuring capacities is open to considerable error if the condenser is partially shorted or has high series resistance. For this reason, an additional check on the condition of the condenser is advisable. If the condenser will take a charge when connected to a source of proper voltage, and discharge again when its terminals are short-circuited, it is generally safe to assume that the condenser leakage is negligible and that the indicated capacity is sufficiently correct.

In the case of electrolytic condensers, any undesirable series resistance will make the capacity of the condenser ap-

MEASUREMENTS
AUDIO TRANSFORMER RATIO

and a home-built testing transformer! Reprint is by special permission of the author and of Radio Trade-Builder.

BALDWIN

pear to be less than it actually is. This is not a serious limitation of this method of measuring condensers as a condenser with a high series resistance has a low filtering efficiency and should be discarded just the same as a low-capacity condenser.

It should be noted, however, that wet electrolytic condensers, particularly in the larger sizes, lose their capacity if they are not in use for some months. Such a condenser, when tested on 2 volts will show a capacity of possibly 25% lower than the same condenser after it has been re-formed by being put into service on normal voltage.

SELECTING PROPER SCALE AND VOLTAGE

When the supposed capacity of the condenser is approximately known, of course, the proper scale and voltage can be selected beforehand, but when the approximate size of the condenser is *not known*, they must be selected by trial. The secondary tap should correspond with the full-scale voltage of the meter range in use. That is, every time the secondary voltage tap switch is moved, the A.C. voltmeter scale should be changed. These operations should be performed in such order that the voltmeter is not overloaded by excessive voltage.

INDUCTANCE MEASUREMENTS

Inductance measurements cannot be made with the same degree of satisfaction as capacity measurements, largely for the reason that the inductance of an iron-core reactor is not constant, but varies widely under different conditions. In most circuits the direct-current component passing through a reactor or transformer tends to greatly reduce its effective inductance. Similarly the inductance varies greatly with the value of alternating current flowing through its winding. At low values of alternating current the inductance may be comparatively low. As the alternating current is increased, the inductance of the reactor increases until saturation is reached when the inductance again decreases.

In Figs. 2B and 2D we have given the calibration of an A.C. voltmeter taken to have a sensitivity of 2,500 ohms/volt, used in conjunction with the circuit of Fig. 1 to measure inductance on 25 and 60 cycles, respectively. This calibration is given for 2,500 ohms/volt sensitivity rather than for 500 or 1,000 ohms/volt sensitivity as there is less necessity for a correction factor due to the resistance of the inductance. The resistance of the inductance, if appreciable compared to the reactance under test, would cause the reading to be high. It is possible to use a simple correction chart to compensate for the effect of the resistance to the reactance. The writer has prepared such a chart, which he will be glad to furnish to any Servicemen who are interested.

The calibration charts given in Figs. 2B and 2D may be applied to any other sensitivity of meter used on the same frequency of test voltage. It should be remembered that the inductance calibration is directly proportional to the resistance of the meter. If a 500 ohms/volt meter were used instead of a 2,500 ohms/volt meter, the calibration given for inductance should be divided by 5.

CONSTRUCTION DETAILS OF THE AUTOTRANSFORMER

Now we come to the constructional details of the 25-60 cycle transformer assembly which can be used for this purpose.

The constructor will realize, of course, that there are many modifications that could be made and still achieve the same object. The circuit of the transformer assembly complete is shown in Fig. 1. The *autotransformer* principle is used for simplicity and small size.

The cross-section area of the core is 0.9-square inch. The punching used is .025-inch thick and is illustrated in Fig. 3A.

The thickness of the stack of laminations is 1-5/16 ins.

The autotransformer's coil is wound on an insulated tube, 1/32-in. thick with inside dimensions 23/32 x 1-9/32 ins. The length of the tube is 1-9/32 ins. The main winding consists of 5,906 turns of No. 32 enamelled copper wire, 109 turns per layer, approximately 54 full layers and 20 turns on the last layer which is filled level with paper. Between each layer is wound 1 turn of 0.0006-in. Kraft paper, 1-9/32 ins. wide (if fibre end-washers are used to make a complete winding spool, these should be ⅛-in. thick and the Kraft paper between layers will then be 1-1/32 ins. wide instead of 1-9/32 ins.). See Fig. 3B for taps.

After winding this main section with its proper taps, wind 1 turn of 0.002-in. Kraft paper, 1-9/32 ins. wide. The 2-volt secondary section consists of a single layer of 61 turns of No. 28 enamel copper wire, wound on top of the previous section.

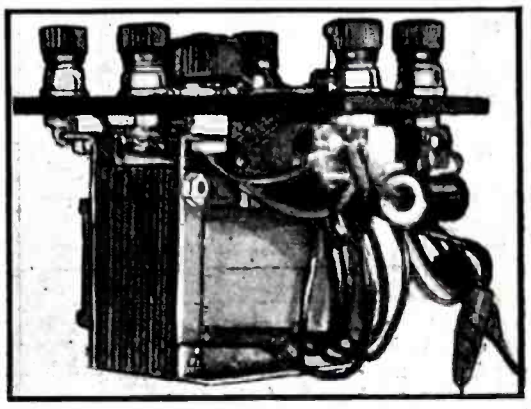


Fig. B. Interior view of the test instrument.

The final insulation on top of the coil is 1 turn of 0.005-in. treated rope cement paper and 1 turn of 0.004-in. fish paper, both 1-9/32 ins. wide. All starts, finishes and taps should be tied to the coil and protected when crossing the layer by a strip of varnished cloth. The coil should be dried thoroughly and impregnated with any standard thin gum. The complete assembly is illustrated in the photographs of Fig. A and B.

"APPARENT" AND "ACTUAL" STEP-UP (OR -DOWN) RATIOS

If we were to take an ordinary audio input transformer with step-up ratio of 3 to 1 and apply 20 volts A.C. to the primary, the secondary voltage would be 60 *if there were no losses in the transformer or measuring circuit.* The effect of any losses would result in the measured secondary voltage being less than the primary voltage times the step-up ratio. With an ordinary A.C. voltmeter having a range of 1,000 ohms/volt and a scale of 200 volts maxi-

(Continued on page 123)

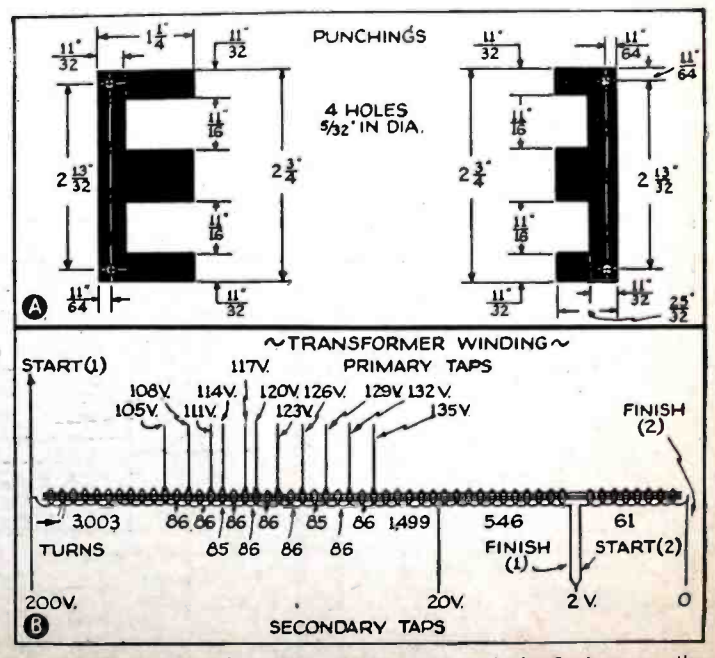


Fig. 3. In A, the dimensions of the core and, in B, taps on the autotransformer.

SHORT-CUTS AND KINKS

Three cash prizes are awarded for the most practical Short-Cuts and Kinks published in this department. They are: 1st Prize $10, 2nd Prize $5, 3rd Prize $5. All others judged good, and published, are given Honorable Mention. Send in your pet ideas; they may earn money for you and certainly help others.

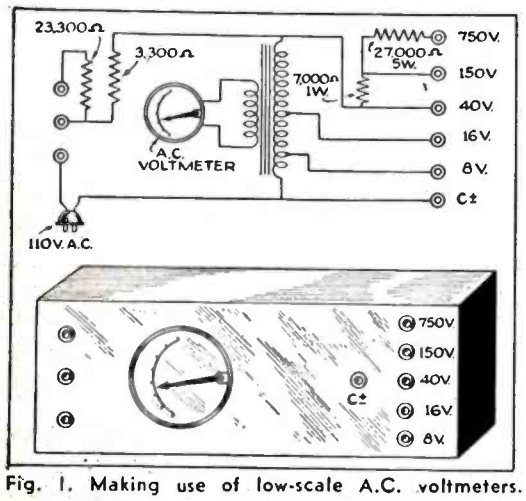


Fig. 1. Making use of low-scale A.C. voltmeters.

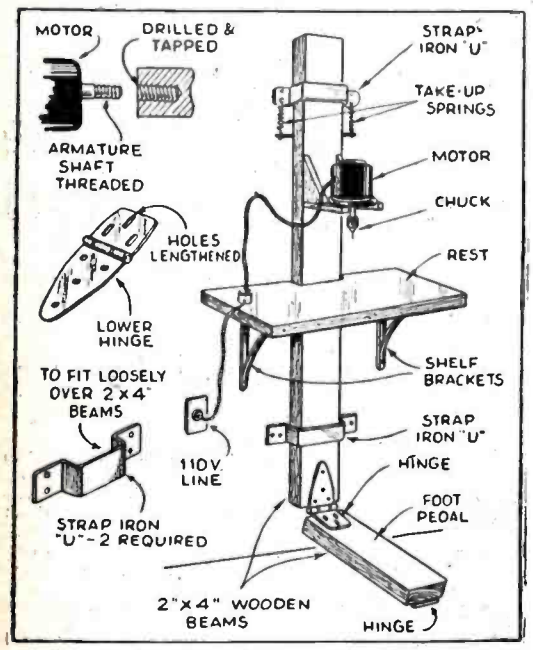


Fig. 2. Ingenious home-made drill press.

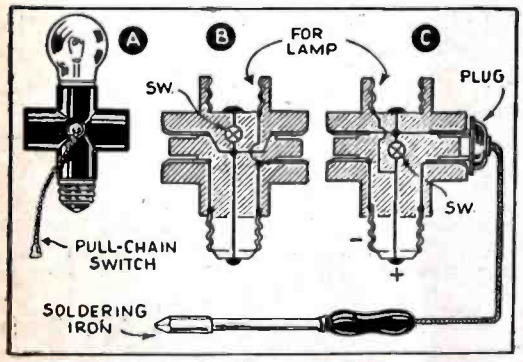


Fig. 4. Socket adapter soldering iron control.

FIRST PRIZE—$10.00

USING OLD A.C. VOLTMETERS. Service Men who have old-style A.C. voltmeters with very low voltage, full-scale, such as 0-3 volts or 0-4 volts, find very little use for them in present day A.C. receivers. However, by the addition of a shop-made transformer, they may be made to read low, medium or high voltages. Such transformer is herewith described and is sufficiently accurate for all set measurements, even up to 1,000 volts or more by the use of series resistors. See Fig. 1.

An old audio transformer, such as in the RCA catacombs of old, are a good size, the smaller the better. Remove all old windings and use original cardboard core, with side pieces cut to fit, and cemented in place to just fit inside window of laminations.

If a 3-V. A.C. Weston 476 is used, which I have, the primary will require about No. 24 or No. 26 enameled wire, 45 turns, and 4-volt—60 turns. (Core cross-section squared and divided by 6, will give number of turns required for your particular laminations. If it is ¾-in. wide and ¾-in. thick, then ¾ x ¾ ÷ 6 = between 10 and 11 turns-per-volt. 10 is OK, for it isn't used for any great length of time, and so will not overheat.)

Several layers of tape, varnished cloth or heavy brown paper is shellacked in place, for insulation. Then, start winding the secondary, which is continuous and tapped. For the 1st section, 8 volts, wind 120 turns in even layers, using about No. 28 enameled wire; for the next tap, wind 120 more turns (for the 16-V. tap), using No. 32 E. wire; then, 360 turns of about No. 34 for the 40-volt winding. If there is sufficient room and you want to include a 150- or 160-volt tap, then (for a 150-volt tap) add 1,650 turns of very fine wire, such as No. 38 or No. 40 enameled, in layers with a thin sheet of paper between each layer.

Having finished the coil, shellac and immediately wind several layers of tape or paper around and shellac. Put the laminations in place and, if a small metal box such as coil shield with lugs for mounting is handy, place in can and fill with pitch or wax; this makes a neat job.

Having only wound to 40 volts, I used resistors (1-watt carbons), for higher voltages, namely, 150 and 750. Use several 1-watt resistors in series for 750-volt reading, as it should be about 5-watt resistor to drop this 600 volts. It requires about 5,200 ohms for the 150-volt reading and about 21,000 ohms, 5-watt, for the 750-V. reading.

This whole affair can be put in a small box size about 4 x 7 ins., and 3 to 4 inches deep. An aluminum panel makes for an attractive-looking product. This arrangement, to avoid shocks or fireworks, must be well insulated! By the simple addition of a right-size resistor to make the meter read full-scale with 110 V. circuit, condensers can be checked, chokes measured, etc. It is the next handiest thing to the ohmmeter, which in my case it matches in size and shape.

D. V. CHAMBERS

SECOND PRIZE—$5.00

IMPROVISED DRILL PRESS. While rummaging in my junk-box, I found an old electric sweeper motor and from it I devised the following drill press, which cost me 65c. (See Fig. 2.) It is comprised of a 5-ft. "2 x 4," 2 hinges, some strap-iron, the motor, a chuck, bolts, and odd pieces of wood. The strap-iron is made into 2 U-shaped pieces as shown. The motor is mounted on the 2 x 4 near one end with blocks and bolts. The chuck is drilled and tapped to fit the motor's threaded armature. If the armature is not threaded, a collar may be used and the chuck left as it is. The assembly may be seen in the drawing. The strap-iron pieces form sliding bearings for the 2 x 4. A piece of wood is used as a treadle, being hinged to the 2 x 4 and to the floor. It is a good idea to lengthen the bolt-holes in the floor hinge and leave a little play when bolting down. The other hinge is fastened tightly.

This little press is fine for radio work as it leaves both hands free. The work rest may be the bench with a hole cut for the 2 x 4, or an adjustable rest may be worked out to fit your need.

ROBERT SANFORD

THIRD PRIZE—$5.00

CAR RADIO NOISE BALANCER. Recently I installed a radio set in a car and was unable to entirely eliminate the motor noise by the ordinary methods of shielding and suppressing. After some experimenting I found that the motor noise could be eliminated by mounting a bucking-coil, in the antenna circuit, under the dash of the car. This coil is 5 ins. in diameter (see Fig. 3) and consists of 3 turns of heavy bell-wire, one end of which is connected to the shielded antenna lead of the radio, the other end to the antenna lead-in. By means of very little experimenting, while set is in operation and the car running, the exact plane or position in which the coil should be mounted can be determined.

When this position is found the coil can be clamped to the speedometer cable by means of 2 metal straps. The coil should be taped together all the way around to make it stiff.

The voltages set up in the coil bucks that set up in the antenna and lead-in. No suppressors or shielding is needed.

FLOYD M. GLASS

HONORABLE MENTION

A SIMPLE, COMPACT, 1-PIECE SOLDERING IRON REGULATOR FROM AN OLD ELECTRIC SOCKET. Procure 1 electric light socket, with 1 bulb socket and 2 plug receptacles, as shown in Fig. 4A. The pull-chain controls the bulb only. The cutaway hookup of the socket is shown by diagram in Fig. 4B.

To make the regulator from this socket you simply rewire it as shown in Fig. 4C. All this wiring is done within the socket. When through

(Continued on page 108)

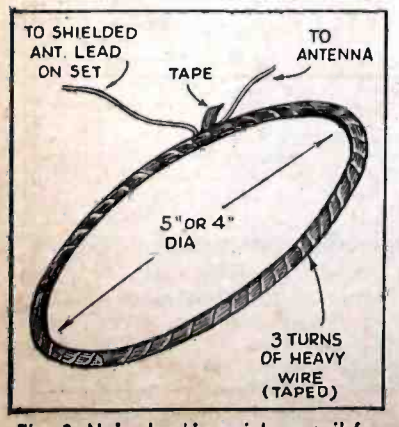


Fig. 3. Noise-bucking pick-up coil for car radio.

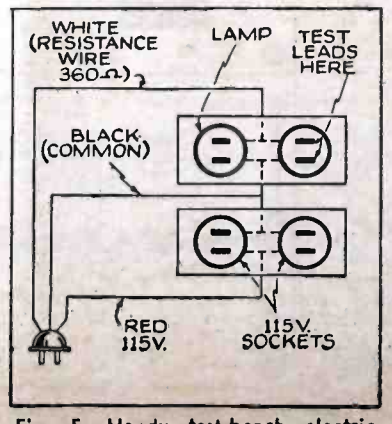


Fig. 5. Handy test-bench electric outlets.

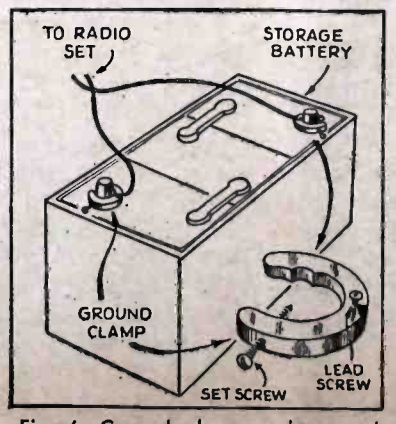


Fig. 6. Ground clamp makes good battery terminal.

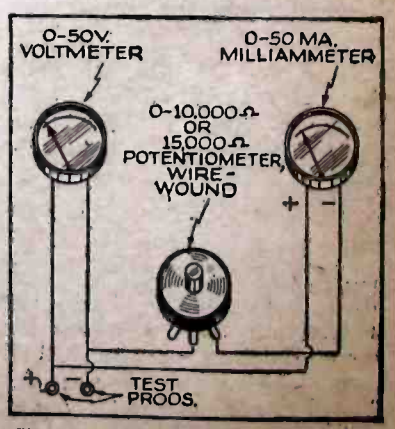


Fig. 7. Tests "B" batteries under "load" conditions.

BOOK REVIEW

PRINCIPLES OF RADIO, by Keith Henney. (3rd Edition, 1938.) Published by John Wiley & Sons, Inc. Size, 5½ x 8 ins., cloth cover, 495 pages, 311 illustrations. Price $3.50.

Here is a publication prepared in textbook style which the student in radio will find particularly useful; especially, in view of its being a revised edition of a widely-known radio book for either home or class study.

New practical problems have been added dealing with the circuits and constants upon which activities are based. Of exceptional importance is the fact that detailed information concerning the features of present-day receiver design and other recently developed devices, brief statements of television transmission, etc., have been added.

Have you ever wondered *how* and *why* set designers arrive at component values? *Read this book for the answer.*

Chapter headings are as follows: Fundamentals; Ohm's Law; Production of Current; Inductance; Capacity; Properties of Alternating-Current Circuits; Resonance; Properties of Coils and Condensers; The Vacuum Tube; The Tube as an Amplifier; Audio Amplifiers; Design of Audio-Frequency Amplifiers; High-Frequency Amplifiers; Detection; Receiving Systems; Rectifiers and Power Apparatus; Oscillators, Transmitters, Etc.; Antennas, Transmission, Etc.; Facsimile and Television Transmission.

BEGINNERS' 4-TUBE SUPERHET. "VACATION PORTABLE"

(Continued from page 87)

fabled bedspring to and including a water pipe. No input circuit can be expected to tune efficiently with such a variety, so the trimmer is used to compensate for the mismatch. The R.F. trimmer on the gang condenser should be opened wide, since the manual trimmer takes its place. Alignment should be made with the manual trimmer set at about mid-scale and with an antenna of moderate length. The variable core of the oscillator coil may be found helpful in getting the tuning range set satisfactorily.

Note that the screen-grid of the 1D7G is varied together with the screen-grid of the 1D5GP. This is somewhat contrary to general practice, but it overcomes a certain blocking or overloading of the 1D7G which occurs if the latter is run at full screen-grid voltage when very strong signals are being received.

Although no provision was made on this set for headphone operation, this feature may be desired for some applications, so a headphone jack is shown on the circuit diagram. When the phones are plugged in, the speaker is cut out. Due to the fact that no D.C. can reach the headphones, crystal phones may be employed as well as the more common types.

General case and chassis dimensions are given (Fig. 2) to guide those who are starting construction from scratch.

LIST OF PARTS

One Raytheon 1D7G tube;
One Raytheon 1D5GP tube;
One Raytheon 1E5GP tube;
One Raytheon 1F5G tube;
*Two 45-volt batteries;
*One 3-volt battery;
*One 7½-volt battery;
*One 5-inch P.M. dynamic speaker, with transformer to match;
One Meissner I.F. transformer, No. 5740;
One Meissner I.F. transformer, No. 6131;
One Meissner antenna transformer, No. 1496;
One Meissner oscillator coil, No. 7560;
One Meissner R.F. choke, No. 6844;
One Meissner dial, No. 18248;
One Meissner tuning condenser, No. 15114;
One Meissner trimmer condenser, No. 15165;
One Meissner padding condenser, No. 17025;
Four Meissner octal sockets;
Three Meissner knobs;
One Cornell-Dubilier 500 mmf. mica condenser;
One Cornell-Dubilier 0.004-mf. mica condenser.
One Cornell-Dubilier 100 mmf. mica condenser;
One Cornell-Dubilier 250 mmf. mica condenser;
Four Cornell-Dubilier 0.25-mf., 400-V. paper condenser;
One Cornell-Dubilier type BR, 12-mf., 150-V. electrolytic condenser;
Two Cornell-Dubilier 0.01-mf., 400-V. paper condensers;
One I.R.C. 75,000-ohm potentiometer with D.P.S.T. switch;
Three I.R.C. 50,000-ohm, ½-W. resistors;
One I.R.C. 2 megohm, ½-W. resistor;
One I.R.C. .5-megohm, ½-W. resistor;
One I.R.C. .15-megohm, ½-W. resistor;
One I.R.C. 1 megohm, ½-W. resistor;
One I.R.C. 10,000 ohm, 1 W. resistor;

MISCELLANEOUS

One carrying case to dimension shown
One aluminum panel
One aluminum chassis
One jack
One 6-ohm filament rheostat
Wire, hardware, etc.

**Most Radio mail order houses can supply this item if properly identified as to title of article, issue (month) of* RADIO-CRAFT *and year.*

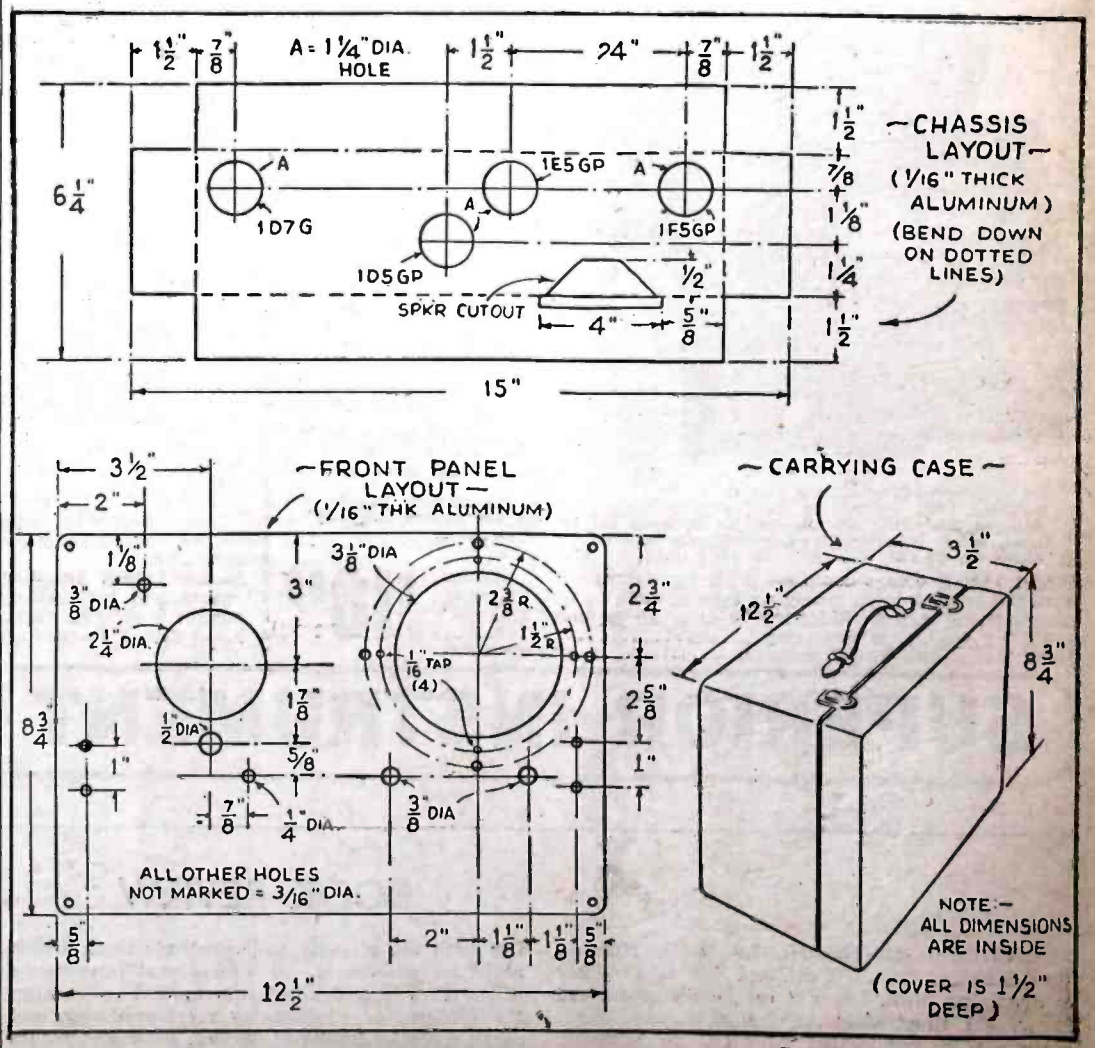


Fig. 2. Although of course any desired metal may be used for the chassis of the "Vacation Portable," aluminum is particularly recommended in view of its lightness; it's easy to work, too. The carrying case can be made from cigarbox wood, but, the sizes are fairly standard and little trouble should be experienced in obtaining the case already made. It should be fairly sturdy, however, because the batteries add considerable weight.

TOMORROW'S TELEVISION SERVICING

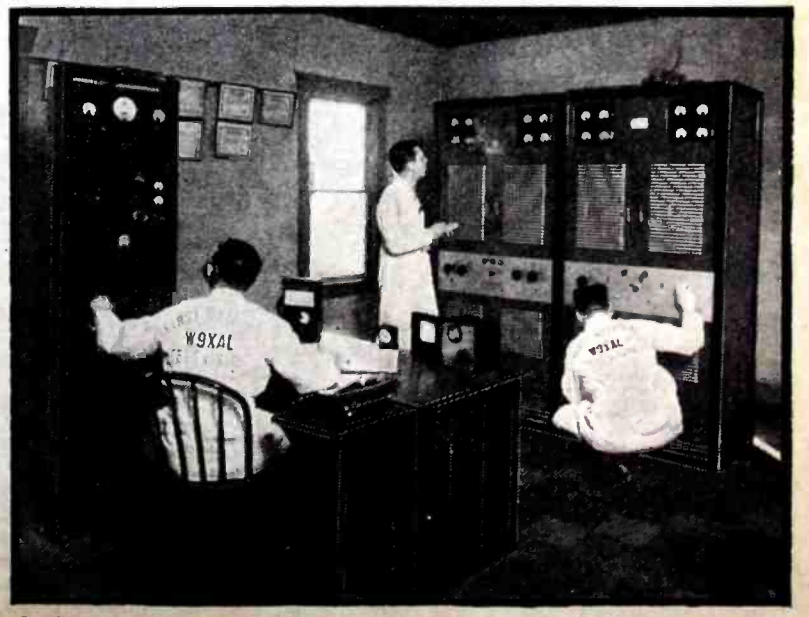
(Continued from page 81)

tie-in between motion picture studio environment with television." In other words, the expert television technician will have a knowledge which extends considerably beyond the present somewhat large sphere of standard radio program transmission and reception. A new RCA image Iconoscope recently introduced at W9XAL is shown in the picture.

Another radio school which has gone in heavy for technical equipment of the latest type with which to instruct the ambitious radio man is Midland Television, Inc. One of the photos they specially posed to assist in making *Radio-Craft's* cover painting is reproduced on pg. 81. It shows, on the extreme left, a special cathode-ray oscilloscope, with a Du Mont 9-inch tube, used for testing sweep circuit waveforms in the system. The left-hand *rack* contains the main amplifiers for a 441-line television system; the center rack contains monitoring for both audio and video (the cathode-ray tube shown is an RCA 12-in. unit); and, the rack on the right is a sweep-circuit generator and control circuit for the Iconoscope camera which is shown at the right of this picture.

Although the battle between *mechanical* and *electronic* television still rages, with no quarter asked or received, one old-timer in the television field has the unique distinction of being on the fence; at least, his technical background has encompassed active work in both types of television operation. Mr. U. A. Sanabria, Chief of Staff of American Television Institute, Inc., which also contributed specially-posed photos for cover-reference, is the engineer in question. Newcomers to the fold will find it worthwhile to dig into his highly informative series of articles, "Television Students 'Learn by Making' Cathode-Ray Tubes," in the December, 1937, and January, February, April and May, 1938, issues of *Radio-Craft*. His article, "The Importance of Interlaced Scanning," in the August, 1936, issue, also is worth reviewing. We feel sure that Mr. Sanabria could be induced to prepare other articles of value to *Radio-Craft* readers, if they care to write-in and offer suggestions as to topics for discussion they consider will have most general interest.

Students at American Television Institute are taught to work with actual television apparatus and to build up working units from the requisite components. Here you see 2 of the students putting the finishing touches to the cathode-ray equipment of a television receiver.



Student engineers at First National Television, Inc., in Kansas City, are here shown checking the transmitter (on the 31st floor).

SHORT-CUTS AND KINKS

(Continued from page 104)

assemble socket. To operate the regulator, pull the chain switch and you have full 110 V. on the iron. After the iron is well heated and you want it to stay same you merely pull the switch again and you will have the 150-W. lamp in series with the iron which will keep the iron at an even temperature. You will see that there is no chance of short-circuits within the socket after you construct one.

HIDENOBU HIEJANE,
Honolulu, T. H.

HONORABLE MENTION

HANDY SERVICE BENCH OUTLETS. Here's how I use an A.C.-D.C. 360-ohm cord instead of a regular electric cord, on the service bench. I have connected a 3-wire cord across 2 double electric sockets, using the 2 lower connections for 115-volt outlets, and the 2 upper for miscellaneous, small A.C. voltage tests, which are obtained by changing light bulbs of different watts, in one socket and using the other for test leads. (See Fig. 5.)

Placing a 7-watt lamp in one socket, you get 90 volts at the other. For 10-watt lamp you get 80 volts; 25-watt lamp, 60 volts; 60-watt lamp, 25 volts; 75-watt lamp, 15 volts; and 100-watt lamp, 6½ volts.

W. F. ONDER

HONORABLE MENTION

PERMANENT BATTERY CLAMP. In servicing car radio and other 6-volt jobs I often misplaced my battery terminal clamps. It was on one of these occasions I tried using a ground clamp that was lying on the bench. I found that this worked out swell. Now I just leave two clamps permanently on the battery. (See Fig. 6.) They do not pop off when you turn the set over for voltage readings.

JIM GOETSCH

HONORABLE MENTION

"B" BATTERY TESTER. In Fig. 7 is shown a "B" battery tester that will test "B" batteries under load.

Service Men who do rural radio repairing will find this tester very handy. The diagram is self-explanatory. A switch may be hooked in series with the milliammeter lead to disconnect the meter from the circuit so the meters may be used for other purposes.

Operation is very simple. Connect the test leads to the battery to be tested. Be sure the potentiometer is turned all the way to the left. Turn the potentiometer slowly to the right, watching the milliammeter till the reading is between 20 and 30. The voltmeter reading will tell you what shape the battery is in. Open or high-resistance connections may be easily found in this procedure.

EDWIN BOEHM

HONORABLE MENTION

TIME SWITCH. Enclosed you will find an idea of mine which I wish to enter in the Short-Cut ideas contest. It is a simple, inexpensive method of turning on a radio set at any predetermined time and can be assembled in a few hours. As the diagrams herewith show the only parts needed are an alarm clock, a phonograph stop switch and a thin strip of spring brass, bent as per drawing, its size depending on the type of alarm clock used.

The operation is as follows:—Turn on your radio set and tune in the station you will want to hear next morning. Then set switch arm "A" (Fig. 8) in the "off" position and rest it on the alarm clock winding key in the position shown in Fig. 8B. Now set your alarm clock in the usual way and forget about it all. When the alarm goes off the alarm winding handle will unwind or turn, pushing up switch arm "A" which locks mechanically and turns on the radio receiver, lights, or what-have-you.

This little device can be made for the small sum of 60c (cost of switch) provided you already have the alarm clock. The switch assembly, for appearance sake, can be enclosed in a small box.

A. A. SCHMITT

HONORABLE MENTION

NOVEL MICROPHONE STAND. An excellent microphone stand of the type used in broadcasting studios can be easily made from a discarded dressmaker's figure. (See Fig. 9.) These figures can be obtained for next to nothing, and as the stands that they are provided with are designed to support considerable weight, they will be found to be far sturdier than the average microphone stand. The better-quality figures are provided with a pedal or thumbscrew for adjusting the height, and all that is necessary to convert them into a microphone stand is the removal of the figure.

GEORGE NICHOLAYEFF, JR.

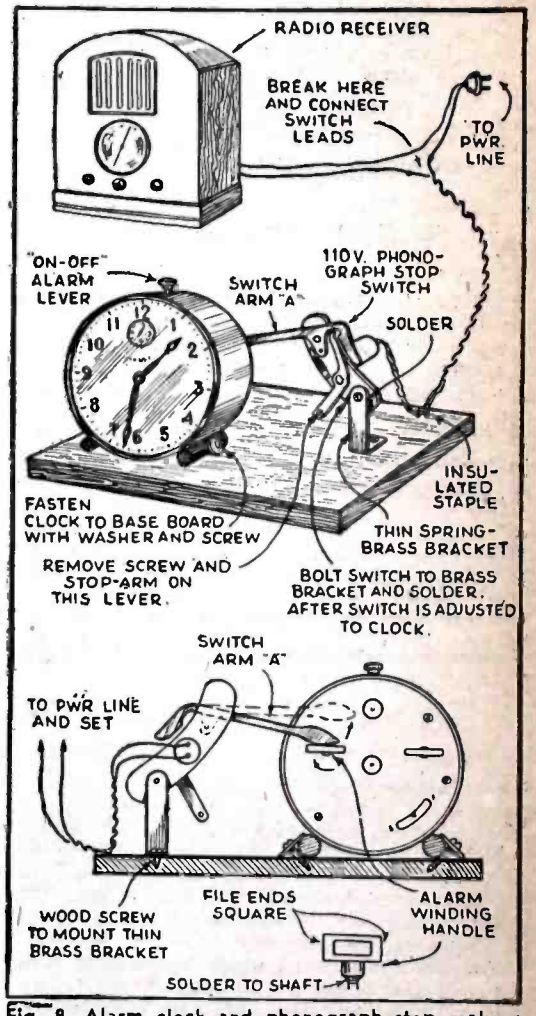


Fig. 8. Alarm clock and phonograph stop make a practical electrical time switch.

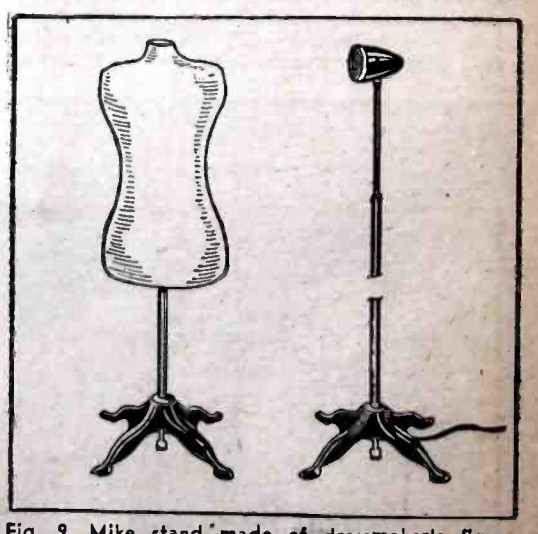


Fig. 9. Mike stand made of dressmaker's figure.

SERVICEMEN!

October *Radio-Craft* will tell you how to make a 38-range, bench-type radio set tester, with PUSHBUTTON SELECTION of the meter ranges!

NEW CIRCUITS IN MODERN RADIO RECEIVERS

(Continued from page 88)

better quality action for a detector limited to a low-voltage supply. Any change in the drop across the cathode resistor, due to changes in modulation level at the transmitter, is transmitted through C15 to the grid-return and thus keeps the cathode and grid at a relatively constant potential difference with respect to such signal changes so that its operation is more uniform. It greatly reduces the tendency toward degeneration (which is undesirable at this point in the circuit). The suppressor-grid is connected to the ground side of the filament and thus is somewhat more negative than the cathode. While this slightly decreases the Gm of the tube and its gain, it provides a more uniform operating characteristic through the fact that the suppressor-grid is maintained at a constant potential. It will permit the detector to handle a greater signal with these other advantages.

(4) VIBRATOR WINDING USED FOR FILAMENT SUPPLY

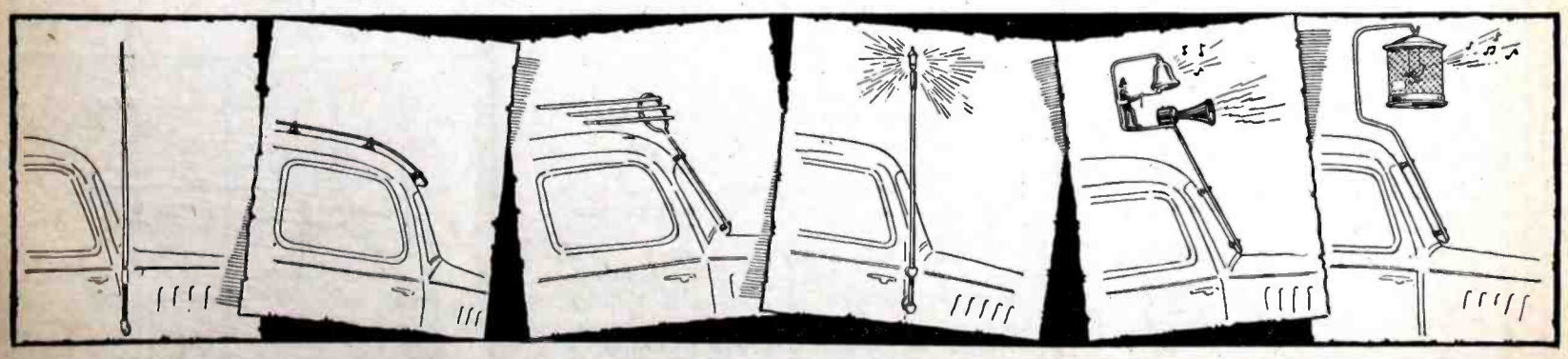
Crosley Model 667. *A highly efficient and effective method of adapting the power supply of a circuit to 110 volts A.C. and 6 volts D.C. is used.*

Figure 1D is the circuit of a universal input transformer having a 110-volt primary winding for use on 110 volts and a single other primary winding acting either as the vibrator primary or as a filament secondary when 110 volts A.C. is used. The filaments are all in parallel, the rectifier being isolated from the rest with chokes. In the position of all the switch points shown (position 1) the 110-volt supply is used. Note that the vibrator winding has a tap to provide 6.3 volts (slightly higher than that required for the vibrator primary). In the other position (2) of the switch points which are all controlled by one knob the 110-volt primary is disconnected and the vibrator and 6-volt supply comes into use. In this position of the switch the filaments are all supplied by the 6-volt battery.

(5) ELECTROLYTIC CELL SERVES FOR DETECTOR BIAS AND R.F. MINIMUM BIAS

Fairbanks-Morse Model 42. *Power detection using the control-grid of a 1B4 tube and an electrolytic cell to bias it, and supply the controlled tubes with the proper minimum bias, is featured in the circuit.*

Sufficient signal in this 2nd-detector grid (see Fig. 1E) will be rectified by the grid filament circuit and charge the electrolytic cell. This will provide a 2nd-detector bias and a minimum bias for the 1st-detector and I.F. tube. This will be maintained as long as the signal peak at the grid equals or exceeds the voltage of the bias cell. A.V.C. voltage will add to this at the grid end of the resistor but when the signal is extremely low, all bias values will be likewise low and the sensitivity of the receiver will be increased accordingly.



UTILITY AUTO-RADIO ANTENNAS

Anyone who looks at a modern radio-equipped car no doubt gets a lot of pleasure from the modernistic out-croppings due to present-day radio antenna practice. Illustrations 1, 2 and 3 (left to right) show the common garden variety of auto antenna. But why not have utility combined with beauty(?).

So one bright inventor recently came out with the device shown in Fig. 4. Here we have an electric parking light on top of the antenna. So far so good. Now let us anticipate what will happen during the next season. Figure 5 shows an antenna combined with an automobile horn and bell. In Fig. 6 a canary bird cage with a live canary, combine beauty with utility and incidentally give the canary bird an outing.

And how about connecting the exhaust to a hollow antenna to get rid of gases *overhead?*

Other similar valuable ideas will no doubt occur to our ingenious readers and we shall be happy to receive them. We guarantee not to exploit inventions and will refrain assiduously from patenting same.

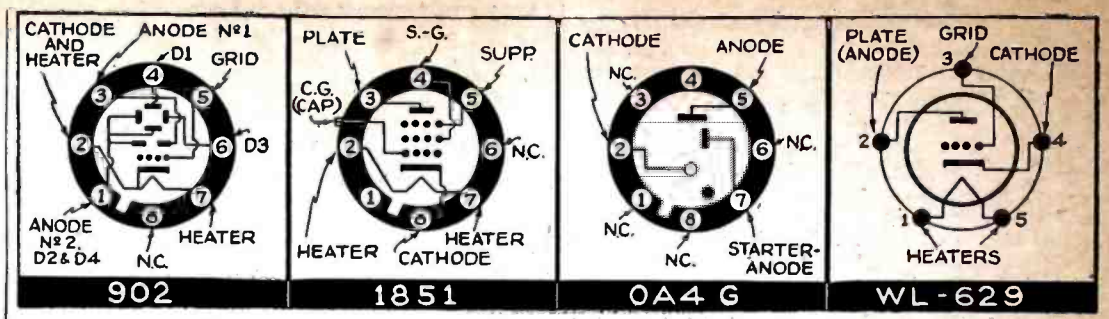


Fig. 1. Terminal connections of the new tubes described in this article.

NEW TUBES FOR TELEVISION AND RADIO

(Continued from page 89)

marily for electronic control applications where small load currents are involved, and will provide the same degree of sensitivity and circuit stability that is inherent in the higher capacity thyratrons.

Any relays which will operate within the tube's ratings may be connected directly in the plate circuit. Thus, no additional amplification is necessary and the whole control unit can be made very compact, which is a definite advantage in most applications.

Terminal connections are shown in Fig. 1; data, Table IV.

The data on the types 902, 1851 and 0A4G tubes were supplied by courtesy of RCA Victor Co., Radiotron Div. Name and address of manufacturer of the type WL-629 tube will be supplied upon request to the Information Bureau of *Radio-Craft*.

902—TABLE I
Tentative Characteristics and Ratings

Heater voltage (A.C. or D.C.)	6.3 volts
Heater current	0.6 ampere
Fluorescent-screen material	Phosphor No. 1
Direct interelectrode capacities:	
Control electrode to all other electrodes	8.0 max. mmf.
Deflecting plate D_1 to deflecting plate D_2	3.0 max. mmf.
Deflecting plate D_3 to deflecting plate D_4	2.8 max. mmf.
Overall length	7-7/16-in.±3/16-in.
Maximum diameter	2-1/16 ins.

Maximum Ratings and Typical Operating Conditions

High-voltage electrode (anode No. 2) voltage		600 max. volts
Focusing electrode (anode No. 1) voltage		175 max. volts
Control electrode (grid) voltage		Never positive
Grid voltage for current cut-off*		−80 approx. volts
Peak voltage between anode No. 2 and any deflecting plate		350 max. volts
Fluorescent-screen input power per sq. cm.		5 max. milliwatts
Typical operation:		
Heater voltage	6.3	6.3 volts
Anode No. 2 voltage	400	600 volts
Anode No. 1 voltage (approx.)	100	150 volts
Grid voltage	Adjusted to give suitable luminous spot.	
Deflection sensitivity:		
Plates D_1 and D_2	0.28	0.19 mm/volt, D.C.
Plates D_3 and D_4	0.33	0.22 mm/volt, D.C.

*With maximum voltage applied to anode No. 1 and anode No. 2.

1851—TABLE II
Tentative Characteristics and Ratings

Heater voltage (A.C. or D.C.)	6.3 volts
Heater current	0.45 ampere
Direct interelectrode capacities:	
Grid-to-plate	0.02 max. mmf.
Input	11.5 mmf.
Output	5.2 mmf.
Maximum overall length	3⅜-ins.
Maximum diameter	1-5/16-ins.

Maximum Ratings and Typical Operating Conditions

Plate voltage		300 max. volts
Screen-grid voltage		150 max. volts
Screen-grid supply voltage		300 max. volts
Typical operation and characteristics:	*Condition I**	*Condition II***
Plate voltage	300	300 volts
Suppressor-grid voltage	0	0 volts
Screen-grid supply voltage†	150	300 volts
Screen-grid series resistor	—	60000 ohms
Cathode-bias resistor‡	160	160 min. ohms
Amplification factor (approx.)	6750	6750
Plate resistance (approx.)	0.75	0.75 megohm
Transconductance	9000	9000 micromhos
Plate current	10	10 milliamperes
Screen-grid current	2.5	2.5 milliamperes

° With shell connected to cathode.
† Screen-grid supply voltages in excess of 150 volts require use of a series dropping resistor to limit the voltage at the screen-grid to 150 volts when the plate current is at its normal value of 10 milliamperes.
* Condition 1 with fixed screen-grid supply gives a sharp cut-off characteristic.
** Condition II with series screen-grid resistor gives an extended cut-off characteristic for applications where gain is controlled by variation of grid bias.
‡ The D.C. resistance of the grid circuit should not exceed 0.25-megohm.

0A4G—TABLE III
Characteristics

Peak anode breakdown voltage (Starter-anode tied to cathode)	225 min. volts
Peak positive starter-anode breakdown voltage	70 min. volts 90 max. volts
Starter-anode current (For transition of discharge to anode at 140 volts peak.)	100 max. microamperes
Starter-anode drop	60 approx. volts
Anode drop	70 approx. volts
Maximum overall length	4⅛-ins.
Maximum diameter	1-9/16-ins.

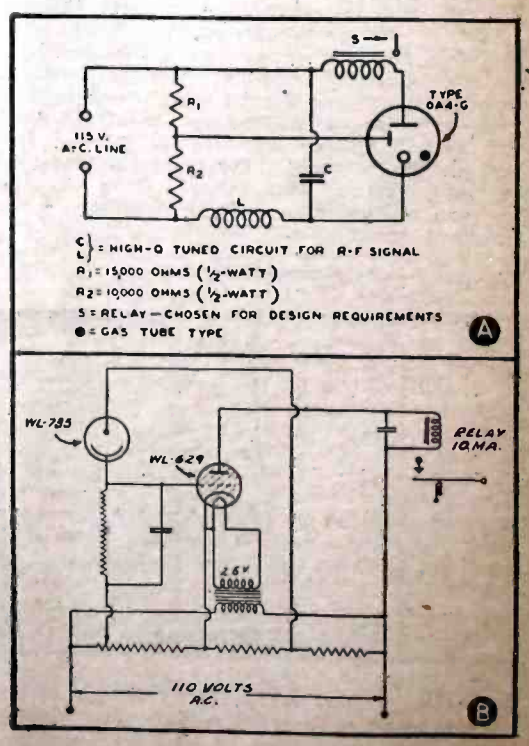


Fig. 2. At A is shown a schematic relay circuit using the new cold-cathode glow-discharge relay triode. At B is shown the grid-glow or thyratron-type tube in a simple relay control connection.

Maximum Ratings and Typical Operating Conditions

Peak cathode current	100 max. milliamperes
D.-C. cathode current	25 max. milliamperes
Typical operation with A.C. supply:	
Anode-supply voltage (r.m.s.)	105-130 volts
A.C. starter-anode voltage (peak)	70 max. volts
R.F. starter-anode voltage (peak)	55 min. volts
Sum of A.C. and R.F. starter-anode voltages (peak)	110 min. volts

(A schematic relay circuit, using the type 0A4G tube in A.C. operation, is shown in Fig. 2A.)

*WL-629—TABLE IV
Technical Data

Heater voltage	2.5 volts
Heater current	2.7 amperes
Maximum anode ratings	
Av. current	0.04-ampere
Crest current	0.2-ampere
Crest forward voltage	350 volts
Crest inverse voltage	350 volts
Length (max.)	4¼ ins.
Dia. (max.)	1-9/16 ins.

* Indirect-heater tube.

(A schematic circuit illustrating the use of this WL-629 "grid glow" or thyratron-type tube is shown in Fig. 2B.)

U. S. TELEVISION STATIONS

(Continued from page 80)

announcements made at intervals on the video channel.

W9XG—Approx. schedules, Tuesday, 7:30 P.M., Thursday, 8:00 P.M., C.S.T. No audio channel but announcements made on video channel. All pictures are broadcast from 35 mm. film.

W9XK—Approx. schedule, Tuesday and Thursday, 7:15 to 7:30 P.M.

W2XAX—Schedules uncertain.

W6XAO—Announcement title reading, "W6XAO, Don Lee, Los Angeles," simultaneously, *Washington Post March*, by Sousa, on aural. Also, 38 horizontal bright bars, on the visual; simultaneously, 1,000-cycle tone on aural.

Operating time schedules: nightly, except Sunday and holidays, 6:30 to 7:15 P.M. and Monday 9:00 to 10:00 A.M., Wednesday 11:00 to 12:00 A.M. and Saturday 2:00 to 3:00 P.M. (additional schedules occasionally). Has been on the air continuously on announced schedules since first official broadcast on 44.5 mc., December 23, 1931. Image reception and demonstration at 20 miles.

W3XPF—Characteristic signal or symbol not standardized at present. Scanning equipment at receiver: C.-R. sync. circuits adopted narrow vertical sync. pulses and amplitude selection. Operating time schedules experimental; no fixed schedule.

W9XAL—Schedules indefinite. Identifying signal or symbol, W9XAL.

W1XG—Approx. schedule Monday to Friday, 3:00 to 4:00 P.M.

W2XBS—No identifying signal or symbol. No regular schedule.

W3XE—Operating schedule irregular. Field test only. Philco narrow vertical synchronizing for best interlacing. True high-fidelity due to transmission of video frequencies up to 4.2 mc.

W2XDR—Identifying symbol is RP (trademark). Daylight operation only. No schedule. Engaged in laboratory development rather than regular programming.

W3XEP—Operating hours irregular. Sets in area recording reception. Several experimental television receivers have been set up within 2 or 3 miles of each other. The receivers are a part of the equipment used in television research.

The frequency band occupied by the transmitter is 2.5 mc. on each side of the carrier. This band width is determined by measurements of the overall frequency characteristic of the system.

This transmitter has served as the basis for the design of the television and sound transmitters installed in the Empire State Building in New York City.

This station operates a 30-kw. sound and image transmitter as licensed by the F.C.C.

Transmitter is portable or mobile in vicinity of Camden, N. J.

W9XAT—No identifying signal or symbol. Approximate schedule is Monday, Tuesday and Thursday, 10:00 to 1:00 A.M. Television broadcast is on 45 mc. Now patenting equipment to broadcast sight and sound from standard 24-frame film. Triple spiral multiple 45,000, 125 lines is used for sending motion picture film while broadcasting talking pictures. W9XAT for pictures and WDGY for sound.

W2XBT—No regular operating schedules.

W3XP—Operating schedules irregular. Field tests only. Philco narrow vertical synchronizing for best interlacing. True high-fidelity due to transmission of video frequencies up to 4.2 mc.

W3XAD—Operating hours irregular.

Sets in area recording reception—Several experimental television receivers set up within a radius of 2 to 3 miles for experimental purposes.

Transmitter is portable in laboratory at Camden, N. J.

W10XX—Operating hours irregular. Sets in area recording reception—Several experimental television receivers set up within a radius of 2 to 3 miles for experimental purposes.

Additional information—This station is used only for straightforward research or special demonstration service.

This station operates a 50-watt sound and image transmitter as licensed by the F.C.C.

The frequency band occupied by the transmitter is 2.5 mc, on each side of the carrier. This band width is determined by measuring the overall frequency characteristic of the system.

Transmitter is portable or mobile in vicinity of Camden, N. J.

W9XD—(Comment on this station—listed by F.C.C. until March 1, 1938, but renewal of license denied as in default March 28—by The Journal Co., Milwaukee, Wis.): "We have dropped this experimental license and are postponing any further work in connection with television until further developments in the art make television broadcasting more practicable on the part of individual stations."

NEW ULTRA-FLEXIBLE P.A. AMPLIFIERS

(Continued from page 95)

Proceeding along this line the writer has developed the units illustrated in Fig. A. At the left is the fully A.C.-operated and entirely hum-free driver and power amplifier developing 20 watts output at not over 3% total harmonic distortion when supplied with a 1-volt signal. Next to it is another desirable innovation in P.A. speakers—a really efficient 15-in. loudspeaker weighing 18 lbs., the electric-to-sound conversion efficiency of which increases effective sound output to compare with that of a 50-watt amplifier feeding customary loudspeakers. The small box to the right is a completely self-powered A.C. or D.C., 2-channel preamplifier-mixer having one high-gain and one low-gain channel. One—or a number with outputs connected in parallel—may feed one, or a number, of the power amplifiers through up to 50 ft. of ordinary shielded microphone cable—or at a greater distance, through No. 19 twisted telephone pair if simple and inexpensive plate-to-line and line-to-grid matching transfer wires are placed at either end of longer lines. The new dynamic microphone, having high output of –52 db. and high-fidelity frequency response, gives a good size comparison of these units.

Each may be easily assembled from standard, readily available parts. The units seen in Fig. A make up a complete P.A. system having one input of 105 db. gain and a second of 67 db., as for phonograph or radio inputs, a frequency response flat to 2 db. from 30 to 8,000 cycles including loudspeaker, a power output of 20 watts, completely hum-free operation and the full convenience of remote mixing and volume control in a small, easily transported and self-powered unit.

The preamplifier is diagrammed in Fig. 1. It is A.C. or D.C. operated through a 165-ohm resistor cord and plug of 6/10-ampere current carrying capacity, a 6J5 used as a rectifier, and a filter consisting of two 8-mf., 200-volt dry electrolytic condensers in conjunction with a 4,000-ohm, 1-watt resistor-filter "choke." One 6J7 is used pentode connected for low-level microphone operation, and feeds one triode of a 6F8G—which is two 6J5G's in one bulb.

The volume, or mixer, control for this channel follows the 6J7G so that being at a point of high signal, it will introduce no contact noise in operation. The low-gain channel feeds through the second volume-mixer control into the second triode of the 6F8G, which functions as an electronic mixer since its plates are in parallel. Provided with plate load resistor and 0.025-mf. output coupling condenser, the output terminals may connect across the grid leak resistor of a following amplifier tube, or to the primary of any grid plate-to-line or other coupling transformer. Parts values are all indicated on the diagrams—and if preferred the preamplifier could be arranged to obtain plate and filament power through the power amplifier—which it can easily supply as well as an extra 15 watts of power for exciting the fields of additional speakers, powering a radio receiver, or any desired use.

In constructing such a preamplifier, it should be made small and compact for convenience, with short wiring connectings, and a very short 6J7G grid lead to the microphone jack, which must be kept away from A.C. wiring, as well as be used only with a shielded microphone cable and plug such as is always necessary with high-gain amplifiers. Microphone channel gain is 53 db. and phonograph channel gain 23 db. No other special precautions are necessary—except to reverse the power plug if at first the circuit doesn't work on a D.C. power line because of reversed polarity.

The power amplifier is diagrammed in Fig. 2. It consists of one triode of a 6F8G as voltage amplifier, its second triode as inverse-feedback, balanced phase-inverter driving the 6L6G beam power tubes to 20 watts output class AB_1, and a 5Z3 rectifier. As the circuit indicates, it is simplicity itself, yet provides 52 db. voltage amplification—a total of 105 for both preamplifier and power amplifier. One 6-prong socket is for speaker connection, while the second 7-pin socket provides input connections to grid and ground, 6.3 volts A.C. at 2.7 amperes for heater and 275 to 300 volts at 100 ma. for plate or additional speaker field power. The specified 15-in. giant speaker also receives 15 watts of field power through its plug connections to its series and shunt fields.

Through simple, but quite meticulous, design of both circuits, excellent frequency response, high gain, almost negligible distortion and a good 20 watts of power are obtained coupled with a new order of flexibility. Yet the preamplifier is only 6 x 7 x 3½ ins. and the power amplifier 12 x 4¼ x 7 ins. high over tubes!

This article has been prepared from data supplied by courtesy of McMurdo Silver Corp.

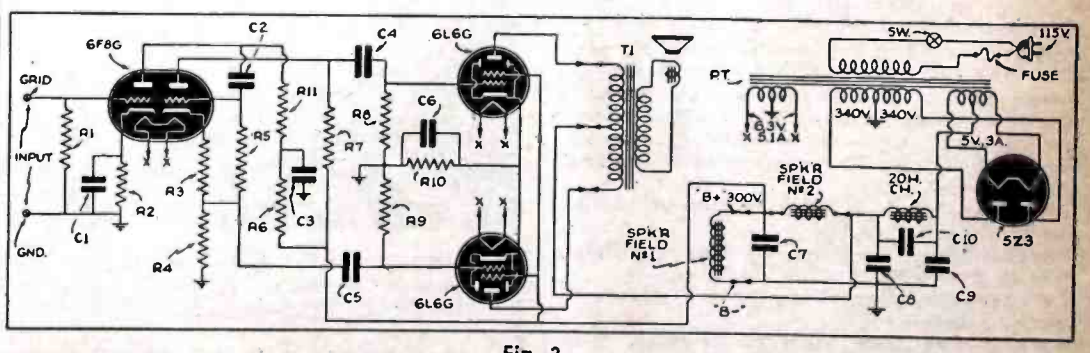


Fig. 2.
Schematic circuit of the power amplifier and its power supply.

R1—½-meg.
R2—1,000 ohms
R3—6,000 ohms
R4—30,000 ohms
R5—½-meg.
R6—15,000 ohms
R7—30,000 ohms
R8—0.1-meg.
R9 —0.1-meg.
R10—125 ohms
Field 1—8,000 ohms
Field 2—695 ohms
C1—5 mf.
C2—0.025-mf.
C3—0.5-mf.
C4—0.1-mf.
C5—0.1-mf.
C6—50 mf.
Filter Choke—20 hy., 200 ma.
C7—25 mf.
C8—25 mf.
C9—25 mf.
C10—0.1-mf.
T1—Output Trans.
P.T.—Power Trans.

LATEST CONTINUOUS-FILM TELEVISION

(Continued from page 83)

SUITABLE DISSECTOR TUBES

The technique of building the Dissector tubes utilized with this projector has progressed to a point where very excellent sensitivity is obtained. These tubes include a 9-stage D.C. "multiplier," a product of the Farnsworth organization, which multiplies the photoelectric current many thousand times before it is further amplified by thermionic amplifiers.

These tubes inherently give excellent contrast and definition, as is generally recognized both in this country and in Europe.

A Dissector tube, with its associated scanning and focusing coils and amplifier, is mounted closely adjacent to the projector, and is associated with the usual source of synchronizing, blanking and scanning power supplies and controls.

This development is believed to be a very definite contribution to the television art, making it possible to reproduce motion picture film with a higher degree of excellence than is usually obtained.

TELEVISION EXPERIMENTS WITH A SERVICING 'SCOPE

(Continued from page 85)

in frequency between the two types of pulses.

The completed separator-oscillator unit may be partially tested before the vision or *video* receiver is built. A sound or audio (the audible, or "tele-audio" portion of the television program as we call it to avoid confusion with the odd-sounding video or image portion of the program—*Editor)* receiver or converter tuning to 46.5 megacycles can be used for the test. A sound receiver will pass the frame synch. pulses with ease but will weaken the line synch. pulses very materially.

TESTING "THE WORKS"

To test the completed set-up, tune the receiver to the television signal. You can recognize the signal by its characteristic sound. It is an unvarying harsh 60-cycle buzz. It is not a hum. Connect the output terminals of the receiver to the input terminals of the synch. pulse separator. Connect the power supply to the separator. The power may be obtained directly from the oscilloscope. The author found that this was very easy with the Du Mont type 164 service 'scope; it will probably be relatively easy with many other makes. Consult the wiring diagram supplied with the unit by the manufacturer. Terminals may be mounted on the oscilloscope case so that it can be easily disconnected and taken out to a job if need be.

The power also may be obtained from any conveniently available power pack.

Connect the vertical oscillator to the "V" terminal on your 'scope. Turn the amplitude selector knob so that all resistance is "in"; set the synch. pulse intensity control on the oscillator to about the half-way point. Adjust (by means of the controls on the oscilloscope) the size, shape and intensity of the raster or pattern appearing in the oscilloscope window. Now bring the amplitude selector knob up until the "raster" begins to "dance"; reduce this control until the "dancing" just stops. Frames will now be observed on the screen. These frames will probably be running away rapidly either up or down. Adjust the frame frequency control knob. The frames will slow down until they will "lock" into a steady position. Further turning of the frame frequency adjustment knob in the same direction will cause the frames to gradually resume their running away but now in the opposite direction. If the frames fail to lock into a steady position, advance the synch. pulse intensity control gradually.

Let us disillusion you right now if you have any idea that the sound receiver will be able to put pictures on your screen. The television carrier is modulated at 1.5 megacycles; a sound receiver will pass a band of frequencies less than 10,000 cycles wide or 0.01-megacycle. (Television carrier with sidebands occupies 3 megacycles.) The author, having obtained good pictures with a sound receiver in 1931-'32 with the old low-definition 60-line television set-up, has made arduous and exhaustive tests on a variety of sound receivers in an effort to obtain sufficiently broad pass band but he found that there is no *superheterodyne* receiver at present on the market with an I.F. sufficiently high to permit of enough "broadening". The gain on *T.R.F.* receivers, on the other hand, vanishes when this much broadening is attempted.

The video receiver to be described in a forthcoming issue, however, uses tubes having an extremely high amplification factor and made especially for television (RCA type 1851) so that enough gain may be retained in the broad-band tuner and video frequency amplifier.

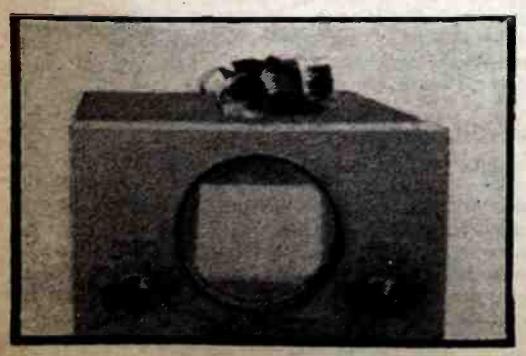


Fig. D. This unretouched photo illustrates the uniform illumination and aspect ratio of the television "raster" as set up on a standard Du Mont service oscilloscope.

The author of this article is instructor in Applied Electricity at New York City's Brooklyn Technical High School; he is also operator at WNYC Auxiliary at the School.

LIST OF PARTS FOR SEPARATOR—OSCILLATOR

One Cornell-Dubilier condenser, type DT6PI, 0.2-mf., 600 V., C1;
One Solar condenser, 0.1-mf., 1,500 V., C2;
Two Cornell-Dubilier condensers, type DT6PI, 0.1-mf., 600 V., C3, C4;
One Cornell-Dubilier condenser, type DT6SI, 0.01-mf., 600 V., C5;
One Cornell-Dubilier condenser, type DT6DI, 0.001-mf., 600 V., C6;
One Centralab resistor, type 648 potentiometer, 4 megs., R1;
One Centralab resistor, type 648 potentiometer, 5,000 ohms, R2;
One Centralab resistor, type 648 potentiometer, 15,000 ohms, R3;
One I.R.C. resistor, ½-W., 0.1-meg., R4;
One I.R.C. resistor, ½-W., 1,000 ohms, R5;
One I.R.C. resistor, 2 W., 0.1-meg., R6;
One I.R.C. resistor, ½-W., 1 meg., R7;
Two I.R.C. resistors, ½-W., 15,000 ohms, R8; R11;
One I.R.C. resistor, ½-W., 10,000 ohms, R9;
One I.R.C. resistor, ½-W., 3,000 ohms, R10;
One Du Mont ½-henry choke coil without core, L1;
One Du Mont type 885 tube;
One National Union type 76 tube;
One National Union type 6H6G tube;
One aluminum panel 7 x 10 ins. high, 1/16-in. stock;
One iron chassis, 7 x 9 x 2 ins. high, 1/16-in. stock;
One 4-connection terminal strip, and insulators;
One 5-connection terminal strip, and insulators;
Five knobs;
Two 5-prong sockets;
One octal socket.

ANY TELEVISION ANTENNA FOR GOOD RECEPTION?

(Continued from page 75)

system may produce multiple signals of sufficient intensity and time-phase displacement to be objectionable.

TRANSMISSION LINE REFLECTIONS

Under ordinary conditions, at most installations, it is necessary to use transmission lines between the antenna proper and the receiver in order to control properly the point of signal pick-up. If the maximum dimension of the antenna system (transmission line plus antenna) is of the order of 100 feet or more, and the line is not properly balanced and terminated at the receiver, reflections in the antenna network may cause a loss of detail in the reproduced picture.

Thus the problem of preventing blurring or double images caused by multiple-signal reception may be divided into the following 2 parts:

1st—The antenna must be made non-susceptible to strong secondary waves from external reflecting media;

2nd—The antenna and its transmission line must be so constructed and terminated that reflections from the receiver end of the system can not bound back to the outer end of the antenna and be reflected there to re-enter the receiver as a delayed signal.

It is difficult to describe in words the appearance of images produced by multiple-signal reception, and difficult to show it clearly by illustrations produced by the photographic and printing processes necessarily involved. Figures B1 to B4 are views showing a small section of a Kinescope screen reproducing a transmitted pattern, under different conditions of multiple-signal reception. The illustrations are of course not clear or representative of the general appearance of the screen when viewed by the eye, and are intended merely to show the relative effects of antenna changes. The pictures were taken on the same receiver with different antennas, but without any changes in receiver tuning. A detailed description of the antennas and the effect of each on the received image will be given later.

SOURCE OF SPACE WAVE REFLECTIONS

It is to be understood that the reflecting medium need not be a metallic object. The specific inductive capacities of building stone, brick, paving material, and ordinary soil, are sufficiently greater than that of air to have high coefficients of reflection for television frequencies at some angle of incidence. Therefore almost any surface can act as a reflector, if its dimensions are comparable to, or greater than, one-half wavelength.

If the transmitting antenna is within line of sight of the receiving antenna, and a plane surface parallel to the ground is located between the two and within sight of both, the strength and delay factor of the reflected energy will depend upon all of the dimensions of the geometrical orientation of the 3 objects. However, it can be shown by simple calculations that only within a radius, from the transmitter, of about 6 times the combined transmitting and receiving antenna heights (above such a surface) can reflections of this nature be sufficiently delayed to cause a loss of detail in the reproduced image. This, of course, is based on our present standard of 441-line, 30-frame per second transmission. Therefore, at most receiving locations, more than a mile or two from the transmitter, where reflections are troublesome, the reflecting area must lie in some plane other than that parallel to the ground.

Large buildings surrounding a receiving location offer ample opportunity for multiple-path reception even when the transmitting and receiving antennas are within line of sight. If the two are hidden from each other by tall buildings or by hills, the direct signal may be so greatly attenuated that the reflected energy exceeds that which travels the direct path. One example of this was noticed recently at a receiving location which was hidden from line-of-sight of the transmitting antenna by a nearby building. In this case, the single strong reflected wave produced an image misplaced by an amount which indicated it had travelled about 900 feet further than the direct wave. The receiving doublet was rotated to a position which eliminated the direct signal (which was much the weaker of the two) and good reproduction was obtained.

The most satisfactory indicator for determining the presence of undesired reflected waves and for aiding in the determination of their source, is a television receiver equipped with a portable doublet on the end of a long pole. It is necessary, of course, that the transmitter be in operation at the time of test, and that the transmitted image be stationary and of such a nature that either blurring of horizontal detail (at the edges of vertical lines) or the presence of a secondary image, is readily apparent. A single black vertical line in the middle of a white background would suffice.

The effect of orientation and rotation of the portable doublet on the relative strength of the direct and reflected signals, as reproduced by the receiver, together with a calculation of the difference in path lengths by a measurement of the displacement of the two images on the screen, will usually indicate the probable source of the reflection quite accurately. However, in many cases such information may turn out to be of only academic interest, since it will often be found that the correct answer to the problem of proper location and construction of the fixed receiving antenna can be determined only by empirical investigation.

MINIMIZING SECONDARY SIGNALS

Probably the most generally useful type of television-receiving antenna will be a simple doublet, or double-doublet, connected to the receiver by means of a low-impedance, twisted-pair transmission line. At the majority of receiving locations this will undoubtedly give completely satisfactory reception if normal care and thought are used in its installation. Even at many places where multiple-path reception is encountered, the same type of antenna may be made to serve satisfactorily by orientation to minimize the reflected signal, or by shielding it from the reflecting source. This might be done by placing it in proper relation to existing conductors such as metal flashings, copings, eavestroughs, etc. Usually such location can be found only by trying different positions and noting the effect on the received image. Another method of shielding a receiving doublet from reflected waves is to place a second, unloaded dipole near it and in proper position to minimize the reflection image. Here again the cut-and-try method will probably yield the best results.

If several strong reflected signals are present at the receiving location more drastic action will probably be necessary. This was the case at the RCA License Laboratory which is located about 6,000 feet north of the transmitter on the Empire State Building. Figure B1 was taken to illustrate the maximum number and relative strength of reflected signals which could be picked up at this location. The antenna was a half-wave doublet at the end of a 60-foot twisted pair which, however, was connected with the two wires in parallel to act as a "T" antenna against ground. In this case the first reflection arrived with proper phase and intensity to invert a large amount of the direct-signal detail into negative values of light intensity. This was followed by 5 more reflected signals varying in time of arrival and amplitude. The last of these is displaced by an amount which indicated that it had travelled 3.8 microseconds longer, and thus about 3,700 feet further, than the direct wave.

It is interesting to note that in this case horizontal synchronization of the receiver was seriously impaired. The whole pattern moved to the left as though the receiver had synchronized on one of the reflected signals. This was undoubtedly the case due to partial destruction of the true horizontal pulse by the strong, short-delay, out-of-phase reflection.

Figure B2 was taken with the doublet and transmission line connected normally to the balanced-input terminals of the receiver, and with the doublet adjusted to the position which minimized secondary images. However, it can be seen that this antenna would be entirely unsatisfactory for good reception. Two principal reflections are still apparent. These are displaced by amounts which indicate additional path lengths of 800 feet and 2,300 feet. A very faint trace of the 3,700-foot reflection, which is strong in Fig. B1, still remains.

The antenna for Fig. B3 was the same as for Fig. B2 except that one end of the doublet was lengthened by adding a 3½-wavelength wire

toward the transmitter. This was supported ¼-wavelength above a wide copper coping parallel to, and about 150 feet directly above, Fifth Avenue. Resistance termination at the outer end of this antenna had little or no effect on the reproduced image, so Fig. B3 was taken with the far end open. In this case the 2,300-foot reflection is still faintly visible, but probably represents an acceptable minimum of direct- to reflected-signal ratio.

Of a large number of antennas tested, that used for Fig. B3 seems to be the only one which gives acceptable performance for reception at this location. Reflection conditions at this point are unusually severe and do not, by any means, represent the average to be expected. Although objectionable secondary images are picked up by simple half-wave doublets at various locations within the range of the transmitter, there are many more where no reflections are apparent.

BEHAVIOR OF TRANSMISSION LINES AND LONG WIRE ANTENNAS

The long-wire antenna at the License Laboratory is necessary only because its directional characteristics improve an adverse direct- to reflected-signal ratio. At, or near, the boundaries of the service area of a television transmitter it will sometimes be necessary to use something other than a simple dipole and twisted pair for the antenna system in order to raise the signal well above the receiver hiss level.

Rubber-dielectric, twisted-pair lines dissipate a considerable amount of the received energy if they are more than a few wavelengths long. Measurement of several types of such lines indicates that the average attenuation to be expected is between 1.5 and 2.0 db. per wavelength at 50 mc. Therefore, a fair increase in signal strength at the receiver can often be obtained by the use of an open-wire line, particularly if the distance from the antenna to the receiver is 50 feet or more. The attenuation of the average, close-spaced, open-wire line is about one-tenth of that of twisted pairs. However, if an open-wire line is used, its increased impedance will cause the antenna to operate less efficiently unless the two are connected together in such a manner that the damping of the antenna is about the same as with the lower-impedance line. This can be done by the use of the well-known Y connection which is common in amateur transmitter practice.

It is also necessary for the input impedance of the receiver to be at least approximately matched to the higher-impedance line in order to realize the increased-signal level. In some recent tests it was found convenient to have a small residual-inductive component as part of the input impedance at the balanced-input terminals of the receiver. The resistive component of this impedance measured about 100 ohms; therefore, when using a 100-ohm line, two small series condensers (one in each wire) were inserted to cancel the reactance. If, however, the reactance was cancelled by shunt tuning, the input resistance became 500 ohms, which was the impedance of the open-wire line. This made it possible to analyze the behavior of the two lines without making changes in the receiver input-coupling circuit.

Under some conditions the energy picked up by the 2 wires of the transmission line acting in parallel may exceed that in the antenna proper. If the entire system, and the receiver input in particular, is well balanced to ground, the signals from this source cannot enter the receiver. If, however, an unbalance does exist, energy from this source may give rise to considerable trouble. This is particularly true if the entire length of line and antenna is of the order of 100 feet or more. In this case the unwanted signals may be reflected back and forth between the receiver and the outer end of the antenna producing a new image, slightly displaced from the previous one, on each round trip, and thereby obliterating much of the horizontal detail.

The energy loss in twisted-pair lines is usually sufficient so that signals cannot travel in them (back and forth) for a sufficient length of time to cause blurred reproduction before being attenuated below a disturbance level. However, energy travelling on the 2 wires in parallel is often subjected to much less attenuation and can make trouble, if lack of balance in the system allows some of it to enter the receiver.

A marked example of this effect was noticed recently. At a particular location, a half-wave doublet and twisted-pair line gave no indication of extraneous reflections, but the signal level (about 800 microvolts) was somewhat too low for a good signal-to-receiver-noise ratio. Therefore, it was decided to install some type of long-wire antenna and open-wire line as an experiment to determine just how much this could be increased without resorting to means other than those which will be at the disposal of the average Serviceman. Existing supports were not available for a rhombic antenna which would have had to extend from the lead-in point in a direction toward the transmitter. Therefore a single-wire, 5-wavelength antenna, was placed between 2 tall trees which were on a line about 20 degrees from the direction of the transmitter. The 2-inch spaced transmission line was Y connected to the antenna across a point ¼-wavelength from the end toward the transmitter. With this arrangement it was realized that the major portion of the received energy would have to travel to the far end of the antenna, be reflected there, and then travel back the entire length before entering the transmission line. Furthermore, the whole system was, of course, unbalanced with respect to ground.

A test of the operation of this antenna showed that it delivered about 10 times as much signal voltage to the receiver as the doublet and twisted-pair. A large portion of this was due to an increase in height above the old antenna; the rest of it was accounted for by increased antenna and transmission-line efficiency. However, the reproduced image was decidedly poor. The radical loss of horizontal detail which resulted was at first assumed to be due to a too sharply defined resonant characteristic of the antenna proper; however this proved not to be the case. The cause of the trouble was found to be end-to-end reflection of that energy which flowed down the transmission-line wires in parallel. The distance from the receiver to the outer end of the antenna was about 175 feet. The blurring of the edges of vertical lines extended for a distance which indicated that at least 3 complete round trips (1,050 feet) were made over this path by the extraneous signal before it was sufficiently attenuated to be unnoticeable.

The difficulty was corrected by shorting and grounding the transmission line at its bottom end and tapping off a short length of low-impedance line (for a lead-in) at an empirically determined point a few feet above the ground rod. It would normally be expected that a terminating resistor between the shorting bar and the ground connection would be required to prevent reflection of unbalanced signal energy at that point; in this case it was not necessary.

In its final form the antenna delivered somewhat less signal to the receiver than when first tried with a direct connection; but it still gave a 15 db. improvement over the half-wave doublet. This was sufficient to raise the signal well above an acceptable minimum.

CONCLUSIONS

Some locations within the service area of a television transmitter will require individual receiving-antenna study and design to meet conditions at those locations.

It appears at present that a standard antenna design, or any single preventative of multiple reception, can not be prescribed for all receiving locations, especially where service from 2 transmitters in the same area is to be obtained.

Satisfactory performance has been obtained in every case studied, by means described in the paper.

The above article has been reproduced, by special permission, from the April, 1938, issue of *RCA Review*.

NEW BOOKLETS

CHARACTERISTICS CHART AND SOCKET CONNECTIONS—A new 16-pg. booklet (1275-B) having this title has just been released. Unlike the previously available, more detailed characteristics manuals, this handy little "breakdown" of tube data comprises only the actual tabular matter and socket connections ordinarily found only in a large chart. Available upon request to RCA Mfg. Co., or in care of *Radio-Craft*.

TRANSMITTING TUBES—Air-Cooled Types. This second 16-pg. booklet (TT-100), also available from RCA Mfg. Co., contains data similar to the first; and, in addition, illustrations of the tubes, prices, considerable theoretical discussion and the diagram of a 30-mc. transmitter.

THE RADIO MONTH IN REVIEW

(Continued from page 71)

pick-up camera by one of the television operators at Mortlake!

A mock air-attack on Alexandra Palace supplied thrilling material for viewers, last month.

With a view to creating "a new film public," B.B.C. proposed to Kinema Renters' Society that a reel of trailers on films showing at local movie houses be worked up each week for televising; K.R.S. said no soap.

To "shoot" the Derby 3 television cameras were to be used; one a super-Emitron with 12-in. telephoto lens to catch a "binocular view" of the start of the race, while the other two were to be used in showing saddling, weighing-in, and close-ups of the winning horse and its owner.

"*Checkmate*", a colorful ballet with black and red "chessmen", was scheduled for telecasting during May (show premiered at the Paris Exhibition); *The Emperor Jones* a little later; and Chelsea Flower Show is billed for yet later in the same month; and cricket matches at Lords and the Oval, tennis at Wimbledon, polo at Hurlingham, and swimming championships at Wembley Pool are on the video bill-of-fare.

"Let the viewer decide" is a phrase which a cheetah race is scheduled, as we go to press, to introduce. The B.B.C. plans to give a cheetah 40 yards headstart over a greyhound, in a 450-yard race on the greyhound track at Harringway, and let the owners of television receiving sets see just how fast supposedly the "fastest 4-footed animal in existence" really does travel —and whether the claim can be proven.

A television DX record for an Alexandra Palace "outside broadcast" was hung up, last month, when an Eastbourne viewer announced the reception of good clear images, on a standard Baird receiver, of the telecast program of the Head of the River Race. Airline distance, about 55 miles.

Practical and Amateur Wireless (London) reported last month that about 36 of the latest-type television receivers were in operation, ranged along a "Televiewers Parade," at the Ideal Home Exhibition at Olympia. Makes included Baird, Cossor, G.E.C., H.M.V., Marconi, and Murphy.

The Baird model T-11 television receiver, complete with all-wave radio receiver is now offered for 55 gns. (about $290). This price includes antenna, installation, and 1 year's free service.

The South of England, it was anticipated last month by *Television and Short-Wave World* (London Eng.), most likely will be included in the service area of France's new Eiffel Tower television station. Particularly, comments the editor, in view of the fact that Alexandra Palace transmissions have repeatedly exceeded normally expected ranges. Political rabblerousers would give a right-arm for *carte blanche* to use a medium with such wonderful opportunities for raising international hades—and gesticulating to a fine art.

"Television eye" is stated by *Reynolds* (London) to be the latest malady to be charged to radio; the complaint is said to be caused by sitting too close to the television screen. Operators of ultra-shortwave transmitters sometimes get "radio fever," short-wave operators sometimes get a "radio-frequency burn," studio performers are not immune to "mike fright," and telegraphers sometimes experience "glass arm." What next, under the heading of Occupational Ailments, can we charge to Radio?

"Thermion," militant author of the columns, "On Your Wavelength," in *Practical and Amateur Wireless* (London), calls attention to the fact that a certain Sunday newspaper does not like television, and that for 2 weeks running it has been attacking the B.B.C. on the matter; and quotes a reader of the paper as saying, "I think the B.B.C.'s expenditure on television from the listeners' license money is a crime." Having thus led with his chin, he receives the following from brother "Thermion": "Where the 'crime' comes in I do not know, unless we consider the 3 years' delay as a crime . . . . We pay 10s. a year to be entertained with our wireless sets, and unless television is radiated by the B.B.C. we shall be tied to 'blind' broadcast matter for the rest of our days . . . . You cannot stop progress . . . . Television is inevitable . . . . It has been hampered by the caprices of the Government, the radio trade, cranks, lack of money, inspired criticisms, ignorant criticisms, and the insouciant remarks of the flibbertigibbets who haunt newspaper offices earning their miserable pence for their equally miserable lines. I hope some one will extirpate these miserable creatures who have a few items of knowledge and regurgitate them like ruminative quadrupeds which chew the cud in the field." My, my.

German point-to-point videophone (as your managing editor dubs the Teutons' combined telephone and television service over coaxial cable), which has been in operation for some time over the 90-mile link between Berlin and Leipzig, is soon to be pepped up to permit 30 simultaneous "telephone-and-vision" calls to be made.

DOMESTIC TELEVISION

PROJECTION-TYPE television with screen sizes of 3 x 4 ft. and 4 x 5 ft. was demonstrated *over wires* by Kolorama Labs. (Irvington, N.J.) last month. Interlaced, the 225-line images were reported by *Variety* as having observable flicker and line-trace; *Motion Picture Herald*, stating that the reproduction was comparable with "the average home motion pictures," went on record as saying that "The demonstration supported the company's contention that there is no noticeable flicker," despite the fact that the field frequency is 24 per second and the frame frequency, 12. Feature of the system is its large-size image, in light-greenish-blue, obtained by a mechanical-scanning system; newest trick announced by vice-President Kern is a secrecy device which would enable only subscribers to a receiver-rental system to see anything but blurred images.

Having passed the S.E.C. examination with flying colors, International Television Radio Corp. lays claim to being the only television system to receive the complete OK of the Government experts. Using the Priess system of mechanical scanning (vibrating system oscillating, at natural periods, in right-angle planes), this organization is said to have a "controlled patent situation on this type of system, which has many marked advantages in cost, maintenance and performance over any system so far devised."

Arthur Levy, talking for Scophony, Inc. (London, Eng.), in N.Y.C. last month, said that his company had sold 3,000 television receivers, each with a receiving range of about 70 miles; said theatre exhibitors were resentful because English pubs (cafés, etc.) were installing television receivers by the thousands and, so far, charging no fees for viewing the programs.

An interesting little description and commentary on the status of modern television is entitled "Electronic Television—Sound Movies by Radio," by Howard C. Lawrence. Story appeared in *The Tech Engineering News* (M.I.T. house organ) for April.

Radio amateurs, 23,000 of them, have gone to bat with the F.C.C. for space in the frequency spectrum in which to experiment with television. With RCA backing these expert amateur technicians by having made available to them professional-type television components, we figure oldtimer K. B. Warner has better than an even chance when he pleads his cause, as secretary of the A.R.R.L. Reports in *Variety's* Radio-section, last month, gave 112 to 118 kc. as the frequency range desired by the association to be opened-up next October.

Television experimenters will do well to take note of every technical advance in the illumination field. For instance, Fluorescent Lumiline Lamps are now available, according to talks delivered at engineering societies, last month, by G.E.'s Ward Harrison, which in efficiency have a 100-to-1 advantage over filament types; translated into dollars and cents, if it costs $1 to run a filament-type lamp for a given length of time, a fluorescent-type lamp of same lumens-per-watt rating could be operated for 1c! Advantage No. 2 is that any color of the rainbow may be obtained; and a "daylight" equivalent closely approximating the U. S. Bureau of Standard's "color temperature" of 6,500°K. These "electric discharge type" lamps are vaccum tubes containing synthetic fluorescent powders which luminesce at different colors, and white, under the influence of ultraviolet rays emanated by ionized mercury-vapor.

Televised last month for the first time, the first industrial film from the state of Washington was said also to be the first made for radio station promotion. More than 7 months were spent in the preparation of the film; section 1, "Behind the Scenes in Radio," played up both the enter-

tainment and business angles of operations by KOMO and KJR, Seattle, while section 2, prepared in part from material supplied by the U.S. Bureau of Foreign and Domestic Commerce supplied data, in both statistical and dramatic form, on items concerning the Northwest and its coverage by the N.B.C. affiliates.

HAM "OPS"

HAM radio had several innings last month, as per the following amateur-radio items:

Hot item of the annual convention of the New England Division of the A.R.R.L. scheduled to meet about press date, is the announced first-hand account by big-chief K. B. Warner, of his recent trip to represent U.S. ham radio operators at the International Telecommunications Conference. Highlight No. 2 at the convention will be initiation into the Royal Order of the Wouff Hong, classical semi-secret society pledged to good operating practices.

The Chicago Area Radio Club Council anticipates an attendance of 3,500 amateurs at an amateur radio trade show and convention to be held at the Sherman Hotel in September. The din-makers have plenty time to cook up code-practice ideas.

The radio amateur's "Bible" is now available in a Spanish edition, according to the A.R.R.L. The English version sells about 75,000 copies annually, including 15,000 copies outside the United States and Canada! Revista Telegrafica will produce the book in Buenos Aires.

The Hiram Percy Maxim Memorial Award, a bronze replica of the Wouff Hong, goes to the amateur under 21 who has most meritorious record of amateur radio accomplishment for the year. Oscar L. Short, W9RSO, Webb City, Mo., garnered the trophy this year after 1,000 hours' operation of his station.

A "Special to the *New York Times*" last month disclosed one day's-good-turn by amateur radio. When Gov. Blanton Winship's military aide, who was stationed in San Juan, Puerto Rico, learned of the death of his sister in Hawaii, he obtained further details from his brother-in-law and former West Point room-mate, Lieut. Morris, via the amateur radio station of H. Guildemeyer, who succeeded in contacting the Army post at Honolulu.

CLAIRVOYANCE

MAROONED, telephonically, last month, Rikers Island in the East River, New York, enlisted the aid of fire and police departments of Manhattan and the Bronx. A passing boat, presumably, cut telephone and fire alarm wires from the Island, leaving in its wake a case of jitters, for the guards of 2,000 prisoners. Hero of the day was Deputy Fire Chief Harold of the Bronx, who foresaw 2 years ago (said the *N.Y. Post*), the possibility of some such contingency; the 2-way emergency radio set he whisked to the Island was part of the solution he had formulated.

MORE FIGURES

WORLDWIDE, 70,000,000 radio sets are in use, according to a *New York Sun* report of last month, in discussing a say-so by B.B.C.; latter's figures were garnered from data released by the International Broadcasting Union—which makes the whole thing official.

The *N.Y. Sun* also quoted "a prominent radio editor" as having figured that present-day tubes make possible about 4-billion different and workable radio circuits, a good ½-billion of which can be worked up on the basis of no more than 8 tubes (including the rectifier). Each new tube manufacturers announce, about doubles the possible number of practical circuits. How many's a billion circuits? Well, if you wired-up a set to have a new circuit complete in 1 minute, and worked uninterruptedly 12 hours a day, everyday, you'd have polished off your billionth circuit at the ripe old age of about 340!

The Radio Manufacturers Assoc. of Canada rates radio business in the Dominion, for 1937, compared with 1936, as follows:

Apparatus	*1936*	*1937*
A.C. Sets	168,353	169,564
Battery Sets	61,127	71,476
Auto Sets	18,711	23,169
Total sales	248,191	264,209

Commenting on these figures, last month, *Radio and Electrical Sales* (Toronto) continued: ". . . radio retailers throughout Canada are suffering from the heavy duty-free importations of sub-standard radio sets from the United States, estimated to exceed 50,000 sets, or approximately 20% of the total Canadian production." We are sorry to learn that our neighbor has so many radio salesmen insufficiently glib to out-sell vendors of sub-standard merchandise; or *is* it sub-standard?

Included among the judges who will pass on answers to the question, "How much money has been spent to advertise the name RCA-Victor in the last 10 years?" is your managing editor. This nation-wide contest among radio tube dealers, with awards going to contestants who send in the 50 most accurate answers, gets under way shortly.

RADIO CELEBS.

HISTORY in the making was scheduled as this issue of *Radio-Craft* went to press. The occasion was the 3-day stately ceremony dedicating the Benjamin Franklin Memorial, at the 114-years-old Franklin Institute, Phila., Pa.; concluding gesture was to be the unveiling of the Fraser statue (see illustration) of Benjamin Franklin (1706–1790)—first great American scientist—whose legion achievements perpetuate his memory.

Included in the exhibition and display plans were the reading within Franklin Hall (the soundproofed memorial room) of a message from the President of the United States, while loudspeakers fed the talk to listeners outside; demonstrations of army and anti-aircraft equipment, in action, utilizing electricity; exhibits, in the Institute's "Wonderland of Science," showing the progress of science since the days of Franklin's experiments with kites, silk thread and keys (electrostatic electricity, via the "electrophorus," though, was his very first love); and, demonstrations, in the new 1938 House of Magic, of science's latest discoveries, were made.

In 1888 Hertz demonstrated the existence of the electromagnetic or "radio" waves hypothesized in 1865 by Maxwell after learning of Faraday's theories, on this subject, first expounded in the latter's 2-part paper, "Experimental Researches," in 1831 (Part I) and 1832 (Part II). Last month, the Royal Society (London, Eng.) broke the 106-years-old seals on a document Michael Faraday had given over to the strongboxes of the Society for safekeeping, in 1832. In this document Faraday lays claim to what is clearly the electromagnetic "wave" theory which we today call "radio"! We quote:

"I am inclined to think the vibratory theory will apply to these (electromagnetic) phenomena, as it does to sound, and most probably to light.

"By analogy, I think it may possibly apply to the phenomena of (electrostatic) induction."

Add coincidences. In its April 12 issue, *The Times of India* (Bombay, India, newspaper) carried the suggestion of "N. P. P." that a "Hertz Family Fund" be paid in gratitude to the straitened family of the famous scientist who experimentally demonstrated what we now call "radio." On the newsstands May 1, June *Radio-Craft* carried on pg. 842 a similar plea, under the title—"The Hertz—an Open Letter to the Radio Field."

The Italian government announced its appropriation to cover the Italian exhibit at New York's World Fair in 1939—$1,000,000. Included in the exhibit, said the *New York Times*, will be a reproduction of Guglielmo Marconi's workshop. Fair's publicity continues over the short waves.

SOUND USAGE

SPOTLIGHTING Muzak—static and advertising-free music over wires—last month, *Motion Picture Herald* pithily told how Warner Brothers, present owners, anticipate a great future for the concern by expanding Muzak's activities to include 1,000,000 eventual customers (in homes, hotels, restaurants, cafés, etc.), to gross $3-million, at $3 per month per customer. Muzak, once discussed by technicians as possible television outlet, is now scouted as such.

Reynolds' (London, Eng.), reported, last month, that a powerful loudspeaker was scheduled to call to the Easter services, the communicants of St. Michael's. Before each service, strains of hymns, which could be heard 2 miles away, were "loudsung."

From London, Eng., came reports, last month, that Gaumont-British is trying out the idea of a hearing-aid installation in a Glasgow cinema theatre. Unique part of the idea is that the hard-of-hearing patron does not utilize either a microphone and amplifier, or a connection made to the sound system of the talkies equipment;

(Continued on page 119)

MICROPHONES EXPLAINED FOR BEGINNERS

(Continued from page 91)

This extended range of audio response is not very important as far as speech is concerned but does add brilliance to the reproduction of sound from musical instruments.

The output of this unit is approximately the same as that of a condenser-type microphone, so it also requires a 2-stage amplifier to bring the output level up to about −30 db.

The velocity microphone is a low-impedance device, but it always has a coupling transformer mounted right in the microphone case. By matching the line impedance to that of this coupling transformer, the amplifier may be located some distance from the unit itself, provided the connecting cable is properly shielded.

This type microphone is of a rugged nature and also possesses a very marked *directional* effect, the greatest response being obtained at right-angles to the plane of the ribbon; an "acoustical labyrinth" is sometimes provided to enhance the directional characteristic by absorbing ½ the backwave. The construction of the microphone is of such a nature that its operation is very quiet and free from noise or hiss.

DYNAMIC MICROPHONES

The operation of the moving coil or dynamic microphone, like the dynamic loudspeaker, is fundamentally that of a conductor moving in a magnetic field, thus generating an e.m.f. in the conductor. See Fig. 1E. The diaphragm is made of thin *duralumin* which—in a high-grade unit—is pressed into a dome shape for stiffening to secure a piston action over the audio frequency range; improved frequency response is achieved by providing an "air passage" to afford outlet for the backwave.

The moving coil is made from thin aluminum ribbon cemented to the diaphragm, and moves in the air gap between the pole pieces. The permanent magnet is composed of cobalt alloy steel, which will remain magnetized for a long period of time.

The moving coil microphone is quite rugged and is not affected by climatic conditions. Its output level is approximately 10 db. higher than that of the condenser-type microphone, or about −80 db.

The low impedance of the dynamic microphone makes it possible to locate the pre-amplifier some distance from the microphone itself. The frequency characteristic of the dynamic microphone is quite uniform from 35 to 10,000 cycles, so it has very good fidelity response to sounds in the normal audio range. This type unit has no inherent noise, and due to its very rugged construction can stand quite a bit of rough handling.

CRYSTAL MICROPHONES

Two types of crystal microphones are in common use today, to wit: 1st, the *sound-cell* type (See Fig. 1G.) in which the sound waves act directly upon the crystal; and 2nd, the *diaphragm* type (See Fig. 1F.) which uses a diaphragm to the center of which the crystal is attached by means of a mechanical link. In either of these units, the principle of operation depends upon the piezoelectric effect or voltage produced in certain crystals when subjected to mechanical stress (bending, etc.).

The sound-cell unit is an assembly of 2 "bimorph" Rochelle salt crystal elements in a bakelite frame. The bimorph elements, in turn, are each made up of 2 crystal plates with electrodes attached, cemented together so that an applied sound will cause a bending of the assembly, and produce a voltage. The mounting is such that mechanical shocks have little effect on the unit.

No diaphragm is used, the sound impulses actuating the crystal elements directly. An exceptionally wide frequency range, even into the super-audible band and on down to zero frequency, may be obtained from this unit. Of the 2 types of crystal microphones, the sound-cell *has the better frequency characteristics.* Its output is very low, however, so it requires greater amplification. This type of crystal microphone is usually employed for full-range musical pick-up.

The diaphragm type will give much greater output, eliminating in most cases the need for a preamplifier, but it has the disadvantage of limited frequency response. This type of crystal microphone is most used for voice work.

This article has been prepared from data supplied by courtesy of Coyne Electrical School.

THE RADIO MONTH IN REVIEW

(Continued from page 117)

instead, a so-called "miniature radio receiving set" (to quote the report), which the patron holds in his or her lap and to which an earphone is connected, picks up sound radiations from a copper coil around the auditorium and from copper leads placed under carpets and seats. Microphones concealed near the movie screen pick up the sound from the talkie's loudspeakers. This apparently is the old "induction telephone" scheme, but modernized to employ an amplifier, etc.

A correspondent of *Time* magazine naively suggested last month that the War Department would have been spared a deficit of $96,000 had electrical transcriptions been used in place of flesh and blood salutes. It was suggested that a super-power amplifier and the transcription could be used to simulate a 21-gun salute with lower volume on the amplifier to give the effect of fewer guns. (Aren't the shots fired in sequence any more?)

MISCELLANEOUS

TINY Holland, recalling how a boy once saved a dike by using his finger to plug a leak, is once again looking to the youth of the land to help fend off enemies of a different sort. According to *L'Industria* (Milan, Italy), last month, the Dutch found during recent military maneuvers that radio amateurs with radio-transmitter-equipped bicycles were able to give an alarm in well under 1 minute to cities and defense zones, for relay to anti-aircraft defenses, that an airplane had been sighted.

Across quadrillions of miles of interstellar space came cosmic energy from galaxies which operated a radioteletypewriter, last month, at a novel exhibit in Rochester, N. Y.; the radioteletypewriter, ordinarily used on an ultra-shortwave circuit by International Business Machines Corp., to receive news bulletins, was operated by means of a relay actuated by a cosmic-ray detector or "Geiger-Mueller counter."

Golden Gate International Exposition, San Francisco's big to-do about plenty, has scheduled Engineers' Week for July 10 to 17, 1939. Radio and electrical engineers will take an active part in a gala celebration at the Fair on July 13.

With WHK (1,390 kc.) at Cleveland limited to facsimile transmission between the hours of 1:00 to 6:00 a.m., United Broadcasting Company's technical supervisor, E. L. Gove, conceived the idea of effecting more intensified experimental facsimile work by getting permission to put their shortwave-er, W8XNT, on the air at 38.6 megacycles with facsimile programs *24 hours of the day.*

Apropos of Ireland's first experimental shortwave transmitter, revealed in a Dail debate on the Broadcasting Estimate and reported by *Ireland's Own* (Dublin, Eng.), it is expected that Irish listeners will be deprived of the station's programs since its signal probably will not drop down much inside a 300-mile radius. Incidentally, are we soon to have an E.I.R.E. Chapter (Irish [Eire] Institute of Radio Engineers)?

In addition to the regular schedule of the convention, in Chicago, of a well-known manufacturer, a service school will be held under the auspices of the parts and service division. The service school, according to a statement, last month, from their company's parts and service manager, will cover every technical point in the entire new 1939 line.

This service study, it is believed, will eliminate any difficulty which might ordinarily arise with service departments trying to familiarize themselves with the latest radio developments.

A Texas radio school last month announced the acquisition of an RCA "SOS alarm" or automatic emergency device, an emergency-type transmitter with short-wave attachment, latest-design long- and short-wave receivers, and a direction finder. Nice way of celebrating the "28th anniversary of its founding as a non-profit business and radio school."

Eastern Electronic Research Association held an Annual Convention at Hotel Pennsy., (N.Y.C.), last month. Avowed purpose in life, of E.E.R.A.: ". . . an organization of physicians, scientists and laymen representing various schools of practice, branches of science and health promotion, interested primarily in the development and application in practice of methods employing the detection and identification of radiant emanations as an aid to diagnosis, and the use of high-frequency waves as a means of treatment." Of its 10 officers and directors, 7 are titled "Dr." In its program, under "Appreciated Offers of Helpful Service Co-operation," we find such strange bedfellows as "Radio-Craft Publications, Inc.," and "'Longchamps' Restaurant"!

OPERATING NOTES

(Continued from page 94)

SOCKET BREAKDOWN

I had an interesting although uncommon service case. The set when turned on hissed and sparked and smoked at the socket prong of the type 80 rectifier. Upon inspection the tube was found to be perfect and all the wiring to the socket was perfect. It was a puzzler until they happened to mention that they had spilled some water on the set. I then inspected the bottom side of the 80 socket and observed a thin black streak from one plate prong receptacle to the other plate prong receptacle.

It seems that when the socket had become wet between the 2 plate prongs, the high voltage took this path instead of through the plates of the tube. This high voltage, some 700 volts, burned the bakelite socket at that point and carbonized it, making a high-resistance path; when the set was turned on the voltage ran across this high-resistance path, shorting the high-voltage supply and thus supplying no voltage to the plates. The socket was welded on and not wishing to dismantle it I took a sharp screwdriver with a thin edge and broke away about 3/16 of an inch of the bakelite socket between the plates thus destroying the high-resistance path. The set thereupon resumed normal operation.

(A similar case might occur in a place where the temperature would be extremely humid causing moisture to form on the socket base.)

ALBERT STOCK

Does *your* radio library include a copy of March *Radio-Craft*? Copies of this 144-page, 1888-'38 JUBILEE SOUVENIR NUMBER are still available at the original price of 50c.

$125 TELEVISION RECEIVER NOW ON THE MARKET?

(Continued from page 74)

may falsely claim to be selling stock in the company.

Heretofore the apparatus produced by the company has consisted of loudspeaker systems for ships, but this work is being put aside for the production of television receivers, of which the company plans to have 250 made as the initial lot.

If, as seems likely, they proceed with their plans, it will probably force television out of the laboratory and into the home. Should the public evince interest in purchasing video receivers, other companies, such as RCA, Farnsworth and Philco may be forced to meet competition by marketing sets of their own, and if this is done, it is practically certain that concerns—possibly program sponsors—will be found to provide video entertainment comparable in interest to radio entertainment or home movies.

(Editorial note:—The simulated image shown on the C.-R. tube, in Fig. A, has been "faked in" merely to show the manner in which the image area appears when the 3 x 4 aspect ratio is obtained.)

Our Information Bureau will gladly supply manufacturers' names and addresses of any items mentioned in RADIO-CRAFT. Please enclose a stamped and self-addressed envelope.

At the 1939 Golden Gate International Exposition there will be held on Treasure Island the first international convention of the DX-ers—club of radio listeners whose object is snagging remote air programs.

THE LATEST RADIO EQUIPMENT

(Continued from page 97)

(1657 *Continued*)

A NEW *metal-clad* resistor of the same make, photo B, has its wire, wound on a special heat-resistant bakelite core, permanently imbedded in a moisture-proof bakelite which in turn is encased in a metal jacket; maximum mechanical and electrical security is thus obtained. Resistance values, from 10 to 10,000 ohms; watts rating is 3 W.

SWIVEL-MOUNTED LOUDSPEAKER (1658)

PATENTED acoustical features are said to be incorporated in this "Vibroloc" loudspeaker. Claim is that "even the smallest 'radio' will bring you *full-range concert tones* and the *volume* expansion necessary for symphony performances." (Just how this may be accomplished was not made clear in literature furnished to *Radio-Craft*.) Data follows for the unit illustrated: power rating, 15 W., normal; fidelity, "full tone range"; outside dimensions, 15 x 15 x 7½ ins.; inside dimensions, "non-accessible chamber designed for speaker supplied." Swivel mounting permits locating instrument almost anywhere; finish is per specification, or heavy-grained leatherette; use in radio and P.A. applications.

MOTOR-STARTING ELECTROLYTICS (1659)

(Cornell-Dubilier Electric Corp.)

SERVICE MEN, especially, will be interested in the new, type ETN dry electrolytic condenser illustrated, since it is especially suited, as a motor-starting unit, for use with fractional-horsepower motors of the type used in refrigerators, oil-burners and similar appliances.

These "ETN's" are hermetically sealed in an aluminum case which is externally insulated by means of an impregnated-fiber sleeve. Designed for operation involving a maximum of 20, 3-second starts per hour.

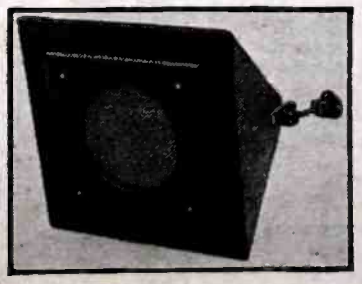
"DISPLACEMENT" PICKUP (Locates Water Leaks, etc.) (1660)

(The Brush Development Co.)

THE "DISPLACEMENT" pickup, here illustrated, incorporates a crystal element which is actuated directly by a suitable drive pin which bears against the vibrating body.

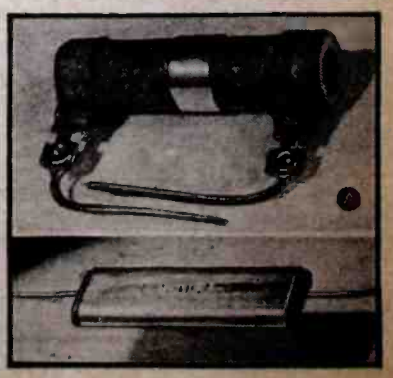
A partial list of applications for these (type DP-1) pickups includes: acoustical studies; localized sound analysis; medical studies; production testing of all kinds of bearings, crankshafts, etc.; location of source of noise or vibration in any reciprocating or rotating machine;

Newest sideline item for Servicemen is the "ozonator" shown at left and described on pg. 97. (1655)



Above is shown a swivel-mounted loudspeaker; housing seemingly is triangular. (1658)

Many new and useful features are incorporated in the automatic and portable reproducer illustrated above and described on pg. 97. (1656)



At A, *inorganic-cement* and *varnish-coated* type of wire-wound resistor (see pg. 97); at B, *metal-clad* type of resistor. (1657)

measuring transmission of vibration through different materials; measuring or recording the vibration of airplane wings, automobile bodies, or pipe lines; *water leak detection.*

NEW 20-WATT PERMANENT-MAGNET DYNAMIC LOUDSPEAKER (1661)

(Wright-DeCoster, Inc.)

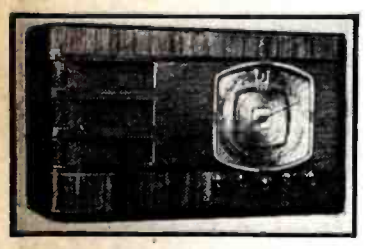
DESIGNED to handle 20 watts *continuously*, a new P.M.-field dynamic loudspeaker, the type N 12 HL, here illustrated, is available in 3 types, with response characteristics as follows: low-frequency type, 50-3,500 cycles; standard type, 60-5,000 cycles; wide-range type, 60-7,500 cycles.

12-TUBE MANTEL-TYPE ALL-WAVE RECEIVER (1662)

(Wholesale Radio Service Co.)

THE Lafayette receiver shown here is available with either an A.C. or an A.C.-D.C. chassis. With either chassis, its outstanding point of merit is its exceptional effectiveness in a radio set of such small proportions; its 4-band circuit operates over the ranges of 13 to 41 meters, 40 to 130 meters, 173 to 555 meters and 835 to 2,050 meters—the latter range being especially interesting in view of its coverage of the European long-wave broadcast stations. Has R.F. preselector on all bands; full A.V.C. noise-reducing control, tuning "eye," beam power output, and so-called "ultra-widerange tone control."

A glance at the tube complement further indicates its modern design, viz.: 4—2516G's, 3—25Z6G's, 1—6K7, 1—6Q7G, 1—6B8G, 1—6A8G and 1—6U5 ("eye"), for the A.C.-D.C. chassis; the A.C. chassis employs 2—6V6G's, 3—6J5G's, 3—6K7's, 1—6A8G, 1—6H6, 1—6U5 and 1—80.



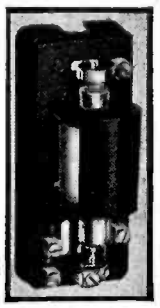
The compact all-wave set shown at left has 12 tubes. (1662)

NON-TILTING VERTICAL MERCURY RELAY IS SEALED-IN-GLASS (1663)

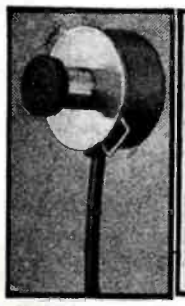
THE "Vertex" relay shown here is said to be the first mercury relay which does not require tilting of the tube and in which *all* mechanically-moving parts are sealed-in-glass. As a result, these relays are said to be highly reliable and efficient in operation and take up less space than any other mercury relay.

The glass tube contains a cylindrical plunger which floats on a mercury bath. When the solenoid winding outside the tube is energized the plunger is drawn, magnetically, down into the mercury which is displaced upward until contact is made with an upper electrode.

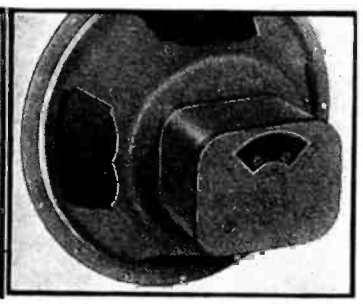
New motor-starting electrolytic has insulating sleeve. (1659)



Mercury relay. (1663)



"Displacement" pickup. (1660)



Wide-frequency-range P.M. dynamic handles 20 W. (1661)

SERVICING QUESTIONS & ANSWERS

(Continued from page 99)

set is bumped and makes that racket. I have unsoldered the wires to the tuning condensers, and I have cut out the neutralizer condensers, with no results as regards locating the trouble.

I have tested all of the bypass condensers. Shorting the grids of the 2nd and 3rd R.F. tubes to ground will clear the noise. Also by shorting the primaries of the 2nd and 3rd R.F. tubes will clear the noise. Perhaps you may have something on this set or any advice that you can give me.

P.S.—With the tuning condensers well open (around 1,200 or 1,400 kc., the noise is much worse when the ANT. and all test leads are disconnected from the set.

(A.) Noisy reception such as you are experiencing with a Majestic 181 receiver is often due to loose or unsoldered leads to the antenna trimmer. Check the grounding pigtail lead to the trimmer assembly. Clean grounding contacts and securely solder grounding leads to the gang condenser. Tighten nuts on power unit receiver cable strip.

As a further measure, disconnect leads to gang condenser stators. And apply high voltage from the receiver across each gang section in turn. Rotate the rotor plates with the voltage applied.

(66) Edward Turowski, New York City

(Q.) I have a Philco 42 D.C., in the shop, which drops in volume after playing for about 15 minutes. Then by pulling a light switch volume will be restored to normal. This condition continues until it is impossible to restore normal volume until the set is closed and allowed to cool. Will you please advise me where to look for the trouble?

(A.) The fading condition described in your letter, experienced on a Philco model 42 D.C., is a common complaint with this receiver. The cause of the fading almost invariably has been traced to an open-circuiting bakelite-encased condenser employed in this receiver. The open-circuit usually consists of a break in the leads emerging from the bakelite case, either at the lug or within the case. With the receiver operating, prod each lead on each of these condensers with some insulated object. Tap the case gently with the handle of a screwdriver. This procedure quickly discloses the faulty condenser. Shunting each condenser with a unit of similar capacity after the receiver has faded, is another method employed by many Service Men.

(67) M. Gentleman, Vancouver, B. C.

(Q.) Would you please give information about interference of a 30-watt amateur station on a G.E. receiver E-81? This phone interference comes in 5 places on the broadcast band, 2 and 6 places on the other two bands. The amateur should come in on 3.9 megacycles. Several other receivers complain of similar disturbance and yet other sets receive him only on the "ham" band. The amateur claims that this trouble is the fault of the receiver not being shielded properly. Could you please furnish information how to remedy this trouble?

(A.) Try changing direction of aerial and bypassing line at receiver with 0.1-mf., 400-volt condenser. Use good ground connection.

A wavetrap tuned to the frequency of the interfering amateur usually helps. Connect the trap in series with antenna close to receiver.

The trouble you are experiencing is not due to shielding or any part of your receiver.

(68) Albert Stines, Shenandoah, Pa.

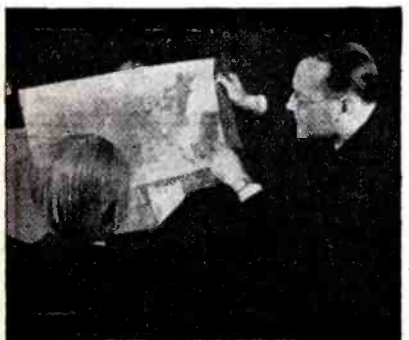
(Q.) I have a Kolster model K70. When the receiver is turned on, after being shut off for about 5 minutes, it has excellent reception. After being on about 5 minutes or less the volume becomes weak. If the volume control is turned back a bit it comes back to normal reception with a "plop". If the volume control is turned

(Continued on page 127)

Please Say That You Saw It in RADIO-CRAFT

A RADIO SCRIPT SHOW GOES ON THE AIR

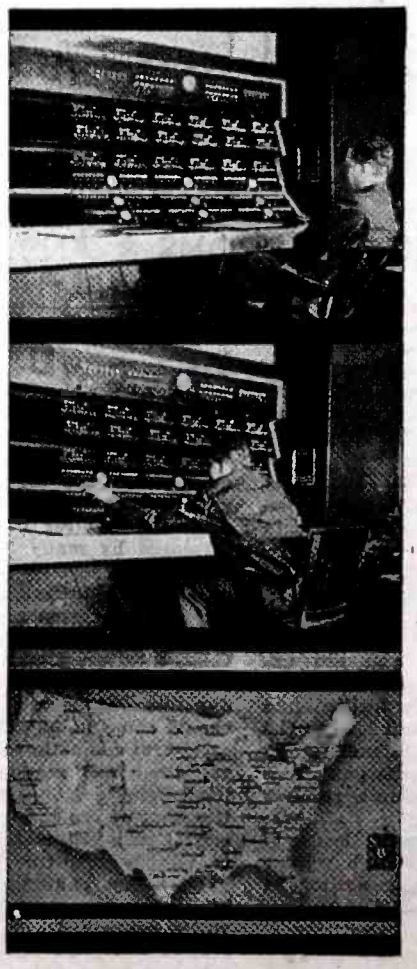
(Continued from page 79)



. . . and the facts to Kellogg's advertising men, and "Girl Alone" is signed up for a local test campaign on WMAQ.

Because thousands of listeners respond to . . .

. . . mail hooks in the local test campaign . . .



. . . "Girl Alone" soon requires William Cole, one of the control supervisors (who relaxes before this complicated station control board while programs are on the air . . .

. . . then works feverishly in the split seconds of program changes) . . .

. . . to connect "Girl Alone" with other stations on the N.B.C. Red network.

All photographs in this article are by *Modern Advertising* staff photographers except the following:

Page 76	Column 1	Frame 3	Maurice Seymour
Page 76	Column 1	Frame 4	N.B.C.
Page 77	Column 1	Frame 7	Maurice Seymour
Page 77	Column 2	Frame 1	Maurice Seymour
Page 77	Column 2	Frame 3	Jun Fujita
Page 78	Column 1	Frames 4 to 7	N.B.C.
Page 78	Column 2	Frames 1 to 6	N.B.C.
Page 122	Column 1	Frame 4	Foto-ad

HOW TO MAKE A COMBINED HEARING-AID AND INTERPHONE

(Continued from page 93)

Two Cornell-Dubilier 0.1-mf. 400 V. paper condensers;
Two Cornell-Dubilier 0.002-mf. postage stamp mica condensers;
One Cornell-Dubilier 0.006-mf. postage stamp mica condenser;
One Clarostat 0.5-meg. volume control with switch;
Two I.R.C. ½-watt 10,000-ohm resistors;
One I.R.C. ½-watt, 20-meg. resistor;
One I.R.C. ½-watt, 2-meg. resistor;
One I.R.C. 1-watt, 600-ohm resistor;
One 300-ohm line cord;
One 7-prong socket;
One octal wafer socket;
One 4-pole double-throw key switch;
Two phone-tip jacks;
Four binding posts;
One piece of aluminum for chassis, several cigar boxes, wire and hardware.

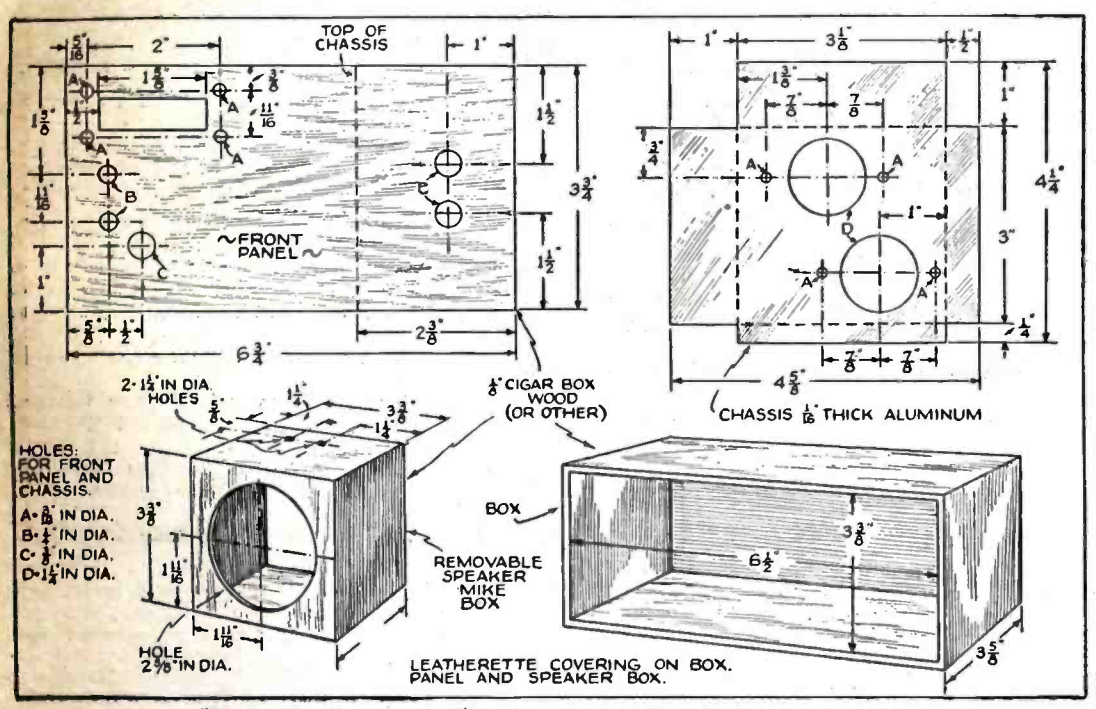


Fig. 3. Directions for making the case for the Electric Hearing-Aid.

Measurements of Capacity, Inductance and Audio Transformer Ratio

(Continued from page 103)

mum, a typical "3-to-1" audio transformer might show a measured secondary voltage of 50 volts when 20 volts A.C. was applied to the transformer primary. This would indicate that the apparent *step-up* ratio transformer was 50-to-20 or 2½-to-1. We know that this *apparent* step-up ratio is lower than the *actual* step-up ratio.

If we were now to take the same transformer and apply say 200 volts A.C. to the *secondary* winding, we would observe with an ordinary 1,000 ohms/volt A.C. voltmeter, an indication of say 63 volts across the primary winding. This would signify an apparent *step-down* ratio of 200-to-63 or 3.2!

That is, when we use the same transformer as a step-*down* transformer instead of a step-*up* transformer, its measured output voltage due to circuit losses is lower than the theoretical output voltage should be. This results in the apparent ratio being higher than the actual ratio. Consequently if we measure the ratio of a transformer, as a step-up and then as a step-down, we know that one apparent ratio is higher than the actual and one lower than the actual and that the actual ratio must be somewhere between the two apparent ratios.

By using higher-resistance voltmeters, the apparent ratio whether measured as step-up or step-down becomes more nearly equal to the actual ratio and in most types of audio transformers, the values of a step-up and step-down ratio as measured with a 1,000 ohms/volt A.C. voltmeter are sufficiently close together that the actual ratio may be assumed to be half-way between the two apparent ratios. In any case, 2 measurements make it possible to tell how accurately the measurement is being made.

FINDING RATIOS WITH 1 MEASUREMENT

Measurements made on approximately *100* different types of audio transformers indicate that if the following rules are observed, transformer ratios can be measured with a single ratio measurement correctly within 10%. These rules are—

For Class A Input or Interstage Transformers

Apply 200 volts A.C., 25 or 60 cycles on the secondary or high-turns winding. Measure the output voltage of the transformer across the primary or low-turns windings with an A.C. voltmeter having a resistance of 500 ohms/volt or higher. The ratio of the input voltage to the output voltage will be equal to the step-up ratio of the transformer within 10%. The indicated ratio will be always slightly high.

Class A or B Output Transformers

Apply 20 volts, 25 or 60 cycles, to the primary or high-turn winding and measure the output voltage across the secondary with a low-range A.C. voltmeter of 500 ohms/volt sensitivity or higher. The ratio of the input voltage to the measured output voltage will be the transformer step-down ratio within 5%. The apparent ratio will always be a little higher than the actual ratio.

It is not advisable to apply more than 100 volts to the primary of an output transformer at commercial power frequencies as due to the low reactance of the primary, the current in the primary is expended largely in the form of heat developed across the resistance of the winding, the test transformer may be overloaded and the accuracy of the measurement greatly impaired.

Class B Driver Transformers

Measure the same as class A input transformers but use an applied voltage of 20 volts instead of 200 volts A.C.

The circuit of Fig. 1 may be used for audio transformer measurements. To do this the proper voltage tap for the transformer under test should be selected; the line-voltage-check switch should be closed; the shunt should not be used and the proper winding of the transformer as indicated above should be connected to binding posts marked A.C. Voltmeter. The A.C. voltmeter should also be connected temporarily to these binding posts, and the line voltage control adjusted to 20 or 200 volts as may be required. The voltmeter should then be disconnected from its present position and used to measure the voltage developed across the other windings.

(The author of this article is in the Service Division of Canadian Westinghouse Co.—*Editor.*)

RADIO WITTIQUIZ

(Continued from page 95)

put of the local oscillator and the incoming signal, with its output circuit tuned to an intermediate frequency. (d) That effect produced in a receiver when an interfering signal "rides through" on the carrier of the station to which the receiver is tuned.

(107) *Birdies* or *tweets* in superhets. are evidence usually of—
(a) Cross-modulation from an unwanted-station program while tuning at broadcast frequencies. (b) Oscillation in the R.F. or high-frequency amplifier and 1st-detector circuits which shows up as squeals while tuning is varied. (c) Interference attributed to birds on your antenna lead-in thus causing signal swings. (d) Lack of pre-selection manifested by a C.W. station's image frequency beating with broadcast station programs.

F. A. UMALI,
Manila, Philippine Islands

(108) *Cross talk* relating to radio means—
(a) An interference between signal carriers. (b) A person talking into a microphone from a short distance. (c) A conversation between the members of an audience in a broadcasting station.

(109) Radio men know that the *space charge* is—
(a) Negative electrons emitted from filament fill the space surrounding a heated filament. (b) Rental charged for shop space. (c) A fee collected by Federal Communications Commission from the stations during their absence from the air.

SHIGETO MAZAWA

(110) A *fluorescent screen* is used in connection with—
(a) Motor cars? (b) Motion pictures? (c) Oscilloscopes? (d) Screen-grid tubes?

JAMES OLIVER,
Christ Church N1, New Zealand.

(111) We all know that a *helix* is—
(a) A device for controlling an undamped wave. (b) A small condenser. (c) A hollow, conducting coil or solenoid. (d) A direction finder used for navigational purposes.

(112) We all know that the *formula for Ohms law* is—
(a) $I = E \times R$. (b) $R = I \times E$. (c) $E = I \times R$. (d) $I = R \times E$.

(113) Did you know that an *acceptor* is—
(a) An official appointed to control radio broadcasting? (b) A circuit of inductance and capacity so arranged and tuned as to offer low impedance to currents of a given frequency, and a high impedance to currents of any other frequency? (c) A ground equalizer inductor? (d) A direction finder?

(114) A *cage antenna* is—
(a) A cage used to keep wild animals in. (b) An antenna placed in a cage to protect it from the weather. (c) An antenna, having conductors, which consists of a group of parallel wires.

C. R. WALLACE

(115) A *swinging choke* is—
(a) An act of hanging a man for murder. (b) A radio choke on a hinge that can be swung to any angle to prevent hum. (c) A choke in a receiver that sways electrically to the rhythm of the music to prevent distortion. (d) A filter choke to retard A.C. ripple and allow a smooth D.C. to flow with reserve current to handle audio peaks.

P. WILSON REDCAY

(116) Everyone knows that an *erg* is—
(a) A new kind of fly from Africa. (b) A resistance-coupled audio amplifier using a space-charged screen-grid tube. (c) A measure of electrical energy. (d) The Boston pronunciation of egg.

JAMES B. LAMB

ANSWERS

(99b) (100c) (101b) (102b) (103a) (104c)
(105d) (106c) (107b) (108a) (109a) (110c)
(111c) (112c) (113b) (114c) (115d) (116c)

READERS' DEPARTMENT

(Continued from page 99)

PHILADELPHIA, PENN.

Gentlemen:—

An article in the June issue Operating Notes section, concerning a Philco Model 45, recommends adding a 50,000-ohm resistor from the 6A7 cathode to the A.V.C.-return. It seems to me there must be a slip-up somewhere because such a repair would nullify the A.V.C. action of the receiver; and probably cause severe overloading and distortion.

It would simply amount to a voltage divider across the A.V.C. network, and since this model uses a 2-meg. filter resistor only 1/40th of the A.V.C. voltage developed would be applied to the controlled grids, i.e., if the 2nd-detector developed 24 volts of A.V.C. voltage only 0.6-V. would be applied to the controlled grids due to the added resistor.

The majority of your Operating Notes are very instructive and helpful. But I suppose something like this is bound to happen. And I must give you credit for not letting it happen very often. So with best wishes for your continued business, I am

EDWARD MCCALLUM

P.S.—I am a constant reader of *Radio-Craft* and I think it is one swell magazine.

E. McC.

Thanks a lot for your comments—and the bouquet.

NEW YORK CITY

Gentlemen:—

Many times I have had occasion to refer to a back number of *Radio-Craft* only to find that the page I wanted had been clipped and pasted into another notebook because of a diagram that was on the other page.

Lately I have devised a card index system which keeps my back numbers intact and also helps in finding the needed information much faster.

A 3- x 5-in. card is used for each model of each receiver, the page number on which any information pertaining to that particular receiver is entered in the center and to the right the issue of *Radio-Craft* in which the information appears.

The entire system is very inexpensive and I think it will help many Service Men to have such a file in the shop. I do not make a card unless I have some information on the receiver. Some fellows will say it is a day's work to sit down and copy a list of makes and models and will fail to use the system, but if a fellow were to start with the *current issue* of *Radio-Craft* and there and then file the information on the receivers, and each month add to that, he would have a fine reference file in a few months.

The file that I use was purchased along Canal Street (New York City) some place. It is a metal cabinet about 16 x 5 ins. and cost 59c, including 200 cards and the index.

Hoping this is of some help to some one, some place, I remain a constant reader of the greatest radio publication going.

RUSSELL MCKEE

Thanks very much for the "index" information, and for your commendatory remarks. We hope that each future issue will continue to merit your approbation.

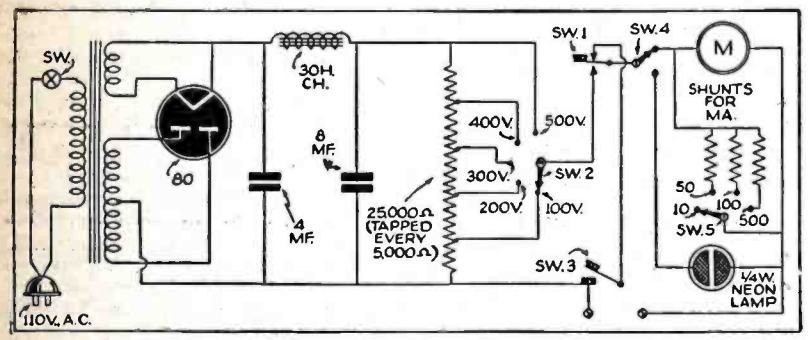


Fig. 1. Corrected schematic diagram of Mr. Chapman's condenser tester described in the April, 1938 issue of *Radio-Craft*, Reader's Department, page 692.

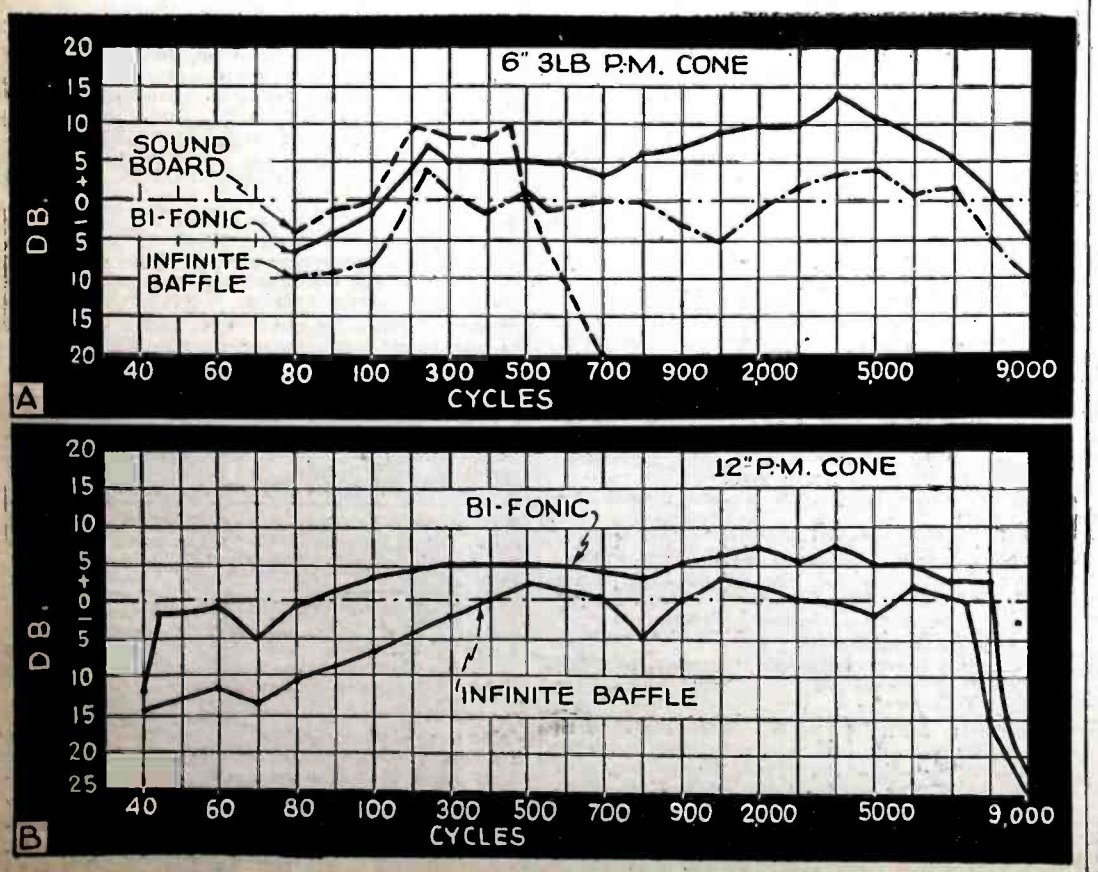


Fig. 5. The above 2 graphs were mentioned but inadvertently were not reproduced in the article, "'Bi-Fonic' Sound Magnifier," in the July, 1938 issue of *Radio-Craft*. Curve A illustrates the comparative performance of a 6-in. dynamic reproducer in each of 2 types of housings and a plane baffle; curve B, comparative performance of a 12-in. dynamic reproducer in either of 2 housings.

OPPORTUNITY AD-LETS

You will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and individuals from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month. Advertisements in this section five cents a word for each insertion. Name, address and initials must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.
Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the September issue must reach us not later than July 5th.

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BECOME A COLUMNIST. PAMPHLET FREE. 10 years' experience. Ben Arld, Station D, Los Angeles, Calif.

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INVENTIONS—PATENTED, UNPATENTED, BOUGHT outright, royalty. Write Arellano-Power Co., 1 LaSalle, Chicago, Illinois.

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MEXICAN DIVORCES: NO PUBLICITY. AMERICAN attorney. Box 1736, El Paso, Texas.

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YOU RADIO MEN WHO WANT TO READ RADIO'S Livest Magazine every month and learn about every new development which takes place—in servicing, in new tubes, in foreign developments, in facsimile, in television, in test equipment, turn to the announcement on page 111 and learn how you can subscribe to RADIO-CRAFT and get an invaluable free premium.

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Space in this department is solely for the benefit of our readers; who wish to exchange radios, parts, phonographs, cameras, bicycles, sporting goods, books, magazines, etc., without profit.

Since we receive no money for these announcements, we cannot accept responsibility for any statements made by the readers.

Only one advertisement will be accepted from any reader for any one issue. No advertisement to exceed 35 words, including name and address.

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CORONA TYPEWRITER, RECENT MODEL; Pathex 9½ mm. movje camera; Philco model 37-610 T radio, to exchange for stamp collections. Describe fully. F. Atlee, Maple Glen, Penna.

SWAP EGERT VISUAL RESONANCE OSCIL-loscope: contains sweep circuit, amplifier, detector and oscillator 100 kc. to 25 megacycles. Cost $150. Excellent condition. For V.T. voltmeter, grid dip oscillator, etc. George Rohr, 67 Thorne St., Jersey City, N. J.

WILL EXCHANGE 3 VOIGTLANDER BRIL-LIANT cameras with F7.7 anastigmat Voigtar lenses for portable electric drill. Also have General Electric auto radio will exchange for 16 mm. projector. Abe Fisch, 1129 Tinton Ave., New York City.

SWAP OR EXCHANGE TWO NEW UTAH 14-inch dynamics, 25 watt rating 3M. Fields Universal outputs. Net cost $28.00 each. Ideal for Radio-Craft 30-tube De-Luxe Receiver. Porter, 1713 Larrabee Street, Chicago, Illinois.

USED RADIO BATTERY, 32V., 110V., RADIO parts, and 4 power telescope rifle sight to trade for power woodworking tools. Roy's Shop, Center, No. Dak.

WANTED: BENCH SAW, WOOD LATHE, and drill press. In exchange for most anything accumulated over a period of twenty years of radio service and experimental work. J. D. Pyle, Pikeville, Tenn.

I HAVE QUANTITY OF ELECTRIC DRY shavers—would like to exchange for $5.00 worth of merchandise. Will trade Schick or Packard shavers for $12.99 in merchandise. J. S. Jackson, Jr., R.D. No. 3, Box 76, Bowling Green, Kentucky.

WANTED: GOOD P.A. AMPLIFIER, 10 watts, or more. I have new RCA record player, magazines, parts, tubes, and other equipment. Write—John Grumm, 1736 La Cresta Drive, Pasadena, Calif.

RADIOLA 30 CATACOMB, RPA UNIT, DAY-rad Tube-Voltage Checker, Electric Sewing Machine, Apex radio 7A and Console Model 3a. Want Mimeograph, Power Drill and saw, radio engineering books, etc. R. G. Devaney, 5126 Penn. Ave., Pittsburgh, Penna.

WANTED: ALL KINDS OF STAMPS, UNITED States preferred. Large accumulations or collections. Offer 1938 test equipment or new radios in trade. Rod Hertel, Wahoo, Nebr.

HAVE YOU A RADIO, SMALL MODEL; OR parts, to swap for any kind of art-work, sign-painting, or "showcards"? I ship work promptly. Carl Newbert, 823 Lill Avenue, Chicago, Ill.

TRADE ALL, OR PART, FOR GOOD MINI-ature camera. WAC ham station transmitter RK20 final. 8 tube communications receiver built by Hallicrafters. All inquiries answered. Shelton Stanton, W5ACA, University, Louisiana.

SWL'S I QSL 100% HR. PICTURE POST-cards also exchanged. Autograph picture side if possible. QRA—E. G. Steffen, CCC Co. 793, Hill City, So. Dak.

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HAVE WESTON 682 CHECKER, SUPREME 339 deluxe analyzer. Swap for signal generator, Triplett vibrator tester or late service manuals. Also have Majestic gene-motor, Majestic twin-six car radio. How swap? E. F. Dunn, Box 73, Versailles, Missouri.

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WIRING SCHOOLS FOR SOUND

(Continued from page 90)

The 12-inch P.M. speakers should be used for auditoriums and gymnasiums. Two speakers are sufficient in either location. The reproducers in the auditorium should be located on both sides of the stage opening, while those in the gym should be hung facing the floor, suspended from the ceiling out of the way of all apparatus. Large, flat baffles are permissible in the gymnasium. Inclined wood baffles are excellent for the auditorium. Study-halls and large laboratory rooms require 2 speakers similar to those used in the classrooms. Cafeterias, which are usually quite noisy, require one or two 12-inch speakers, or several smaller ones distributed at several points.

SWITCHING SYSTEM

It is commonly required that individual switches be provided for controlling each classroom speaker. In those locations where more than one speaker is used, they are controlled by a single switch also. The system shown is designed for schools with from 8 to 10 classrooms. Ten switches are provided with blank panel space for 30 additional positions. A 20-watt amplifier is included which will easily handle up to 9 classrooms and the auditorium. When additional speakers are required, additional speaker control panels (10 switches per panel) are included. A new amplifier, having the proper power output, is also used.

The amplifier connections are of the plug-in type. Sufficient space is available for the installation of 2 amplifiers for dual channel requirements.

To construct one's own control units, the circuit shown in Fig. 2 should be followed.

The load resistor should have the same resistance as the impedance of the speaker it replaces. Two-watt carbon resistors may be used for the resistance load on classroom lines. Resistors with higher watts ratings should be used for auditorium and other high-level lines. If load resistors are not used, it will be necessary to continually readjust the volume level at the control cabinet as the various speakers are switched in or out.

Under some conditions it is desirable to have classroom speakers provided with an individual volume control which is located in the classroom itself. In order that adjustment of individual volume controls will not affect the other speakers, a device which maintains a fairly constant impedance is needed. This need is filled by the "L"-pad volume control. This device maintains nearly constant impedance in one direction and is entirely practical for this purpose. These controls are easily obtainable at a moderate cost in a wide variety of impedances and power-handling capacities.

Monitoring or "talk-back" facilities are being included in a large number of installations. By means of an extra position on the speaker control panel, an associated loudspeaker is connected into the input circuit of a small amplifier. This is an entirely separate unit, having its own loudspeaker and is used only for reception of the talk-back signal.

With this arrangement, a student standing at the rear of the average-size classroom can be distinctly heard when speaking at a normal level.

THE $ FACTOR IN WIRING

The most important factor to consider in the cost of the actual installation is the labor involved in the installation of the speaker and microphone wiring.

When wiring must be installed, this is usually let to the local electrical contractor, who is best equipped for this type of work. Most installations require 2 weeks. Cost figures should be based upon this length of time, taking into consideration wages which prevail locally. Of course, sufficient margin should be allowed to cover incidentals.

Most schools constructed since 1927 are provided with speaker wiring. Those which do not have the actual wires installed, are provided with the necessary conduits and outlets. In those cases where no provision of any kind has been made, the radio-set wiring can sometimes be run through the electrical or signal wiring ducts. Ventilation and air ducts have been used also. When necessary, external wiring fastened to walls or mouldings has provided a successful solution.

A common lead should be used to connect to all rooms with an individual line from each speaker location. If either talk-back or more than one channel or both are used shielded cable is required. Single-conductor shielded cable with the shield as the common or return side is acceptable. Since the speaker lines are usually at relatively high impedance, and carrying moderate power levels, No. 18 wire is excellent from both an electrical and mechanical standpoint.

Remote microphone locations not over 100 feet from the amplifier may be run in regular crystal-microphone cable. This will allow use of crystal or other high-impedance type of microphones. For greater distances the velotron microphone may be employed with the same type of cable. On the other hand, low-impedance (200 ohms), 2-conductor shielded lines may be used instead. Low-impedance lines may be extended up to 2,000 feet, if needed.

Thousands of schools, big and small, will obtain their radio and P.A. equipment this very summer. Service Men: make it your business to approach school boards now with offers to make complete installations during the summer months while the buildings are not occupied. Cash in on this new market for your services.

This article has been prepared from data supplied by courtesy of Allied Radio Corp.

SERVICING QUESTIONS & ANSWERS

(Continued from page 121)

on full suddenly about a second elapses before the signal comes in. When the control is put in the antenna primary and a 25,000-ohm resistor is used in its original place the signal fades as just mentioned. It's a new control.

(A.) The trouble described with the Kolster K70 appears to be caused by too great a "time constant" of the A.V.C. circuit. To lower the time lag in this receiver, replace the two 0.1-mf. bypass condensers in the A.V.C. circuit with 0.02-mf. units.

You mention a 25,000-ohm volume control, the *correct* value is 15,000 ohms and *belongs* in the A.V.C. divider circuit.

Replace the 24A tube in the A.V.C. stage.

---

(69) George W. Bellis, Jersey City, N. J.

(Q.) I was called in to service a Grunow radio set, No. 871 (8E) for a fading condition. I had the set in my shop for a week but it would not fade. I checked all the condensers with a condenser analyzer and the voltages checked normal. The owner of the set replaced all the tubes with new ones. When I returned the set to the owner I told him the set worked OK for me. The following day I received a call that the set had again faded the same way. When I went to the customer's house the set did not fade.

The customer says the set fades sometimes once a day, then other times 2 or 3 times a day. When it fades (I am informed) you can hardly hear the set, necessitating the volume control to be turned up. Then the set comes in with a blast.

(A.) The audio coupling condenser and the R.F. screen-grid and cathode bypass condensers have caused trouble in the Grunow 8E receiver. Check carefully for open-circuiting of these components.

It is advisable to go over the antenna system which is used with the receiver. Check for poor connections at roof, window and ground.

Check the volume control.

When more complete information is furnished, this department may more ably assist in service problems. For example, is your fading condition a gradual one, or does reception cut off completely? Voltage data for the receiver in question greatly assists us in disposing of service inquiries.

IT'S NAUTICAL, but not naughty!, IT'S GAY but not frivolous!, that 4-tube maritime-styled radio set described in September Radio-Craft!

THE RADIO MONTH IN REVIEW

(Continued from page 70)

The work undertaken by the Conference ranges over a very large field, but only the section most likely to be of interest to short-wave listeners is dealt with here. This is the allocation of wavelengths, and now note that this Conference allocates bands of wavelengths to the various services, such as broadcasting, marine, aircraft, etc., but does not attempt to allot wavelength channels to specific stations.

Practically all useful wavelengths were dealt with, ranging from as low as 1.5 meters up to 30,000 meters, and there are 4 main services which have to be catered-to. First there is the "*fixed-station*" service, by which is meant radio-telegraph or radio-telephone between fixed stations. Then there is the *maritime* service, which concerns communication between ship and shore and between ships. Thirdly, we have the *air* service, which, of course, concerns communication with aircraft, wireless aids to navigation and landing, etc. Lastly, there is the *broadcasting service*, to which has recently been added television.

NEW WAVEBANDS

In the long-wave broadcasting band—which is mainly of interest to Europe—no change has been made. We next come to the medium waveband. At present it extends from 545 to 200 m., but the Cairo Conference extended it down to 192 m. for Europe, and down to 187 m. for America and the rest of the world. Then comes what is known as the intermediate waveband—that is, those wavelengths lying between 200 m. and 50 m. For the first time provision is made for broadcasting in a band between 2.3 and 2.5 megacycles (about 125 meters). Then there is a second band from 3.3 to 3.5 mc. (about 87 m.), and a third band between 4.77 and 4.9 mc. (about 62 m.). These new bands, however, are reserved for broadcasting in countries lying in tropical or semi-tropical regions. In such countries a high noise level, owing to atmospherics, very often prevents the successful use of the ordinary medium waveband, and the new bands have been provided for the benefit of relatively local services in those countries. There are some rather complicated restrictions with regard to their use in various parts of the world. For instance, the band from 3.3 to 3.5 mc. is not available for use in Central and South America. In other parts of the world their use is restricted in general to countries which lie within 30° north and south of the Equator.

To come now to the short waves—*i.e.*, waves below 50 meters: The 49-m. band, which was 150 kilocycles wide, has been increased to 200 kc., and the new allocation is from 6.0 to 6.2 mc. A new band, 100 kc. wide, between 7.2 and 7.3 mc., has been created by allowing broadcasting to share with amateurs, except in the American continent. This will be in the neighborhood of 41 m. Then the 31-m. band, which was originally 100 kc. wide, has now been extended to 200 kc., the new figures being 9.5 to 9.7 mc.

No change has been made to the 25-m. band or the 19-m. band. The 17-m. band, however, has been extended, making it 100 kc. wide, instead of 50, the new limits being 17.75 to 17.85 mc. The 14-m. band has been extended from 100 to 300 kc., the new band running from 21.45 to 21.75 mc.

REGULATIONS IN 1929

The Cairo Conference regulations in general will come into force in January, 1939, but the clause dealing with the changes in the allocation of wavebands will not be applied until September 1 of that year. There will, therefore, be no immediate changes in the short wavebands.

The Cairo Conference did not decide definitely whether or not a plan of wavelength channels for individual short-wave stations should be attempted. This would mean, of course, another world conference. The Conference, however, requested the International Broadcasting Union to collect the fullest possible data available on the subject, which will be submitted to all countries for their consideration. If, later on, the majority are in favor of holding a world conference with this object—that is, allocating short-wave channels to individual broadcasting stations—it is possible that such a conference will be held.

Index to advertisers

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

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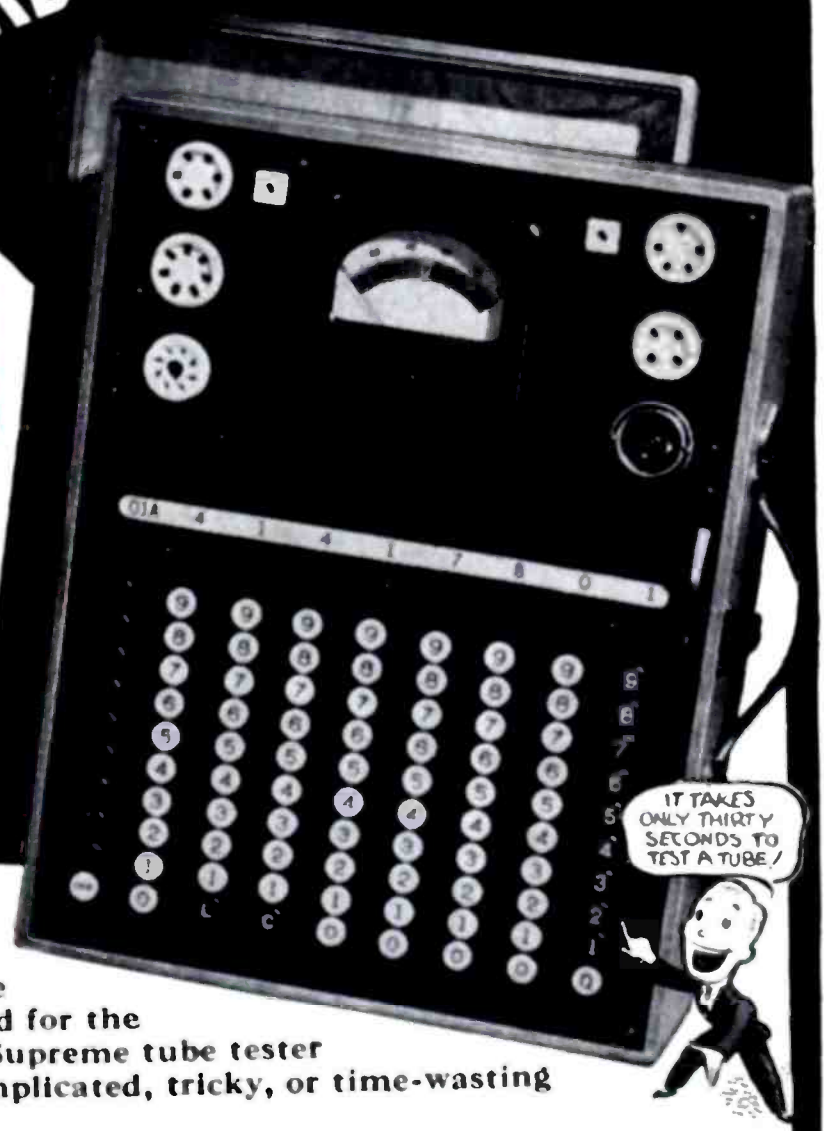

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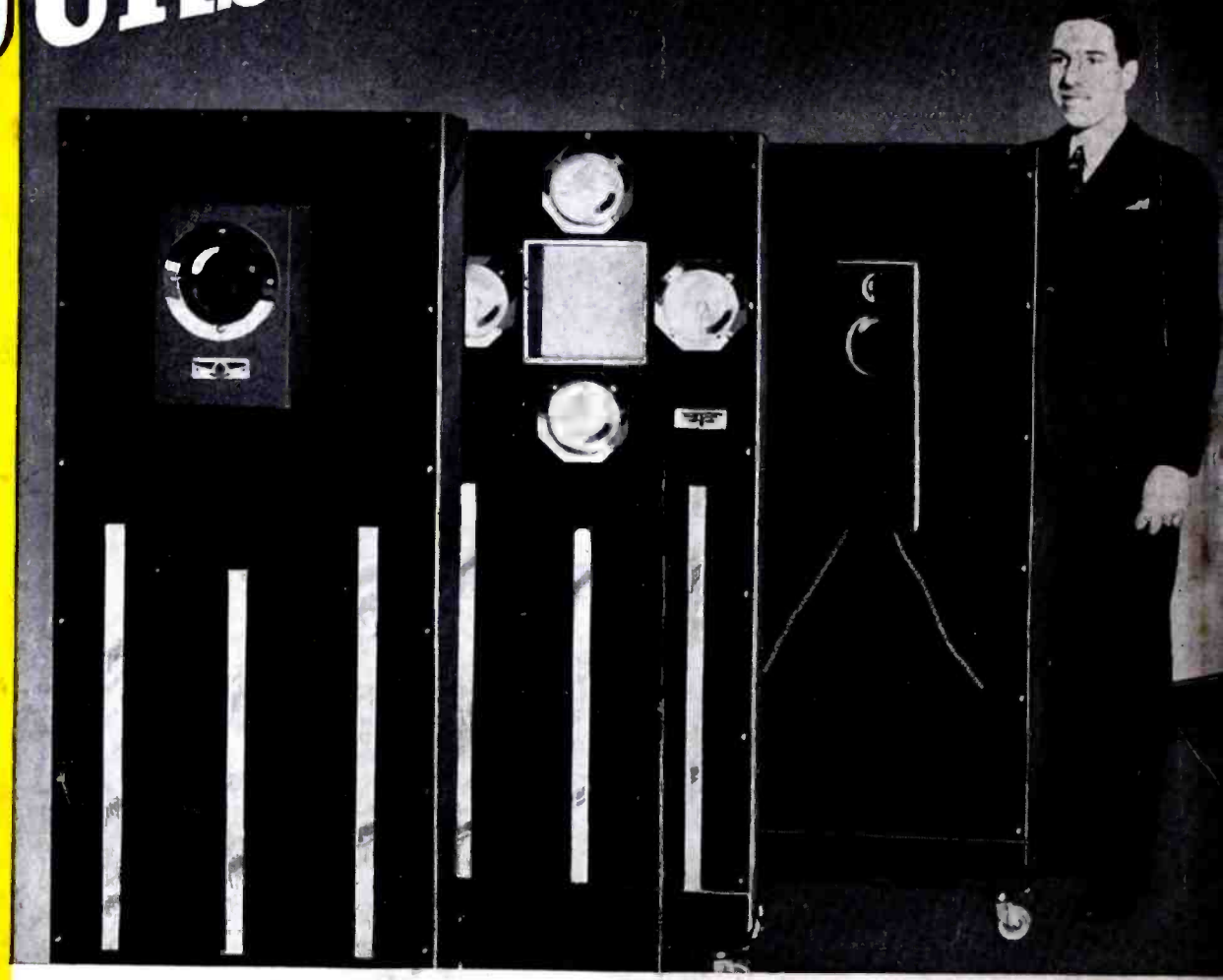

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The A.T.I. method is new, startlingly different. No dull, hard-to-understand monotonous texts. We train you as you never before dreamed you could be trained . . . you get ACTUAL EXPERIENCE with YOUR OWN TELEVISION APPARATUS just like on the real job. With your A.T.I. Television Equipment you can make over 350 amazing, interesting experiments right in your own home. You can produce your own Television programs for a local audience . . . transmitting and receiving the faces of your friends. You can build complete Television Transmission and Reception Systems. You can make hundreds of experiments and comparison tests that show you the phenomena of Television and Radio in a quick, simple, fascinating way . . . much easier to understand than just mere words in a book. All the illustrated Equipment included with training . . . AT NO EXTRA COST.

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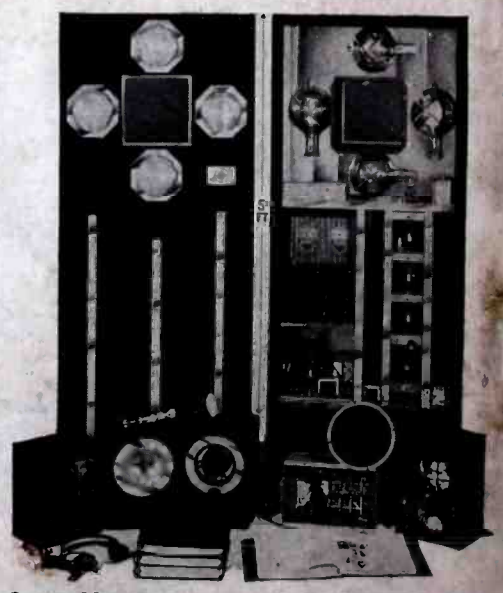

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