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Established 25 years

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Working in Radio Now
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Clip the coupon and mail it. I'm so certain I can train you at home in your spare time to be a Radio Technician that I will send you a sample lesson free. Examine it, read it, see how clear and easy it is to understand. See how my course is planned to help you get a good job in Radio, a young, growing field with a future. You don't need to give up your present job, or spend a lot of money to become a Radio Technician. I train you at home in your spare time.

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Radio broadcasting stations employ engineers, operators, technicians and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loudspeaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And

my course includes Television, which promises to open many good jobs soon. Charles F. Helmuth, 419 N. Mass. Ave., Atlantic City, N. J., writes: "I started Radio in the Marines. Later I took the N.R.I. Course. Now I am my own boss, and get jobs over others who were sure they had them. I owe plenty to N.R.I. Training." James E. Ryan, 119 Pebble St., Fall River, Mass., writes: "I was working in a garage when I enrolled with N.R.I. I am now Radio service manager for the M— Furniture Co. for their four stores."

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Dept. OGB3, National Radio Institute
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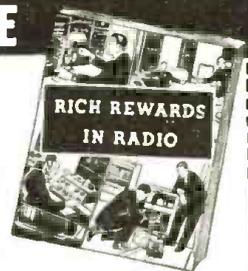
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RADIO & TELEVISION

The Popular Radio Magazine

July — 1940
Vol. XI No. 3

HUGO GERNSBACK, Editor
H. WINFIELD SECOR, Manag. Editor
ROBERT EICHBERG, Television and
Digest Editor

In August Issue

A 3-Tube "Loop" Portable Receiver—
Covers Broadcast band—battery oper-
ated—3 tubes do the work of 6,
in new circuit development.—Chas.
R. Leutz
Beginners' Flea Power Transmitter (also
receiver)—H. G. Cisin, M.E.
2½ and 5 Meter Crystal-Controlled
Transmitter—Milton Meyrowitz,
W2EBO
5, 10, and 20 Meter Receiver of Ad-
vanced Design—Harry D. Hooton,
W8KPX

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Cover Composition by Hugo Gernsback and Thos. D. Pentz

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READS US TWICE!

Editor,

Herewith I am enclosing a photo of my SWL listening post which I hope will be suitable for publication in your very FB magazine. I have been reading RADIO & TELEVISION for some months now and I can honestly say that there is no other radio magazine which I find so interesting. I read the magazine always twice from cover to cover and each time I look through its pages I find something to add to my radio knowledge. I am looking forward to receiving a V.A.C. (Verified All Continents certificate) very soon and also am hoping to becoming a licensed amateur soon. The rig here consists of a Hallicrafter's S-19R communications receiver, an Eilen 6A 5 Meter Converter, a Stromberg-Carlson 7



tube 130 M. superhet and a two-tube "home-made" battery job. I will be glad to QSL anyone in the world and I am always looking forward to new and better articles on radio in R.&T. Lots of luck to RADIO & TELEVISION and 73 to all its readers.

VERT MANDELSTAMM,
738 So. Park St.,
Saginaw, Mich.

NEW CLUB FOR YOU!

Editor,

During these difficult times, we are endeavoring to keep alive the amateur spirit in this country and to help towards this end have formed the British Short Wave Correspondence Club.

We extend to all readers of your very fine magazine, a hearty welcome to join our 100 members. Membership is free and all who request an application from me, at the undersigned address, should enclose a stamp of their own country to cover postage on an unsealed envelope as this is a non-profit organization.

I should like to thank you for your fine magazine which is a contribution of first class quality to the world's newsstands. It contrasts very much in quality to the British radio magazines which, at the moment, provide very poor fare.

In closing I would like to express my willingness to exchange cards with other SWL's and will QSL 100%.

Yours truly,

T. KNIGHT,
50 Scott St.,
Barrow-in-Furness, England.

(Continued on page 191)

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NEW HAM LICENSE EXAMS

New examinations consisting primarily of multiple choice type questions (not unlike the sort used during the past year for the commercial radio operator license examinations) will replace present amateur operator license exams on July 1st, the F.C.C. announces.

The class "A" examination will contain a maximum of forty advanced technical questions dealing mostly with radiotelephony. The class "B" and "C" examinations will contain a maximum of fifty questions, of which approximately thirty will be technical and twenty regulatory and law questions. The code requirements remain unchanged.

The multiple choice type of question is usually answered by the insertion of a number in the space provided and the entire examination can be completed in a very short time. It is believed that this type of examination, in addition to greatly reducing the examination time, will also reduce the elapsed time for grading and issuance of the license and will provide better sampling of the applicant's knowledge by the increased number of questions without making the examination more difficult.

A study guide containing "paraphrased" questions which cover the field of all questions asked in the actual examinations will be released at an early date.

PIRATE TRACKED DOWN

Radio listeners in the area around Passaic, N. J., were puzzled by mysterious broadcasts, consisting mainly of phonograph recordings, which apparently emanated from standard broadcasting stations. At one time the mysterious broadcaster called himself WBEN of Buffalo and used that station's 900 kc. frequency. At another time he assumed the call letters and 1200 kc. frequency of WTHT, the Hartford (Conn.) Times. F.C.C. inspectors made records of the illegal programs, and subsequent bearings and measurements of the field strength finally led the investigators to a house on Monroe Street in Passaic. The commission believes that it has secured sufficient evidence to secure indictment for violating sections 301 and 318 of the Communications Act.

LOST ANY PRISONERS LATELY?

The F.C.C. receives some odd communications, one of which was from the warden of a state prison who wanted to know if he could use local broadcasting stations to transmit emergency information regarding escaping prisoners. The F.C.C. informed him that while the law prevents the use of standard broadcasting stations for routine police work, there was nothing to prevent him from sending news flashes containing information of interest to the public and relative to the escape. There is no law without a loophole, is there?

Licenses are a subject of inquiry with the F.C.C., which gets letters asking how much a receiving license costs. (The answer is that none is added.) But in a certain New Jersey city the amateurs complain that local authorities make a charge for ham operation. The commission though not authorized to interfere in local matters is making an investigation for national ham licenses are free.

How Non-Existent Chimes Ring Out!



Engineers inspect new chime, Inset—the loud-speaker installation.

You've heard the old story of the man who was arrested for arguing with a taxi driver. The reason the police picked him up was that there was no taxi driver there. But if one hears chimes pealing the hour in Times Square he will not run a similar risk, for although there is nothing to strike and no bells to ring, the chimes are heard. The three notes which will be heard every quarter hour and the hourly strike are generated in vacuum tubes, using a circuit invented by J. L. Hathaway, NBC engineer.

Each note has a vacuum tube adjusted, by means of inductance and capacity, to vibrate at a definite musical frequency. A master clock hand makes a contact and Note Number One is heard, then Number Two, then Number Three.

BALL GAMES FOR SHUT-INS

For 10 years Sam Turner of the Bronx, N. Y., never missed seeing the Giants in their opener, but four years ago Sam went to the hospital and hasn't been able to go to a ball game since. Then came the 1940 season—and Sam was in a wheelchair at the Metropolitan Sanatorium on Mount McGregor near Saratoga Springs, N. Y. But General Electric's television relay station in the Helderberg hills had picked up the program from New York, 129 miles distant, and relayed it to the Schenectady television station, which is only 40 miles from the hospital. So more than 50 patients—including Sam—saw the game and were just as enthusiastic as though they had been at Ebbets Field, where the Dodgers were triumphing in the opener.

Progress Made in Mobile Television

THE first telecast of a boxing match ever made on the Pacific Coast originated in the American Legion stadium at Hollywood, California. The broadcast was made by the Don Lee Television System, which installed extra lights over the ring. The equipment included two new portable units with wide-angle and telephoto lenses. Wrestling matches are also to be televised there in the near future. The pick-up is shown at right set up on top of a station wagon much in the way that news reel cameras are often arranged.

DUMONT'S MOBILE TELEVISION PICKUP

The entire field equipment used for television pickup by the Allen B. DuMont Labs. is compact enough to place in the back of an ordinary passenger automobile. It will pick up remote events for relaying to the main transmitter which this company is constructing atop a building in the heart of New York City.



Mobile pickup in use.

Nation's Police Test F. M. and Find Greater Reliability

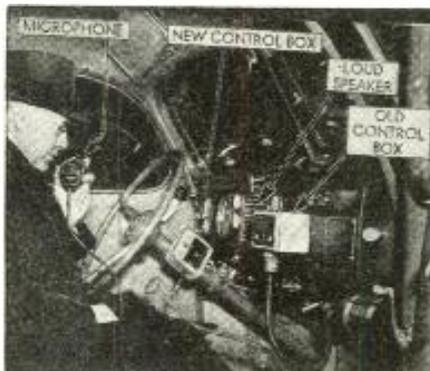
The Connecticut State Police and the Municipal Police of Chicago, Illinois, are conducting experiments with frequency modulation transmission and reception for use in police work. Apparatus designed by Fred M. Link of New York was installed in Connecticut. This type of equipment, together with some produced by Motorola and by Radio Engineering Laboratories, was demonstrated recently to Chicago police. The R.E.L. car installation shown in the picture was tuned to 35.1 mc. to receive signals from the 25 watt output of the transmitter installed at headquarters. The circuit employed the Armstrong crystal control, phase shift method of frequency modulation. This permitted the car to maintain its frequency stability while in motion, in exactly the same manner as present-day crystal control amplitude police transmitters. A total band width of 30 kc. was employed for maximum modulation and the battery drain was 22 amperes, in the transmitting position, which is considerably less than a 15-watt present-day amplitude-modulated police transmitter draws.

The New York Times reported that the experiment showed static elimination surpassing all expectations, according to Fred H. Schnell, radio engineer of the Chicago department. This was true at "dead spots" from which reception is impossible with the amplitude modulation system now in use, he said.

F-M's superiority over A-M was again demonstrated in tests the next day when two squad cars, one carrying the new and the

other the old type of instruments, were used, Mr. Schnell declared.

Cruising side by side through the north and northwest parts of the city, two "skillful ear observers" from an Indiana utility



Photo—Chicago Tribune
Police car with F.M. equipment.

company gave F-M a 100 per cent readability rating at thirty-seven out of thirty-nine places located at distances up to seventeen and a half miles from the transmitting station.

A 90 per cent rating with "fair" and "good" reception was given at the two spots where interference spoiled F-M's perfect score. The first of these occurred eight miles away from the station. The radio engineers blamed the interference on "diathermy" caused, they said, by an electrical device used in hospitals to produce artificial fever.

The second occurred seventeen and a half miles out.

In these cases A-M rating was "no intelligibility" and 5 per cent.

Except where diathermy was encountered, the F-M set produced no noise until the seventeen-and-a-half-mile mark was reached, when audibility was described as "excellent" and "good."

The utility observers' report on the performance of the A-M instrument in the second squad car gave it 100 per cent rating with reception "excellent" or "good" at four points during the cruise. These came twice at points about five miles from the Loop station, once about seven miles and again eleven and a half miles away.

Between the "blackout" by "diathermy" and the 100 per cent mark at the eleven-and-a-half-mile point, A-M's readability varied from 95 per cent to 50 or 60 per cent, until 5 per cent was recorded at the seventeen-and-a-half-mile mark.

A-M's noise percentages recorded by the utility company observers ranged from 20 per cent at the beginning of the cruise to 90 per cent and "no intelligibility" about eight miles out and again 90 per cent at the cruise limit.

Mr. Schnell said that Commissioner Allman and other commanding officers of the department were enthusiastic regarding the performance of the F-M broadcasting method. When the time comes for their installation in Chicago's 200 police cars, he said, leading electrical equipment manufacturers will be asked to submit bids.

NO X-RAY DANGER

A worried viewer recently wrote to the F.C.C., inquiring about "the danger from X-rays to which the public will be subjected in the use of television receiving sets?" The commission replied that according to the best available information, the efficiency of X-ray generation at the voltages employed in cathode-ray television systems is extremely low, and any X-rays so produced are of such low penetrating power as to be completely absorbed by the glass walls of the tube. This is true of transmitters as well as receivers.

SUSQUEHANNA NET PRAISED

James Lawrence Fly, chairman of the F.C.C., paid tribute to the Susquehanna Emergency Network when speaking on the CBS broadcast of the regular monthly drill held by that group of amateurs on May 12th. The program originated at 4401 Leland Street, Chevy Chase, Md., where the transmitter of Roy C. Corderman is located. The S.E.N. was established by a group of radio amateurs to serve the Susquehanna Valley and eastern seaboard during emergencies. Mr. Corderman is the Eastern Division Coordinator of the Organization.

TELEVISION DX RECORD

Howard C. Lutgens of Chicago, NBC's central division engineer, established a new American record for long distance television reception. Nearly a thousand miles from Radio City he managed to tune in both sight and sound programs. After a few minutes the images faded out but the sound was held for 16 minutes. Mr. Lutgens' receiver is located in the Merchandise Mart, Chicago.

NBC engineers explained the phenomenon of reception over the thousand-mile distance as being due to a "sporadic layer" in the upper atmosphere which, in effect, acted as a mirror for the ultra-short radio waves. Ordinarily, they said, these radio waves penetrate the reflecting layers, differing in this respect from the longer waves used by sound broadcast stations.

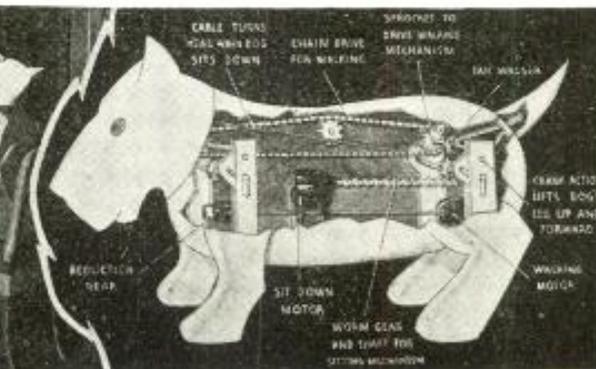
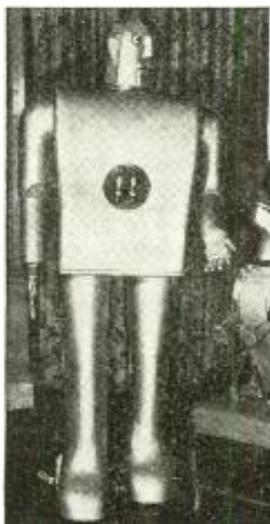
Usually, according to the engineers, reception is limited to viewers within ninety miles of the transmitter atop the Empire State Building (in New York City) with the majority of receivers located at distances of seventy miles and less. The condition which made it possible to receive the New York program in Chicago, they added, is not likely to recur for several months.

"WISH YOU WERE HERE"

Pioneer use of radiophotograph transmission from the Antarctic, to relay pictures from Little America to the United States, is involved in the special temporary authorization granted Press Wireless, Inc., to communicate with the Byrd Antarctic expedition.

ELECTRICITY GOES TO THE DOGS

Man's best friend, *Elektro*, the Westinghouse robot, has an electric dog! J. M. Barnett, creator of electrical men, produced *Sparko*, the world's first all-electric pooch. In one of the accompanying illustrations *Sparko*, who can run, bark, wag his tail or sit up and beg, is seen with his master, *Elektro*, who performs 26 tricks.



Unusual Television Antennas Provide More Efficient Pattern

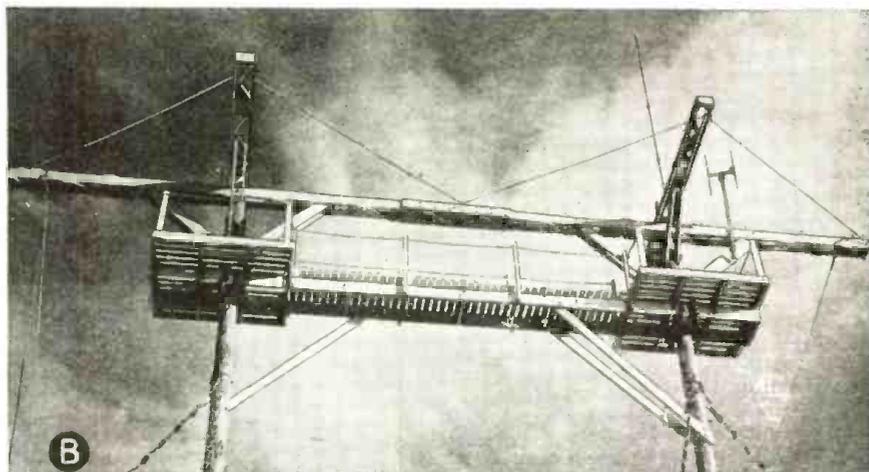
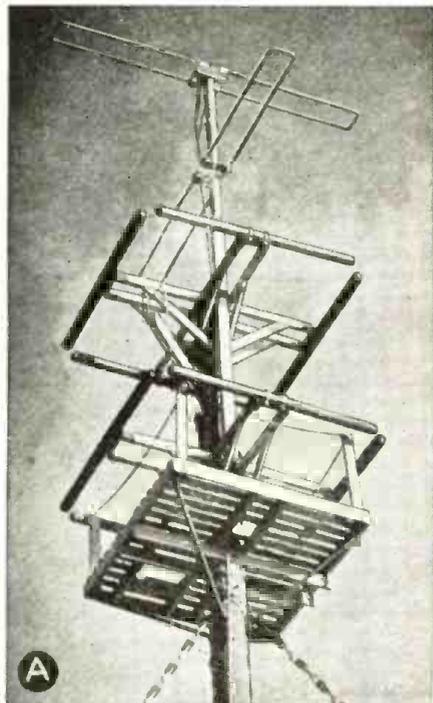
Unusual antennas are used at General Electric's stations in the Helderberg Hills. Shown in photograph A is a dual purpose antenna structure used for both frequency modulation and television transmissions. The two folded dipoles at the top

are so arranged as to give a nearly circular radiation pattern for the FM transmitter. The two lower arrays from a cubic non-directional antenna for the 10-kw sound transmitter of W2XB, the television station. The cubic antenna was developed by General Electric engineers and has been in use for several months. The approximate length of the elements is 7 feet.

Photograph B illustrates a structure which supports three receiving antennas used in the television relay system.

The uppermost antenna, the single vertical element at the right, is a J-type antenna which picks up the audio signal from the

G-E television studio from Schenectady, 12 miles distant. The video signal is received from the studio on the double rhombic antenna which extends the full length of the structure. Video signals from the relay station that rebroadcasts images from New York are received on the double dipole at the extreme right. Both video and audio channels from New York are picked up at the Company's relay station (1½ miles distant.) The video channel is rebroadcast to the main transmitter. The audio signal is carried by land line from the relay station to the main transmitter building, whence it is re-radiated to lookers-in.



New General Electric television antennas as installed at relay station. For full description see text.

ROUNABOUT WAR NEWS

Last month R. & T. told how Europe first heard of the Scandinavian invasion through a broadcast from America. Now, General Electric has word from a Londoner who heard that broadcast. Writing to WGEO, this Londoner said: "I must tell you that I receive your broadcasts perfectly here in my flat and heard the first news of the Norwegian invasion from your station. It makes America feel very near."

"Tonight I was thrilled by an interview from London rebroadcast by your station between an American commentator and a Royal Air Force pilot who had just bombed Bergen. You certainly do things properly!"

TELEVISION ON THE HIGH SEAS

Gay voyagers on the liner *President Roosevelt*, plying between New York and Bermuda, were entertained with television programs while the boat was 234 miles from New York.

NBC engineers who (the lucky dogs) made the cruise said that images were held for a full hour without fading and distortion, despite the great distance.

While this is the record for consistent reception over such a distance, freak transmissions over greater stretches have been known. Chief of these is the reception of an image transmitted from London and picked up in New York.

WORRIES OF THE FCC

Every now and then the FCC gives the public a peek into its mail bag. The following data is all taken from answers to persons who corresponded with the Commission.

There are about 55,000 amateur stations and licensed amateurs in the U. S.

An old survey made by the A.R.R.L. indicated that about 13% of the amateurs take the air every month.

There is no regulation regarding flying an American flag on top of a radio station or at a transmitter.

The public complains in several letters that war news is "biased."

Fully Equipped Field Laboratories for Facsimile



Finch Telecommunications, Inc., specialists in facsimile transmission and reception, are now operating two fully equipped field laboratories. These trailers are fully equipped with the most advanced radio communication apparatus. Experiments are being conducted with frequency modulation carriers which, it is claimed, make it possible to broadcast both aural and facsimile on the same wavelength. The facsimile recorder, it is said, can be operated from the output of any F. M. receiver.

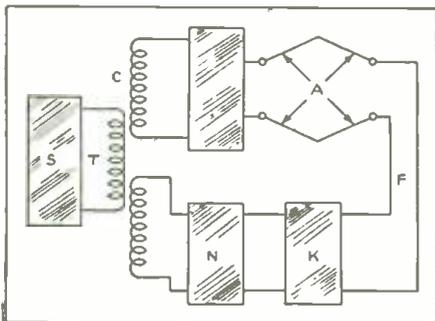
Despite the fact that the feverish activities in the war zone can best be illustrated by maps and diagrams, all facsimile programs we've seen are cartoons! Why?

DIRECTIONAL AERIALS

Developed in Germany

● A NEW German idea reported in *Wireless World*, London, deals with the type of transmitting aerial with which a directional effect is obtained by causing the R.F. energy supplied to one end of a pair of radiators to travel forward along the wires as a progressive wave. To secure this effect the far ends of the wires must be *shorted* by a resistance equal to the surge impedance of the system, in order to prevent the energy from setting up a standing wave. As there is a loss in this resistance the new circuit illustrated is designed to restore the lost energy. In this diagram the directional aerial is of the rhombic type and is fed from the R.F. source S, through the transmission line T.

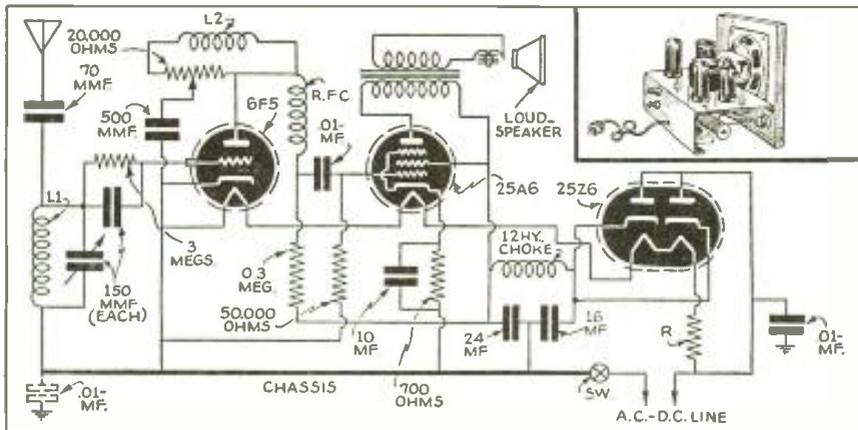
The usual terminating or surge impedance is replaced by a feed-back coupling F, which includes a transformer device K to prevent reflection, and a phase-changing network N which allows the feed-back energy



Block diagram of antenna system.

to reach the input coupling C in the correct phase to reinforce the energy supplied from the source S. The arrangement may also be applied to receiving aerials.

Miniature Set Features Regeneration



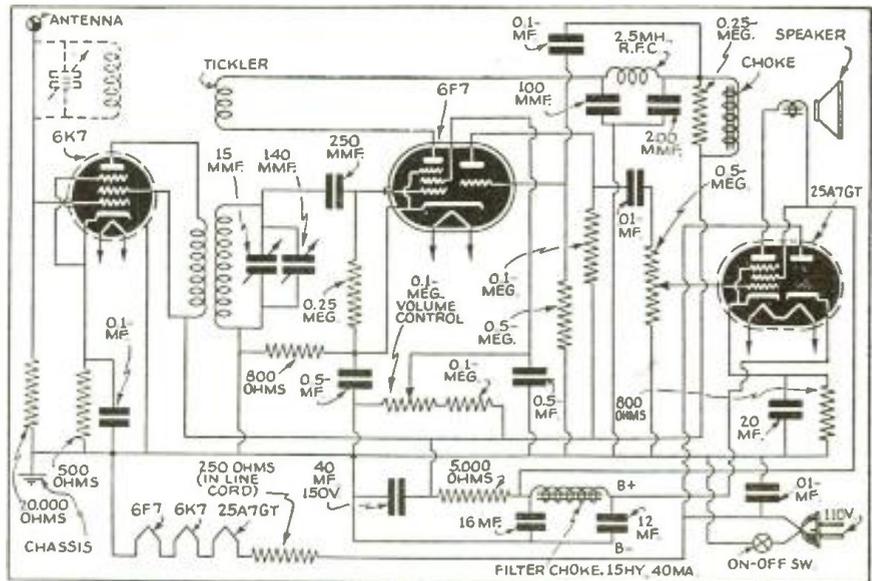
Plug-in coils adapt this circuit to all-wave reception.

● A TINY 3-tube receiver which operates a 2" loud-speaker and operates on either A.C. or D.C. was recently described in *Radio Revista*.

The tubes employed are a 6F5, a 25Z6 and a 25A6. By using plug-in coils the set can be adapted to various wavelengths; L1 is the grid coil and L2 the tickler. As this circuit uses no antenna coil it is not unlikely that it will radiate if it is allowed to break into oscillation. (Careful regulation

of the regeneration control will obviate this trouble.) It is easily constructed of inexpensive parts and the only item to be watched is the resistor R connected from one side of the power line to the second heater prong of the 25Z6 socket. If the set is being used on 110 volts, this resistor should be 200 ohms; it may be either a wire-wound type, affording high dissipation or else included in the line cord. The 10, 16, and 24 mf. filters are dry electrolytics.

Three-Tube All-Wave AC-DC Set

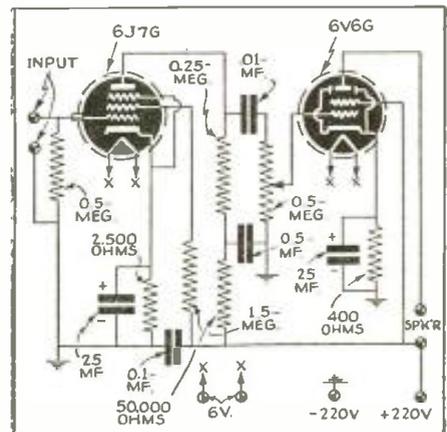


Ultra selectivity assured by built-in wave trap to tune antenna.

● THIS LITTLE receiver which operates from A.C. or D.C. uses coils which cover from 15 to 225 meters and other coils can of course be wound to take in the broadcast band. It has a stage of R.F., a regenerative detector and sufficient A.F. to operate a 4" 7,000 ohm permanent magnet dynamic loud speaker with ease. The coils which are of the plug-in type each contain three windings. These may be standard 2 winding coils with the tickler added. The tickler L2 consists of 7, 14, 21 and 30 turns of No. 30 enameled wire to cover the four bands specified. All values are shown on the diagram, the wave trap (in dotted line) being optional. This information appears in *Radio Revista*.

SIMPLE AMPLIFIER OPERATES FROM VIBRATOR

● AN amplifier circuit which is quite conventional save that a few values of the components have been changed to afford better results is published in *Radio & Hobbies* of Australia. This amplifier is designed primarily for automobile use, employing a 6 volt battery for its filament



Useful circuit for portable operation.

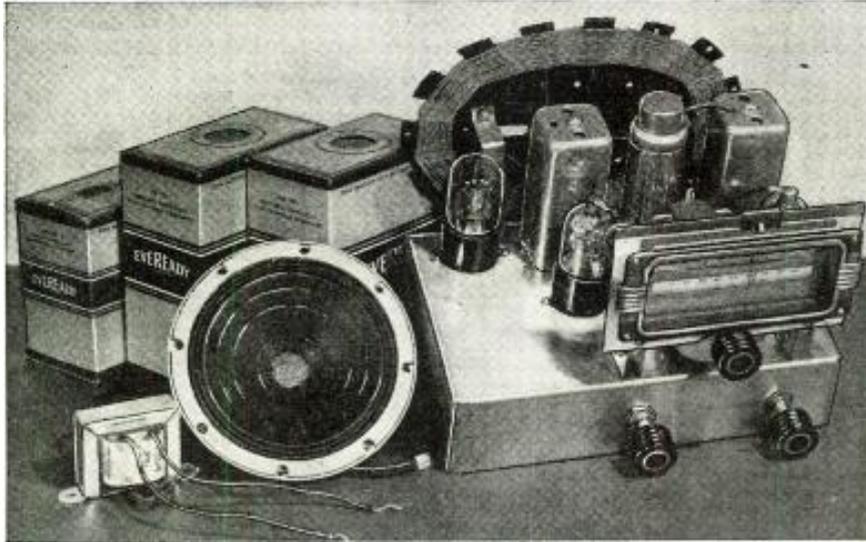
supply and a vibrator to provide plate voltage. It is recommended that an oversized vibrator which will provide 220 volts at 60 ma. be used. The 25 mf. condensers are of course electrolytic and the 2500 and 400 ohm resistors should be of the wire wound type. The loud speaker with which this amplifier is to be used should be of the permanent magnetic dynamic type provided with a transformer, the primary of which will match into a 7,000 to 10,000 ohm load. The tubes employed are standard, being a 6J7G and 6G6G for the output. The whole unit can be built on a chassis 7 x 4 x 2".

Next Month

Scheduled for this department next month are data on, *A Needle Scratch Filter, Interference Reduction Antenna, and many other interesting items.*

Four-Tube Battery Portable De luxe

John Wilcox*



The complete set of parts, including batteries and loop antenna, for constructing the four-tube battery portable.

● THE great popularity of the portable battery-operated receivers with loops was responsible for a great many requests for a good easily built kit. The kit described here is of excellent design and is easily built. Both schematic and picture diagrams are supplied with the complete kit. The chassis is punched and only a few common tools are needed to complete the assembly and wiring.

The circuit employs a 1A7GT mixer oscillator, a 1N5GT I.F. amplifier, a 1H5GT as detector, A.V.C. and first audio, and a 1Q5GT beam power output tube. The use of the beam power output tube results in high output with low distortion.

This 4-tube battery portable employs the superheterodyne circuit and it packs a good wallop. Loud-speaker reception is enjoyed over the broadcast band, thanks to the efficient loop antenna incorporated in its design. Latest type tubes result in maximum efficiency and signal strength.

The oscillator is of the cut-plate tracking type, which eliminates the need for the usual padding condenser and simplifies the alignment considerably. The I.F. transformers are factory aligned and seldom need any further adjustments.

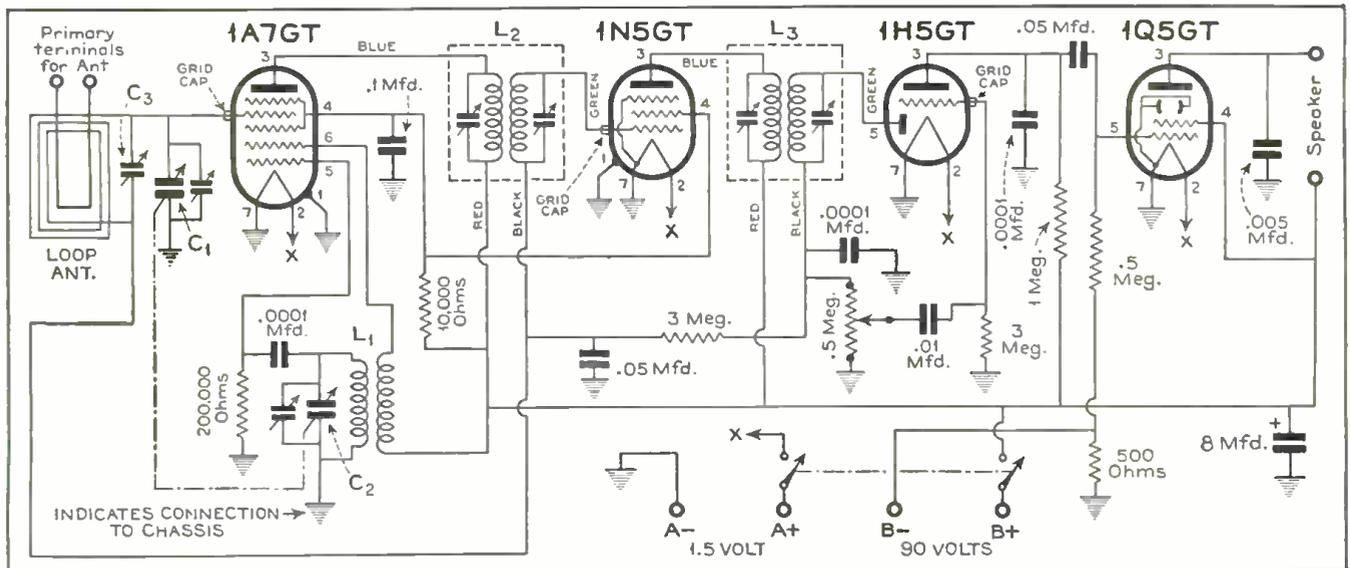
In addition to the usual trimmers on the gang condenser, the loop is provided with a small trimmer to compensate for any changes in this circuit when the receiver is finally put in the cabinet. The battery terminals provided make it possible to use any of the standard "A" and "B" batteries depending on space available for them or portability required. Where the set may be used permanently in one place, two large "B" batteries and a large "A" cell can be used to provide longer life.

The "B" batteries are by-passed with an 8 mfd. condenser to prevent motor-boating and to allow using these batteries, even though the voltage may be below normal and their resistance increased. Any size permanent magnet speaker with an output transformer of 8000 ohms to match the 1Q5GT can be used, a five or six inch speaker is convenient and adequate.

Assembly of the kit needs little instruction except that it is advisable not to mount the dial or the loop until the wiring is completed. The filament leads are usually wired first, the "B" leads next; then come R.F., I.F. and audio circuits. Keep the leads as short as possible on the I.F. transformers, as they may cause oscillation if too long. When all the wiring is completed, the loop can be mounted and wired to the gang condenser. Make sure the outside wire of the loop is connected to the top of the trimmer, and thence to gang condenser. The dial can then

*Technical Consultant, Radio Wire Television, Inc.

Schematic wiring diagram of the four-tube battery portable.



"EARLY BIRD" DEAL...

The Chance of a Lifetime for
Those Who Act Quickly!

Regular
Amateur Net
\$82⁰⁰

SPECIAL

While These
Models Last

\$59⁹⁵

WITH CRYSTAL



These sets were demonstration models, display samples, foreign government research try-outs and laboratory standards. All are factory reconditioned and fully guaranteed by both the Howard Radio Company and Allied. They have been repacked in factory cartons and cannot be told from brand new.

HOWARD "460"

10 TUBE COMMUNICATION RECEIVERS

With Built-in Frequency Monitor and Noise Limiter

MODEL 460 is a precision-built communication receiver designed specifically for reception of distant high frequency and broadcast stations. It has four bands covering 540 KC. to 43 MC. and incorporates the exclusive and much heralded *HOWARD* built-in Frequency Monitor by which ham frequencies are accurately calibrated against popular broadcast stations. It uses the new highly efficient single ended tubes, has R.F. preselection on all bands, crystal filter, two B.F.O. systems, electrical band spread, noise limiter, "R" meter and a full complement of switches and controls. Two stages of I.F., with special iron core transformers, are tuned to 465 KC. The copper plated chassis uses heavy bulkhead type construction providing the ultimate in strength and sturdiness.

The cabinet is of heavy drawn and welded steel of modern design, finished in fine black crackle, trimmed in silver. Receiver dimensions are: 9" high, 18-3/4" long, 8-3/4" deep. Shipping weight 34 lbs.

Separate P.M. Speaker to Match \$7.95

The *HOWARD* Type 3-820 P.M. Dynamic Speaker matches perfectly with the cabinet and the output of the Model "460" Receiver. The 8" speaker unit is scientifically mounted in an acoustically treated, welded steel cabinet. If you need a speaker for this set—this is the one to order.

ONLY \$5.99 DOWN!

The Howard "460" is available on ALLIED'S liberal Time Payment Terms for only \$5.99 Down and \$7.15 monthly for 8 months. (With speaker—\$6.79 down, \$8.10 monthly for 8 months.) Quantity limited! ORDER NOW!

Order TODAY While Supply Lasts!

ALLIED RADIO CORP.
833 W. JACKSON BLVD.
CHICAGO, ILL.

This is my order for a Howard "460" Receiver on your "Early Bird" offer.

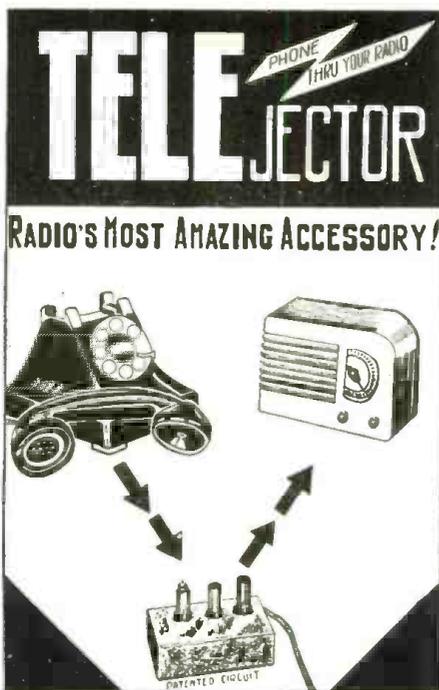
- Enclosed is my remittance in full for \$.....
 Enclosed is my down payment of \$5.99 (\$6.79 with spkr)
 I also want the speaker @ \$7.95

NAME

ADDRESS

CITY

ALLIED Radio CORPORATION
833 W. JACKSON BLVD., CHICAGO, ILL.



A new and practical invention that adds to the usefulness and enjoyment of your radio set. **TELEJECTOR** is an efficient electronic device by which you can broadcast telephone conversations through your radio at loud speaker volume. No wires to connect to your radio or telephone. Merely place the marvelously sensitive "Impulsator" of the **TELEJECTOR** near any telephone instrument, turn on your radio and listen to both sides of any telephone conversation.

Twenty years experience in developing new radio circuits, including the Universal A.C.-D.C. set, the Home Broadcaster and many other inventions, are behind this new product.

Ideal for conferences, parties, entertainments, or long distance talks. Business uses are unlimited. Speak into your home telephone and address a roomful of salesmen at the office. For a birthday party, have a friend phone in a greeting song and let all the guests listen over the radio loud speaker. **TELEJECTOR** simplifies telephoning for the hard-of-hearing as the voices are greatly amplified by the radio loud speaker.

WARNING: The **TELEJECTOR** is not to be used as a detective device for listening in on private phone conversations in any place where this is contrary to Government or police regulations.

GUARANTEE: Fully guaranteed as to materials and workmanship and also against damage in transit.

TELEJECTOR works with any make radio. It is self-powered and operates from any 110-120 volt a.c. or d.c. house-lighting circuit. As easy to operate as a telephone or a radio. Absolutely no technical knowledge required. Furnished wired and laboratory tested, ready to use.

PRICE—COMPLETE

\$5.95

Set of Matched Tubes for **TELEJECTOR** \$1.95

NOTE: Special Telejectors Built to Order for Accredited Investigators and Detective Agencies.

H. G. CISIN'S WIRELESS TRANSCASTER

This wonderful new device has hundreds of practical applications. Broadcasts voice or music from any room or floor in home, office or store to any radio in same building **WITHOUT CONNECTING WIRES!** Works from any lighting socket, a.c. or d.c. Transmits your favorite recordings from electric phonograph through any radio **WITHOUT CONNECTIONS** between radio and phonograph. Makes your radio an efficient public address system, or an interoffice communication system. Simplifies **HOME BROADCASTING**. Great fun for parties. Ideal for auditions. Also permits use of radio as a **DETECTAPHONE**. Listen to secret conversations. Impossible to enumerate many other uses in this limited space.

DE LUXE MODEL TRANSCASTER-TRANSMITTER

Powerful, high-gain device engineered so that it will transmit high-fidelity music without connection wires to remote radio set. No sacrifice of quality or power. Uses separate rectifier tube, 6J7 screen grid mike amplifier, and dual purpose 6A7 modulator and oscillator. Frequency Range 500 to 800 kc. or 1500 to 1750 kc. 100-db. amplification. (less tubes and mike) **\$4.95**

Set of 3 Matched Tubes \$1.95

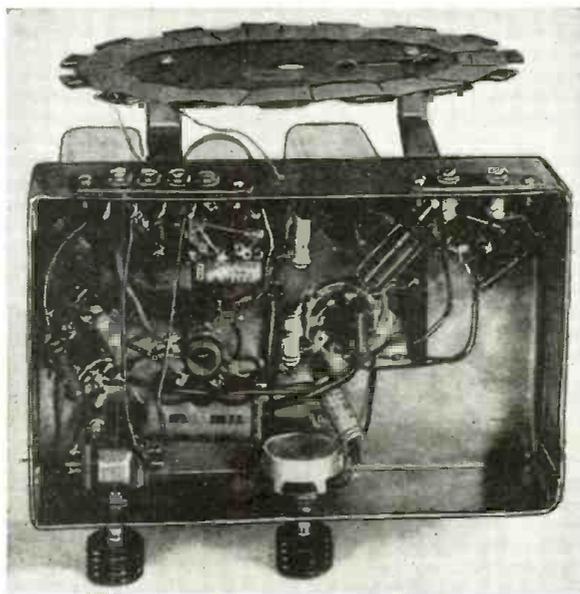
NOTICE: Order **TELEJECTORS** and **TRANSCASTERS** direct from this ad **NO CIRCULARS AVAILABLE.** 25% deposit required with all C.O.D. orders.

TRANSCASTER ACCESSORIES

Earphone Microphone 95c. High Fidelity Dynamic Microphone, 50 db. \$1.95. Send 3c stamp for circulars describing line of wireless and direct connected record players.

H. G. CISIN, CHIEF ENGINEER

ALLIED ENG. INSTITUTE, DEPT. 5-65
85 Warren St., NEW YORK, N. Y.



Bottom view of the four-tube portable receiver. All of the bypass condensers, resistors, volume control, etc., are mounted and wired underneath the sub-panels as this photo shows. The wiring is very simple and can be carried out even by those inexperienced in set-building.

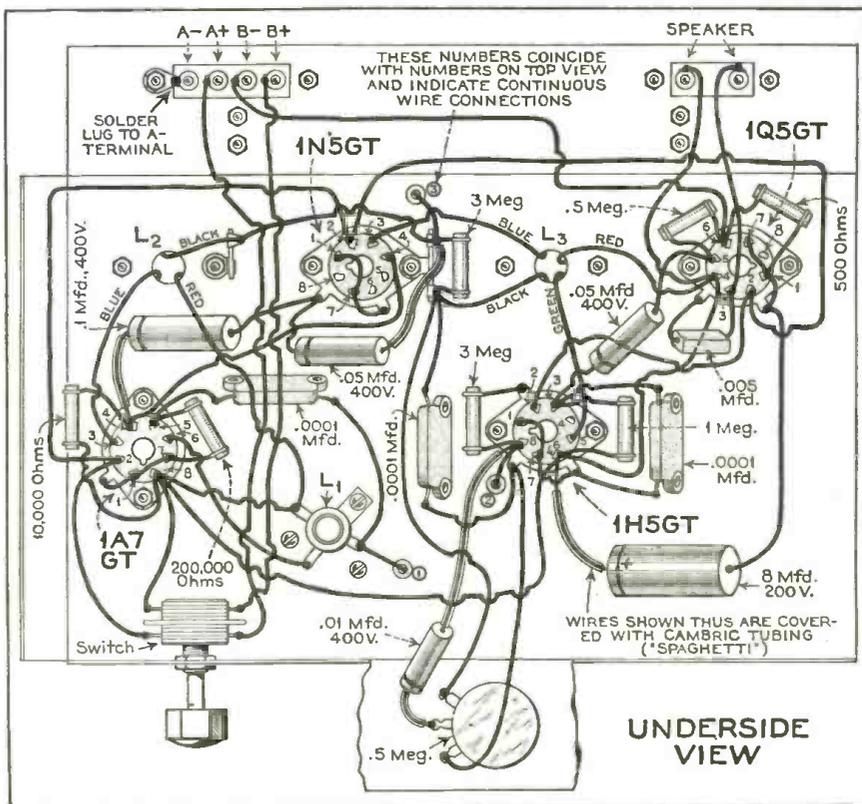
be mounted, using care to see that it lines up with the condenser so as to prevent it from binding.

Check the wiring again with the schematic diagram to see that no wires have been left out or placed wrong. It is advisable to test the filament voltage before placing tubes in sockets to make sure no "B" voltages are crossed to the filaments. When connecting the "B" batteries, make sure of the polarity, because if they are reversed the 8 mf. electrolytic used in the set will break down.

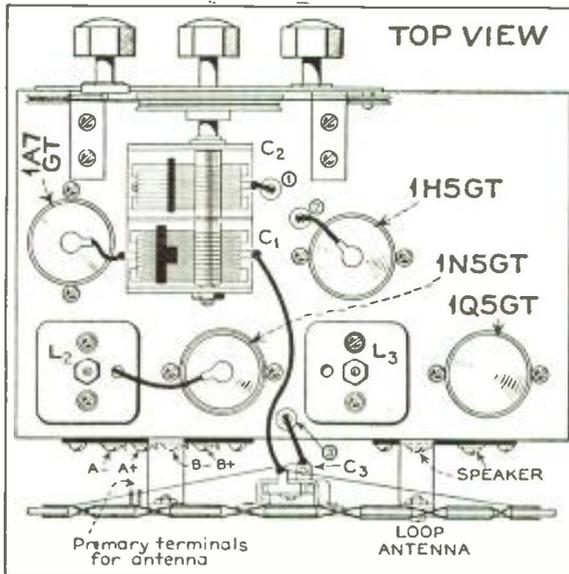
If the set checks normal, tubes can be inserted and the receiver is ready for alignment. If a signal generator is available, it

will provide an accurate method of alignment, similar to the procedure followed if no signal generator is at hand. A signal generator should not be necessary, however. Briefly the procedure is to tune in a station (or set the signal generator) at 1500 kilocycles. The oscillator trimmer condenser should then be adjusted until this station is received at approximately the correct frequency, as indicated on the receiver dial. Next, adjust the loop trimmer for maximum volume. Usually the trimmer on the first gang condenser (C1) can be left set at minimum capacity. If the trimmer on the loop must be set quite tight, the trimmer on the

Below—bottom view of the chassis, showing the physical wiring connections to the various resistors, by-pass condensers and sockets, the terminals of which are all numbered, thus simplifying the wiring.



Picture wiring diagram at right—looking down on the top of the chassis. By means of these diagrams anyone can easily build this extremely desirable and useful battery portable receiver.



first gang condenser can be tightened slightly to allow the trimmer on the loop to be adjusted when the set is put into the cabinet.

It will be noticed that the loop is directional and the set should be placed in such a position as to bring up some of the weaker stations. If the set is used a hundred or more miles away from broadcasting centers an antenna and ground can be connected to the loop primary.

It is a fine little set for use in the home, in a boat, a car or trailer.

Parts List

- 1—Chassis punched
- 2—Loop brackets
- 2—Dial brackets
- 1—Two-gang variable condenser
- 1—Loop with trimmer
- 2—I.F. coils (input and output)
- 1—Oscillator coil
- 1—Dial
- 1—Double pole double throw switch
- 1—Volume control, 500,000 ohms
- 4—Octal sockets
- 1—8 mfd. electrolytic condenser
- 1—.1 mfd. paper condenser

- 2—.05 mfd. paper condensers
- 1—.01 mfd. paper condenser
- 1—.005 mfd. mica condenser
- 3—.0001 mfd. mica condensers
- 2—3 meg. 1/2 watt resistors
- 1—1 meg. 1/2 watt resistor
- 1—1/2 meg. 1/2 watt resistor
- 1—200,000 ohm resistor
- 1—10,000 ohm resistor
- 1—500 ohm resistor
- 1—Two-terminal binding post strip
- 1—Four-terminal binding post strip
- 1—One-terminal lug strip
- 1—Two-terminal lug strip
- 3—Knobs
- 1—Soldering lug
- 2—Tube shields
- 3—Grid clips
- 3—1/4" O.D. rubber grommets
- 24—6/32x3/4" machine screws
- 3—6/32x1/4" machine screws
- 28 6/32x1/4" nuts
- 31—No. 6 lock washers
- 25 Feet hookup wire
- 18" solder
- 1 Length spaghetti

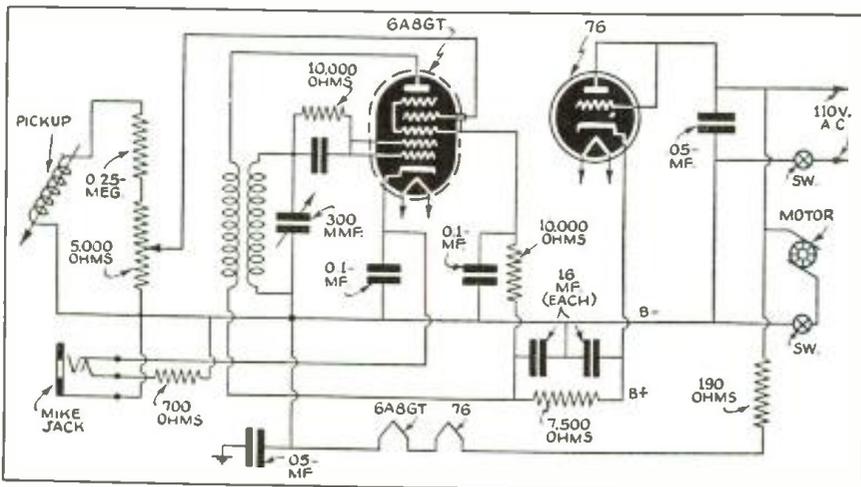
ACCESSORIES

- Tubes -1A7GT, 1N5GT, 1H5GT, 1Q5GT.
- Speaker--1 6-inch PM speaker Lafayette No. K19270
- 1 output transformer Lafayette, No. K19273
- Batteries -2 Eveready No. 762, 1 Eveready No. 741. With special plugs.

MIDGET PHONO OSCILLATOR

● A SMALL 2 tube phono oscillator which uses a 6A8GT and 76 permits the playing of records through a radio set many feet away. A pickup preferably of the crystal type is connected as shown. So small is this little oscillator that it may be built right in the cabinet which houses the

phonograph turn-table, in which case the line cord switch can be used to control both the motor and the oscillator, according to *Radio Revista* (Argentine). The 190 ohm resistor may be in the line cord or if not should be rated at high dissipation. The parts are available on the market.



The radio experimenter will find this phono oscillator useful for many purposes.

SMASHING VALUES OUT OF THE BIG NEW
FREE
LAFAYETTE CATALOG

DELCO AUTO VIBRATORS
 Here's your chance to take advantage of a real price scoop! Each of these genuine Delco vibrators is brand new, in perfect condition, and packed in its original factory carton. We have only a limited quantity available, so place your orders now and avoid disappointment. Diagrams show wiring scheme.

Delco No. 5050673. 4-prong, non-syn. 1 5/8 x 3 5/8". For '38-'39 Chev. Olds. **69¢**
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Delco No. 5060845. 4-prong, non-syn. As above but smaller. 1 1/2 x 3 1/8". For later models. **69¢**
 K1060

POWER TRANSFORMER
 Take advantage of these bargain prices NOW. Universal both electrically and physically. Brackets with "M" type slots permit mounting in all positions. Windings topped for universal use for class "B" sets.
 Pri. for 115 volts, 50-60 cycles. Secondaries: 145-310-310-165 v. at 115 ma.; 25 v.c.t. at 3 amps; 2.5 v. at 35 amps; 5 v. topped at 1.25/1.25/2.5 v. at 5 amps; 2.5 v. topped at 1/1.5 v. at 7.25 amps. 4x x 3 3/8"; con. core 1 1/2 - 2 1/2"; K5630.
\$1.10
 Lots of 5, Each.....
 SINGLE UNIT.....\$1.35

RIM DRIVE PHONO MOTOR with 9" TURNTABLE
 A powerful, constant speed (78 r.p.m.) rim driven motor at a price far below its actual worth. Complete with 9" turntable having a flocced covering. Operates on 110 volts, 60 cycles a.c. Compact and sturdy. Only a limited quantity in stock. K176. Special..... **\$1.95**

BUY BY MAIL OR IN PERSON
 At one of our 7 convenient stores. Either way you're sure to get better service—greater value.
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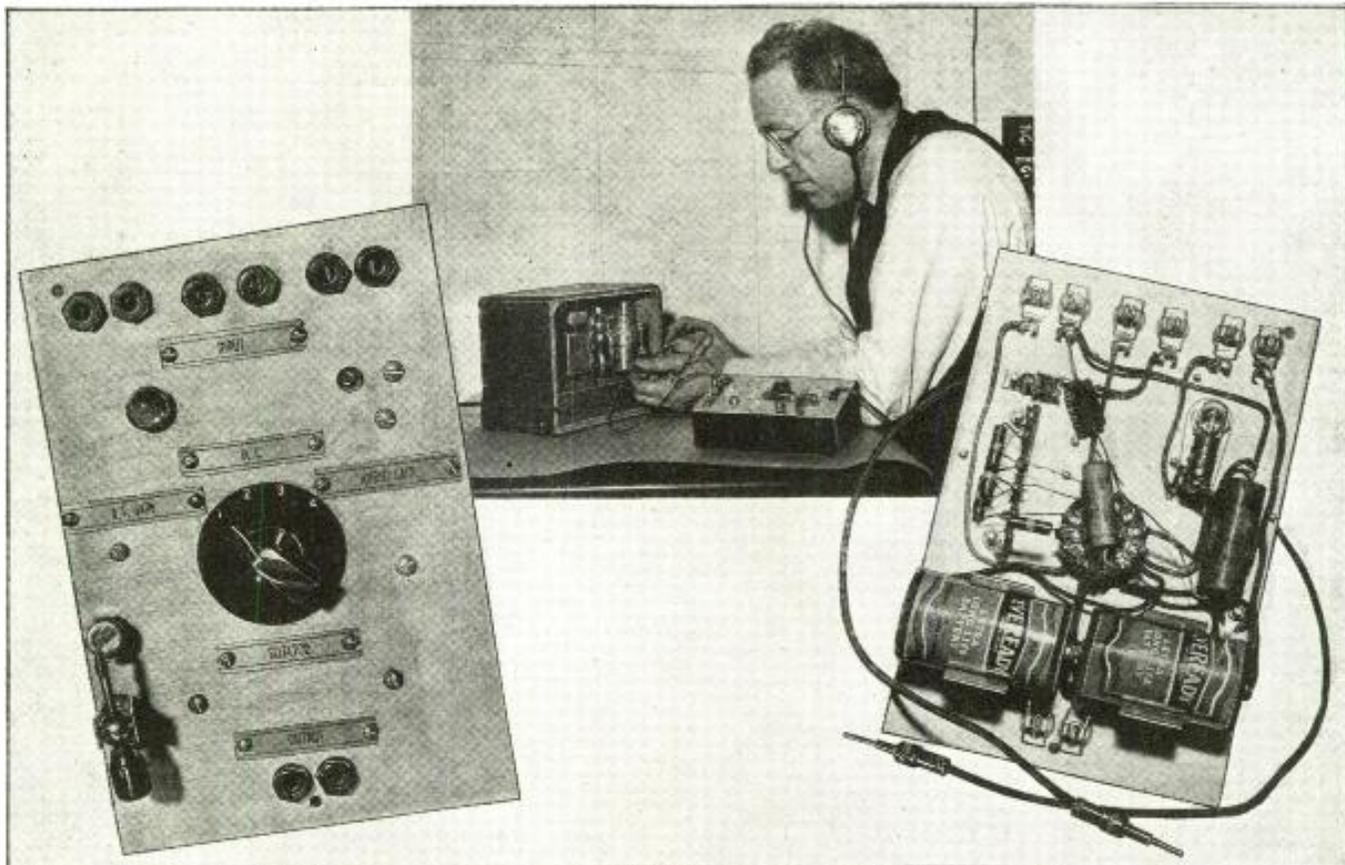
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 I ENCLOSE \$.....RUSH ATTACHED ORDER
 PLEASE RUSH NEW FREE CATALOG No. 80
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A Beginner's "SIGNAL CHASER"—

To Help You Locate Those "Bugs"

Charles R. Leutz



Two views, front and back, of the simple tester for beginners; also picture of the set in use for hunting "bugs" in a radio receiver.

● A LOW cost versatile test instrument is a welcome addition to the limited equipment available to new or student service men. While the unit to be described has been designed primarily for *beginners*, it can be equally valuable to experienced radio service men.

Fig. 1 is an illustration of the complete unit, which is only 7½" x 5" x 2" in size. The schematic wiring diagram is given in Fig. 2 and a pictorial wiring diagram in Fig. 3.

From the above diagrams it will be noted that low resistance continuity tests are made using a 2½ volt pilot bulb and a 3 volt battery. High resistance continuity tests are made using the 3 volt battery and the head telephones.

Indications of voltage are readily obtained using a 1/20-watt Neon bulb, together with series resistances to limit the current to one milliamper. With the single 100,000 ohm resistor in circuit, the neon bulb requires a minimum potential of 90 volts D.C. or 65 volts A.C. to strike a glow. Higher voltages produce a more intense glow and with a little practice, accurate estimates of voltage can be made. Adding additional series resistors, voltages up to 440 to 500 volts can

be measured with safety, a valued point.

By using the Neon bulb and resistor in series with a source of A.C. or D.C. voltage, condensers can be tested for an indication of capacity and for opens.

Any part of the radio frequency circuits can be tested for signal or distortion. That applies to radio frequency circuits or intermediate frequency amplifiers. For example, with jacks No. 5 and No. 6 connected to the output circuit (plate to plate return) of any radio frequency stage, rectification is obtained at that point by the crystal detector and the status of the signal at that point is determined by listening with headphones. Gain can be noted for succeeding R.F. stages.

In testing audio outputs, the head telephones are used in a similar manner, and there is a .1 mf. 600 volt series condenser for protection of the operator. However, there is also a switch position for connecting the phones directly to the test prods, without the protective condenser.

Fig. 4 gives the panel drilling layout dimensions.

The *primary* functions of the test instrument are given many other applications will suggest themselves to resourceful technicians.

List of Parts

1—Piece sheet aluminum 7½" x 5" x 1/16", polished and lacquered

MALLORY

2—Red Tip Jacks, No. 420
2—Black Tip Jacks, No. 421
2—Brown Tip Jacks, No. 424
2—Light Green Jacks, No. 428
1—Selector Switch, 3 pole, 4 position, No. 32345, with plate
1—2½ volt miniature base pilot bulb, No. 170
1—Switch Knob, No. 366
1—Pilot Bracket and Clear Bezel, No. 320C
2—Battery Holding Clips, No. A93435
1—Condenser Holding Clip, No. 93434
1—.1 mf. 600 volt Paper Condenser, No. TP418
1—.006 mf. 600 volt Paper Condenser, No. TP409
1—.0001 mf. Mica Condenser, No. MC839
4—Tip Plugs, No. 15

LITTELFUSE

1—Neon Bulb, No. 122-1
1—Neon Bulb Holder, No. 5125

EVEREADY

2—1½ volt Flashlight batteries, No. 950
1—Galena Detector, Adjustable Type, Complete

CENTRALAB

4—100,000 ohm, ½ watt resistors

CINCH

1—6 Contact Mounting Strip, No. 1540A

BIRNBACH

5 ft. push-back wire, 2' No. 16 Flexible rubber covered wire

MISCELLANEOUS

6—No. 6/32 Rd. Hd. Brass Screws, 6—No. 6/32 Hex Brass Nuts, 6—No. 6 Lock Washers
6—Nameplates, 1 each No. E-13; D-8; I-7; A-9; I-15 and G-15

CONSTRUCTION AND USE OF "SIGNAL CHASER"

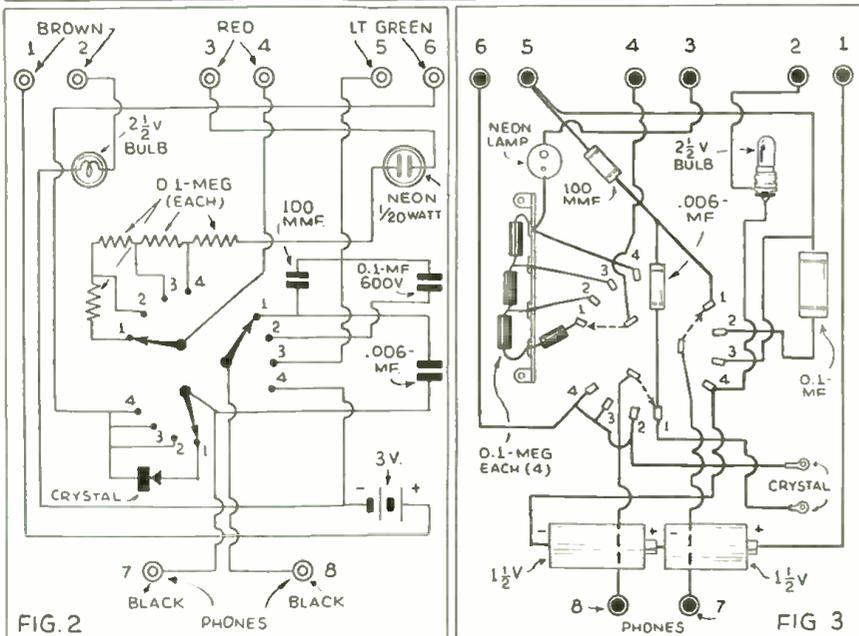


FIG. 2

FIG. 3

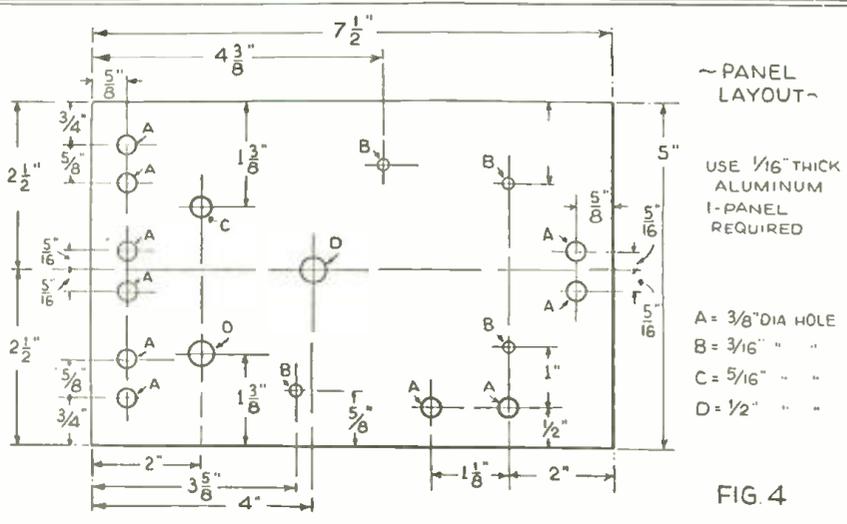
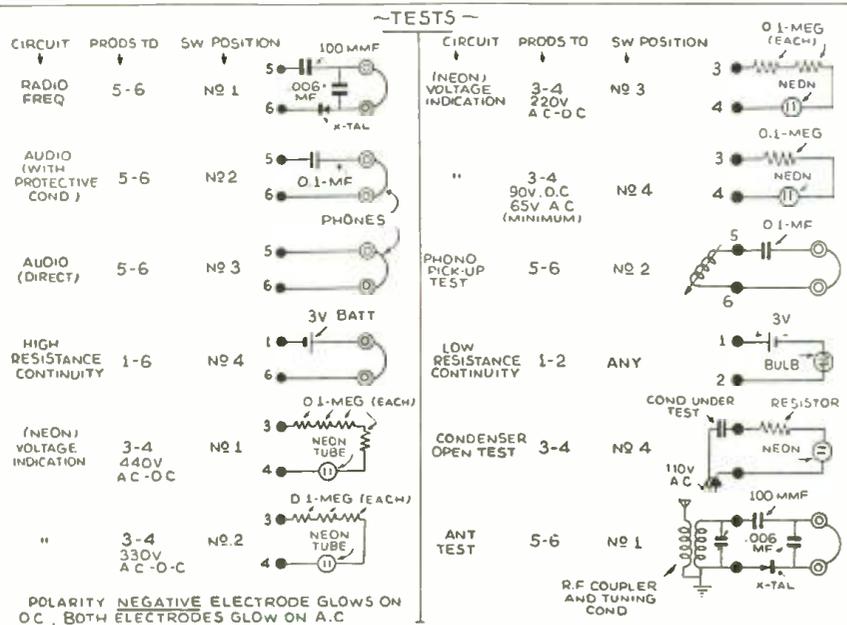


FIG. 4

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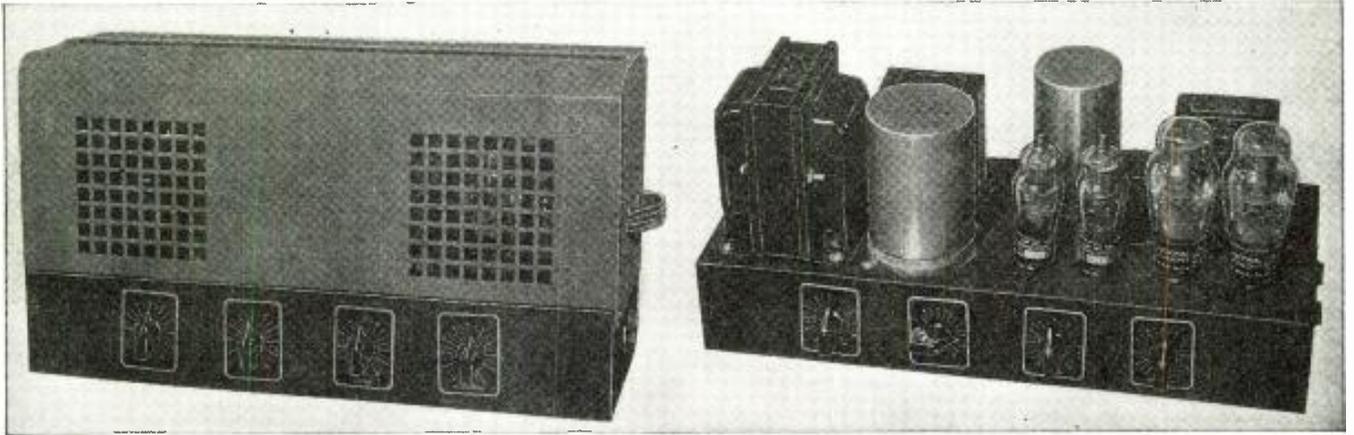
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Frequency Modulation

Adapter and Receiver

Part 2 - Conclusion

Ricardo Muniz, E.E.,* and Jerrier Haddad**

● IN this the second and concluding installment of the description of the *R & T Frequency Modulation Adapter and Receiver* we shall describe alignment procedure using everyday service equipment and also the adding of audio amplification to our adapter, thus making it a complete "F.M." receiver. Two different audio systems will be described: one a simple low cost system giving good fidelity; the other a more elaborate one giving very excellent power and fidelity. The latter audio section brings out the maximum fidelity of which F.M. is capable; even the first sounds better than the average A.M. set.

Preliminary Alignment Procedure: An ordinary A.M. type signal generator will be used to align this set. The Hickok Mod. 180 used by the authors has a built in wobulator having a range of 30 kc. This wobulator does not have sufficient range to be very useful in aligning F.M. receiving circuits. A wobulation range of approximately 340 kc. is required for visual alignment. The wobulator will provide, however, a rough sort of check after alignment has been completed as described below.

The first step in alignment, after having completed construction and checked circuit wiring carefully, is to connect the signal generator to the input of the I.F. system. If an electronic voltmeter is available, it may be connected to the limiter grid and I.F.'s lined up to 1.7 megacycles. The author did not, however, have a V.T. voltmeter available. In this case it was found desirable to clip phones across the load resistors in the discriminator with a strong signal pumped into the front end of the set. This is possible because the Meissner I.F.'s, as they come from the factory, are aligned

near 1.7 mc. (This setting has been disturbed little by our pushing the coils closer together in the transformers.) We now align the entire I.F. system and all three trimmers on the discriminator to maximum signal, using the 400 cycle modulation available in the generator and aligning by ear.

Aligning the Discriminator: The type of *discriminator* circuit used in this receiver was especially chosen to permit simple alignment procedure. Shift the phones to the upper half of the discriminator diode load resistor. Shift the setting of the signal generator to 120 kc. above I.F. frequency; that is, to 1,820 kc. Align the corresponding trimmer on the discriminator transformer for maximum signal. (*A very high resistance voltmeter or a V.T. voltmeter would be more accurate than phones.*) Now put the phones or other indicator across the lower half of the discriminator load resistor. Set the signal generator, still connected to the I.F. input, to 120 kc. below I.F. freq.; that is, to 1,580 kc. Align the corresponding trimmer of the discriminator transformer for maximum signal. **NOTE:** It is necessary, when performing the above operations, to have the limiter lever set at *wide open* and left untouched during aligning.

Checking the Alignment of the Discriminator: Having completed the above operations, the discriminator as well as the I.F.'s should be okay. The center coil of the discriminator has been tuned to I.F. freq. and the other two to 120 kc. above and 120 kc. below I.F. frequency, respectively. A rough check may be made on the alignment of the discriminator at this time if your signal generator has wobulation available as had the Hickok 180 used by the author. Set the signal generator so that it will wobble the maximum kc. of which it is capable with 1,700 kc. as the center frequency. In some signal generators, the wobulation takes place only above the frequency at which generator is set. If this

is the case, we must set the signal generator frequency down one half of the wobulation range. For example if the wobulator range is 30 kc. and this all takes place above signal generator setting frequency, we set the generator at 15 kc. below I.F. freq.; that is, at 1,685 kc. With this signal coming through the set and with the phones across the entire discriminator load resistor, we should hear a buzz. This buzz will be of the frequency at which the wobulator is sweeping across its range. The wobulator is essentially an F.M. signal. The strength of the signal heard in the phones will depend upon how far from central frequency the wobulator goes. The number of times it does this per second will determine the frequency of the audio buzz we hear. It will be around 60 cycles.

Remember to keep a strong signal on the set during all alignment procedure. This is contrary to A.M. receiver practice, where the signal input is made weaker as alignment proceeds. This departure is made necessary by the presence of the limiter.

Alignment of the Oscillator: The alignment of the oscillator is conventional and little need be said here. A convenient method of beginning is to explore with the signal generator connected directly to the converter section. The signal generator frequency is varied until a 1.7 mc. I.F. is produced. Reading the signal generator setting at this time will give the experimenter the frequency of the oscillator by either adding or subtracting 1.7 mc. from the signal generator reading. The oscillator frequency should be either 1.7 mc. higher or 1.7 mc. lower than the frequency of the tuned circuit in the converter. Setting the R.F. tuned circuit to mid-range is most convenient. Leaving the generator set as found above we can align the R.F. tuned circuit by means of the trimmer. If the oscillator frequency, as determined above, was found to be very far from the correct range of values, it should be changed by using the

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**Recent Graduate Brooklyn Tech H. S., Former President Television Club, Laboratory Assistant Automatic Telelector Corp.

trimmer on the oscillator condenser. Since the range of the set is to be 42-50 mc., mid-range is 46 mc. and a suitable oscillator frequency at mid-range would be 47.7 mc. Therefore set the signal generator at 46 mc. and trim the oscillator, with the generator connected direct to the converter, until output, as heard in phones connected across one-half of the discriminator load, is maximum (the half of discriminator used for this method of aligning the oscillator should be set to I.F. frequency). Now, with the signal generator still set at 42 mc. and with 400 cycle modulation still in, connect the generator to antenna terminals and line up the R.F. tuned circuit for maximum signal again.

The conventional ways of aligning an oscillator can be used equally well. It won't be necessary to disturb the setting of the discriminator as noted above if a V.T. voltmeter or other very sensitive indicator is connected in ahead of the discriminator—perhaps on the limiter plate.

The advanced experimenter, amateur and set constructor with experience in building ordinary superheterodynes should have little difficulty in aligning this F.M. job as there is really nothing new about it except the discriminator. The discriminator was purposely made of the simplest type to align.

Choice of Audio System: You can use this F.M. adapter with the audio system in your own radio or with either of the audio systems described herein. F.M. signals, as put on the air, make available much higher fidelity than the average home receiver designed for A.M. stations can make use of. It is therefore more desirable to use a separate audio system. Using the F.M. rig as an adapter will retain the noise limiting advantages inherent in the F.M. system, but

will not take full advantage of the fidelity available. If possible, it is recommended that the more elaborate audio system be built and that a hi-fi speaker be used such as the Utah 15 inch H15P used by the author. Such a hi-fi speaker must be used in a baffle enclosure if full advantage of its characteristics is to be taken. The author used a Cinaudagraph infinite baffle. This type enclosure gives improved bass response over the use of a plain flat baffle and is really quite desirable. The less elaborate audio system has some advantage over the audio in most regular sets in that inverse feedback is used and in that more power is available for reproduction of low notes than is usual.

The Small Audio Amplifier: On studying

will be necessary to increase the size of the de-coupling filter resistors and condensers in the amplifier and probably also in all the stages in the F.M. receiver. Care in wiring to avoid undesired coupling between leads will, however, make such an experimental procedure unnecessary. The power supply is well filtered and the hum level is low. The gain of the audio amplifier is more than ample, when feeding a good speaker, for any apartment dweller. As you know, *inverse* feedback improves the fidelity of the amplifier by feeding the distortion back into it out of phase, thus canceling it.

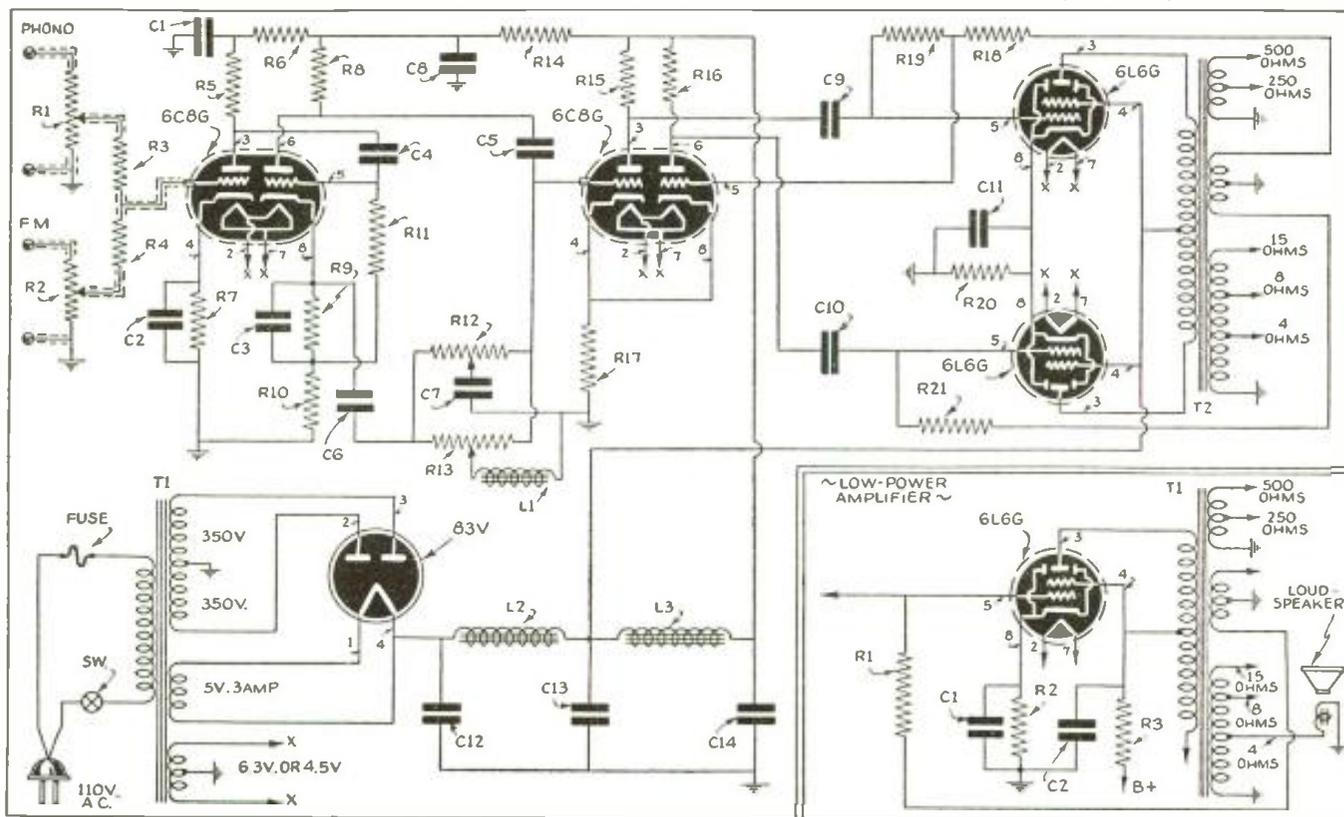
Features of Larger Audio System: Many listeners wish to adjust the fidelity of their audio system by raising and/or lowering its response to the different audio frequencies.

In the last issue we described the radio frequency or "front end" of the frequency modulation converter. In this concluding article the authors explain the construction details of a high-quality Audio Frequency amplifier and power supply, for use with the R.F. unit described last month.

the wiring of the small audio amplifier, one will notice the unusual method of obtaining inverse feedback. The transformer method was used to avoid the "bugs" which often crop up when using the more common tapped resistor method. These "bugs" usually take the form of oscillation or loss of gain through excessive feedback. If the amplifier should oscillate, reverse the connections to the feedback winding, as this shows that the feedback was 180 degrees opposite in phase from what it should be. We want *inverse* feedback—not regeneration. There should be no tendency to oscillate. Should such a tendency be present it

It is also advantageous, as long as a hi-fi amplifier is being built, to be able to use the same amplifier for phonograph, P.A. microphones, etc., as well as F.M. reception. Therefore the hi-fi amplifier described herewith was designed on a separate chassis and was made complete with power supply. It is reasonably cheap but extraordinarily efficient and versatile. The tube line-up is two 6C8-G's, two 6L6-G's and an 83V. Full advantage of F.M. fidelity is realized using this amplifier. The amplifier can also be used for public address work, in conjunction with a hi-fi broadcast tuner, and of course with our F.M. adapter. There may be many

As the diagram below shows, the wiring of the audio frequency amplifier for the F.M. converter is simple yet very effective.



experimenters who will choose to build this amplifier who may not wish to build the F.M. adapter at this time.

Explanation of Circuits Used in Larger Audio System: The two inputs, be they F.M. and phono or two mikes, may be faded and mixed by "pots" R_1 and R_2 . These are so wired as not to interact. Resistors R_3 and R_4 are in the circuit to prevent interaction and to prevent shorting one input when the other is shut down. Freedom from interaction can be further increased by increasing the values of R_3 and R_4 by 50% to 100%. The values specified were found to be satisfactory. The effect of R_3 and R_4 on the overall gain of the system was found to be very small.

The first half of the first 6C8-G is used as a triode amplifier or pre-amplifier, making possible the use of low output mikes, pickups, etc. The second half of this 6C8-G is used as an electronic tone control. This type of tone control has the advantage over the more common tone controls in that the highs may be raised or lowered independently of the lows (by means of the "pot" R_{12}) and the lows can be raised or lowered independently of the highs (by means of R_{13}). Choke L_1 in the electronic tone control circuit should be mounted away from power supply wiring and components to minimize hum pick-up.

The second 6C8-G is used as a voltage amplifier and phase inverter. The use of a phase inverter does away with the transformer commonly used between the single-ended preamplifier and the pushpull output stage. It is cheaper and, except in the case where a very expensive transformer is used, it is better. The function of this tube is to make the voltage impressed upon the grids of the pushpull 6L6-G grids equal in amplitude but opposite in phase.

The 6L6-G output stage is more or less standard. The grid of the phase inverter (second half of second 6C8-G) is fed 1/25th of the voltage applied to the grid of the upper 6L6-G by the first half of the second 6C8-G acting as a voltage amplifier stage. Thus the second half of the second 6C8-G has applied to its grid voltage that has already gone through the first half. The voltage on the grid of this latter half 6C8-G will therefore be of opposite phase to the voltage on the grid of the first half

of this 6C8-G. Since only 1/25th of the output of the other section of this 6C8-G is being put on this grid, the output of this tube will be equal to that of its brother half 6C8-G but opposite in phase (gain of this stage being 25). Thus the upper half 6C8-G supplies the upper 6L6-G and also the phase inverter. The lower half 6C8-G phase inverter supplies the grid of the lower 6L6-G.

Inverse feedback is obtained by using a tapped output transformer as was done in the small audio amplifier. Again if amplifier oscillates reverse feedback winding connections.

Important Note: Hum pick-up by the low level end of any high gain audio amplifier, such as this one, is a problem which must be solved. Great care must be used in routing the wiring of the low volume level end of the amplifier. All grid and plate leads up to the electronic tone control stage, starting from the input connections, should be shielded, and the shield well grounded.

Connecting to Speaker: One or two speakers may be used. Either parallel or series connections may be employed in the event that two speakers are installed. If they are hooked in series, use the 15-ohm tap on the output transformer. In the parallel connection, the 4-ohm tap should be used. For a single speaker, such as the Utah H15P used by the authors, use the 8 ohm tap. If the speaker is to be operated 100 feet or more from the amplifier, the 500-ohm tap on the output transformer should be used. The line resistance becomes too great a factor on long lines to permit transmission of audio at low impedance, although this is far superior where the line is not too long. Use of the 500-ohm tap will make necessary the use of another matching transformer at the speaker to bring the impedance down to 8 ohms again. Cheap speakers, or speakers smaller than 12", will reduce the advantages this amplifier provides.

The cooperation of Bob Bergemann, President of the Radio Club of the Brooklyn Technical High School, in the design of the audio amplifier is acknowledged.

Hi-Fidelity Push-Pull Amplifier Parts List

- THORDARSON (Transformers)**
 1—Power transformer, 350 V.—0—350 V.—T-70R62
 1—Output transformer—T-17S12

- 1—20 henry choke—T-14C70
 1—12 henry choke, 150 ma.—T-17C00B
 1—7 henry choke, 40 ma.—T-13C26

I.R.C. (Resistors)

- 2—2 megohm pot., C.S. taper "D", R_1 , R_2
 4—500,000 ohm, 1 watt BT1, R_3 , R_4 , R_{11} , R_{21}
 3—100,000 ohm, 1 watt, BT1, R_5 , R_{15} , R_{16}
 3—20,000 ohm, 1 watt, BT1, R_6 , R_{14} , R_{18}
 2—3,000 ohm, 1 watt, BT1, R_7 , R_9
 2—5,000 ohm, 1 watt, BT1, R_8 , R_{19}
 1—50,000 ohm, 1 watt, BT1, R_{10}
 2—75,000 ohm pot., D taper CS, R_{12} , R_{13}
 1—1,500 ohm, 1 watt resistor, BT1, R_{17}
 1—200 ohm, 5 watt resistor, R_{20}

CORNELL-DUBILIER (Condensers)

- 1—8-8-8 450 V. condenser, EA880, C_{12} , C_{13} , C_{14}
 1—8-8 450 V. condenser, EA8801, C_8 , C_{11}
 1—10-10 50 V. condenser, BRL115, C_2 , C_3
 5—.1 mf., 600 V. condenser, DT 6P5, C_4 , C_5 , C_9 , C_{10} , C_{11}
 1—.5 mf., 600 V. condenser, DT6P5, C_6
 1—.01 mf., 600 V. condenser, DT6P1, C_7

UTAH

15" Speaker

RAYTHEON

2—6L6's

CINAUDAGRAPH

1—Infinite baffle for speaker

NAT'L UNION

1—83; 2—6C8-G

Low Power Amplifier Parts List

THORDARSON (Transformers)

- 1—T17S12 output transformer, T1

I.R.C. (Resistors)

- 1—100,000 ohm, 1 watt resistor, BT1, R_1
 1—200 ohm, 5 watt resistor, R_2
 1—20,000 ohm, 2 watt resistor, BT2, R_3

CORNELL-DUBILIER (Condensers)

- 1—10 mf., 25 V. electrolytic condenser, type BRL115— C_1
 1—8 mf., 450 V. condenser (part of filter condenser block)— C_2

AMPHENOL (Sockets)

- 1—Octal socket, type S-8

NATIONAL UNION (Tubes)

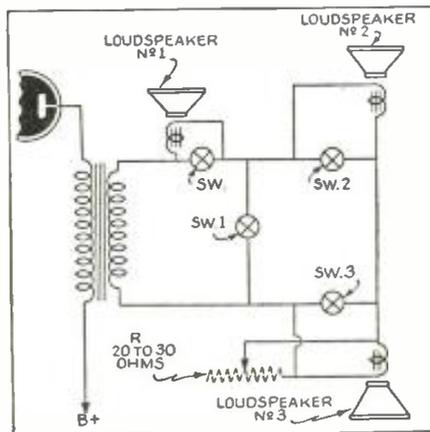
- 1—6L6-G

(To last month's parts list add the following:
 5—Meissner I.F. transformers, No. 16-8100; for 1F1, 1F2, 1F3 and discriminator transformer.)

NOTE FOLLOWING CORRECTIONS:
 R_6 , listed at 1 watt, should be 5 watt rating.
Oscillator tickler coil should be 1½ turns, and the coupling to oscillator main coil should be loose (1¼" spacing).
If the oscillator fails to oscillate, reverse the connections to the tickler coil. Tuning condenser, C_1 & C_6 , is dual Cardwell, 35 mmf. each unit.

OPERATING THREE LOUD SPEAKERS

● A SYSTEM whereby a person who owns but one radio receiver can have loud-speakers operating in three rooms is described in *Le Haut-Parleur* of France. In this circuit LS1 is the loud speaker in the receiver, while LS2 and 3 are the remote units. Switch S is placed across the voice coil of LS1 and no additional output transformers are needed. Switch S1 is connected across the line leading to the two remote units. This line connects directly to their voice coils which are in series. Switch S2 is connected across the voice coil of speaker LS2 and switch S3 across the voice coil of speaker LS3. If local volume control is desired a 20 to 30 ohm rheostat (R) may be connected across the voice coil unit. By opening any of the switches, the corresponding speaker is put into operation. When switch S1 is closed, however, both remote speakers are cut from the circuit.



Opening any switch puts the corresponding speaker into operation. Closing SW1 "kills" both remote speakers, Nos. 2 and 3.

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| W1XOJ | Paxton, Mass. | Yankee Network |
| W2XQR | New York, N. Y. | John V. L. Hogan |
| W2XOR | Carteret, N. J. | Bamberger Broad-casting Co. |
| W9XYH | Superior, Wis. | Head-of-the-Lakes Broadcasting Co. |
| W8XVB | Rochester, N. Y. | Stromberg-Carlson Co. |
| W8XAD | Rochester, N. Y. | WHEC, Inc. |
| W9XAO | Milwaukee, Wis. | Journal Co. |
| W1XSO | Avon, Conn. | Travelers Broad-cast Service Co. |
| W1XSN | Springfield, Mass. | Westinghouse |
| W3XO | Washington, D. C. | Jansky & Bailey |
| W9XEN | Chicago, Ill. | Zenith Radio Corp. |
| W8XVH | Columbus, Ohio | WBNS, Inc. |

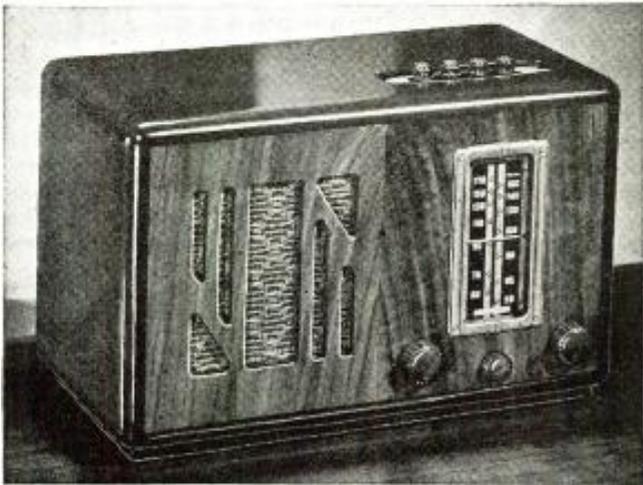
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L. M. Dezettel, W9SFW*



This 5-tube broadcast band receiver has pushbutton selection provided for your most popular stations. Dial tuning is also available for selecting the in-between stations.

6A8G tube is used as a pentagrid converter. Note that a single turn of wire, coupled to the hot end of the oscillator grid coil acts as the oscillator grid condenser. A 6K7 tube is used as IF amplifier in the conventional manner. Further economy is accomplished through the use of a cathode resistor and its by-pass condenser common to both the 6K7 and 6A8G tubes. AVC voltage produced in the diode circuit of the 6Q7G tube is impressed upon both the 6A8G and 6K7 grids. The hi-gain triode amplifier of the 6Q7G tube is resistance coupled to the 25L6G beam power output tube. Flat frequency response is accomplished in the output circuit by inverse feed-back introduced through by-passing the cathode to plate instead of to ground.

GREATER mechanical simplicity and increased manufacturing production now have made it possible for the home tinker to construct a modern push-button automatic tuning superhet receiver at a surprisingly low price. This article describes the construction of a high quality receiver which can be purchased in kit form at a nominal cost.

The automatic push-button tuning mechanism is of the simplified, cam-acting type—positive in operation and easy to adjust. Among the features which permit the construction of this receiver at such a low price is the use of high voltage heater type tubes wired in series. This permits the use of a small and economical plate transformer not required to furnish heater voltage. All of the features of higher priced superhet receivers are retained such as sensitivity, selectivity, tone control, manual and automatic volume controls, diode detection, and beam power output. It has a professional, finished appearance, especially when used with the cabinet recommended.

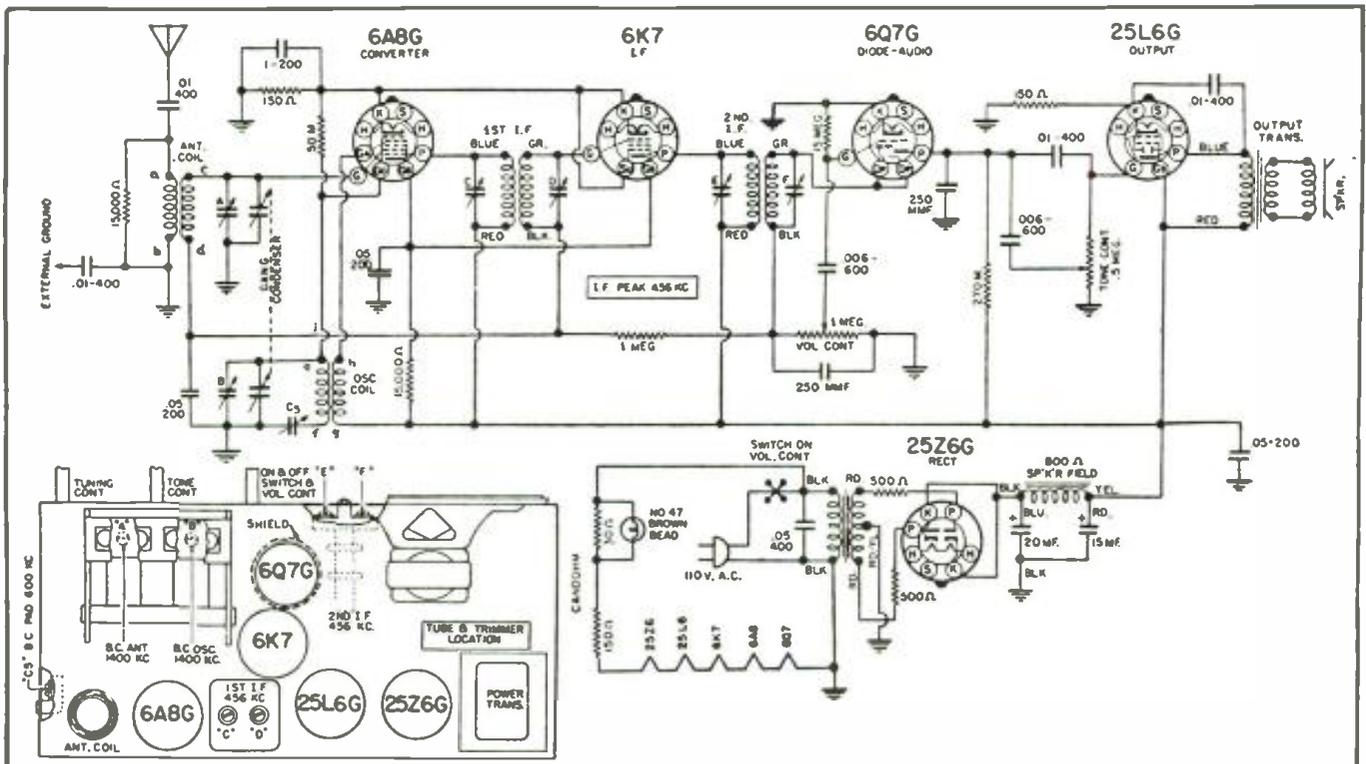
As indicated by the circuit diagram, a

New Type Dial

A new type dial scale is used for tuning, employing a horizontal bar which moves up and down on the scale for frequency identification. The tuning range includes the regular broadcast and 199 meter police bands. All controls are grouped conveniently on the front, just below the tuning scale. Four automatic tuning push buttons are located at the top for ease in operation. The speaker is of the electro-dynamic type, with

*Engineer—Allied Radio Corp.

Wiring diagram for the 5-tube receiver. Also top view layout plan.



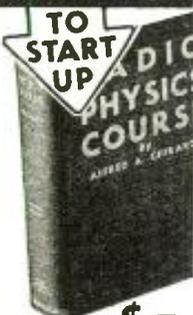


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its field coil used as filter choke. Parts layout is engineered to provide short direct leads.

A punched and drilled chassis can be obtained, making it unnecessary to use any other tool but a screwdriver, pliers, and a soldering iron.

The pictorial diagram shows exact placement of parts. Be sure that sockets are mounted with the guide pin slots pointing in the direction indicated. This diagram is an under-chassis view and socket connections are considered as viewed from the bottom. In assembling the parts, bolt the speaker and tuning dial on last, to prevent damage or scratching.

Wiring

Wiring should follow the usual practice of making short, direct leads. Wire the filaments and power supply portion first; then the fixed condensers, resistors, and potentiometers. All these wires should be kept as close to the chassis as possible. Finally wire the R.F. leads which are those connecting the trimmers and all coils. All of these wires should be kept spaced as far as possible from each other to prevent excessive coupling.

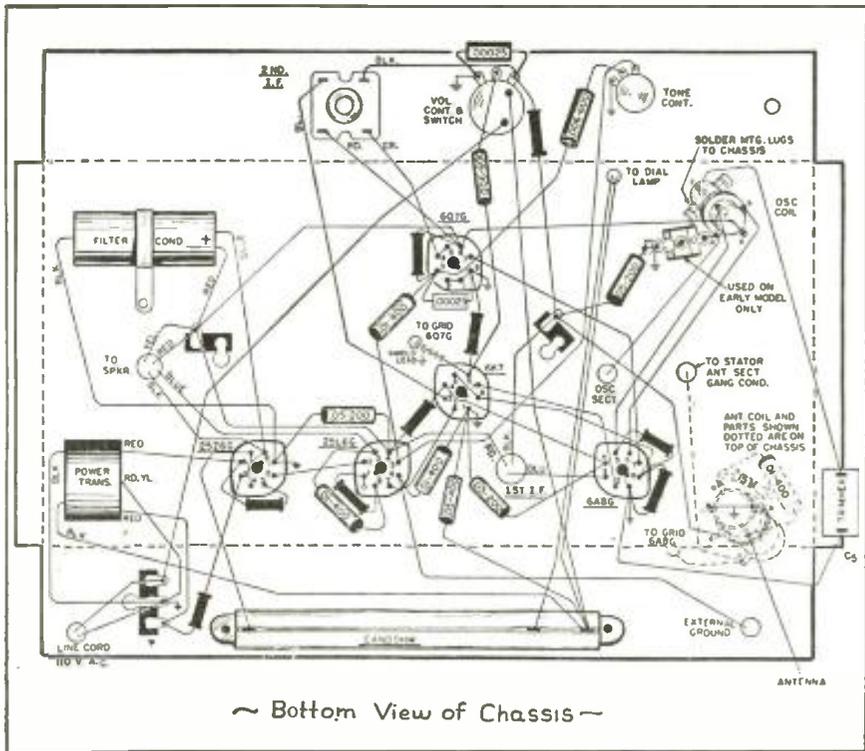
Now for the alignment. Plug the power cord into a 105-125 volt A.C. outlet and turn the left hand knob, which is the volume control, all the way to the right. This also turns on the power. Wait about 30 seconds for the tubes to warm up. A dull red glow should be seen through the tops of the tubes. Tune the condenser manually with the right

hand knob to a station at the high frequency end (about 1400 k.c.) of the dial. Adjust the R.F. parallel trimmer condenser (A) until the station is loudest (this trimmer is reached from under the chassis and is located adjacent to the oscillator coil.) Now tune in a station at the low frequency end (about 600 k.c.) and adjust the series padder (C5) located on the extreme right of the chassis, at the same time rocking the condenser back and forth until the signal is loudest. Now go back to the high end again and check for calibration. If the dial setting reads higher than the actual frequency of the station being received, turn the oscillator trimmer (B) (also reached from under the chassis and located to the left of the R.F. trimmer) slightly to the left. Then again readjust the R.F. trimmer for maximum signal strength. If the dial reading is lower, turn the oscillator trimmer slightly to the right.

I.F. Coils

I.F. coils are usually supplied factory-adjusted, but it may be necessary to re-align them. This is a simple matter and can be done quickly by tuning in a weak signal until it is received loudest. Adjust the two trimmers, reached through the holes in the I.F. coil can which is on top of the chassis, for loudest response. Next adjust the trimmers on the I.F. coil mounted beneath the chassis. These are reached from the front of the chassis, just to the left of the volume control. Incidentally all adjustment can be done by tuning in a station that is com-

Looking at the bottom of the chassis.



~ Bottom View of Chassis ~

F.C.C. Gives F.M. Green Light

paratively weak and requires full volume control setting to be heard.

Adjust the automatic tuning push buttons after the set is installed in a cabinet. If a cabinet is not used, adjustment is made in the same way, however. All adjustments are made from the top of the cabinet without the use of tools.

To make these adjustments, turn each push-button knob to the left about one complete turn. The knobs are knurled to provide a positive grip for this purpose.

With the knobs turned free, tune to any desired station with the manual tuning control. Depress one of the push-button knobs, selected to tune this station, as far as possible and turn to the right to tighten adjustment. Meanwhile, hold the manual tuning control in position to the station tuned. Be sure the push-button knob is held down in position while it is tightened.

After the stations are adjusted for each of the buttons, it is advisable to check each button to make sure it is tight. To assure accurate adjustment, the volume control should be set at a moderate level and the station tuned in slowly to a point of maximum volume and clarity.

It is not necessary to follow any particular sequence of stations since each button is adjustable to any station. With each button definitely set, and securely tightened to the selected stations, the tuner is ready for operation.

With the set turned on to a moderate level of volume, the automatic tuner is operated by merely pressing a button set to the desired station. Station selection may be made automatically or manually at will since the manual tuning control operates free and independent of the automatic unit.

Station call letter tabs should be inserted in the top of the push buttons using designations corresponding to the station selected for each button. Celluloid discs should be inserted in the knob to cover and protect the call letter tab.

Parts List for 5-Tube Super

- 1—Dual 370 mmf. tuning condenser with cam-acting push buttons
 - 4—.01 mf. 400 volt condensers
 - 3—.05 mf. 200 volt condensers
 - 1—.05 mf. 400 volt condensers
 - 1—.1 mf. 200 volt condensers
 - 1—300-600 mmf. mica padder condenser
 - 2—.006 mf. 600 volt condensers
 - 2—250 mmf. mica condensers
 - 1—15 & 20 mf. electrolytic, 200 volt
 - 2—15,000 ohm 1/2 watt resistors
 - 2—150 ohm 1/2 watt resistors
 - 1—50,000 ohm 1/2 watt resistor
 - 1—1 megohm 1/2 watt resistor
 - 1—15 megohm 1/2 watt resistor
 - 2—500 ohm 1/2 watt resistors
 - 1—150 and 30 ohm, 15 watt flat resistor
 - 1—Antenna coil, covering broadcast band with 370 mmf. variable condenser
 - 1—Oscillator coil, covering broadcast band with 370 mmf. variable condenser and 300-600 mmfd. series padder
 - 1—Input I.F. transformer, 456 kc.
 - 1—Output I.F. transformer, 456 kc.
 - 1—5" electro-dynamic speaker with transformer to match 25L6G, 800 ohm field
 - 5—Octal sockets
 - 1—Pilot lite bayonet socket
 - 1—Power transformer with one secondary for plate supply only, 500 volt A.C. C.T.
 - 1—1 megohm volume control with power switch
 - 1—.5 megohm tone control
- MISCELLANEOUS:—Knobs, Hardware, Dial Scale, Grid Clips, Tube Shield, Chassis, Cabinet.

TUBES

- 1—6A8G
- 1—6K7
- 1—6Q7G
- 1—25L6G
- 1—25Z6G
- 1—6-8 volt, .15 amp. pilot lite.

● **ORIGINALLY** established to bring order out of chaos the Federal Communications Commission brought the latter to television when giving the *go-ahead* signal to frequency modulation. The Commission in its wisdom decided that F.M. on a commercial basis is desirable in the public interest and assigned the frequency band from 42 to 50 mc. to provide 40 channels, each 200 kc. wide. Thirty-five of these will be devoted to regular broadcast stations and 5 to non-commercial educational broadcast stations.

The commission points out that the new service will not generally supplant standard broadcasting stations and therefore will not obsolete receivers now in use. It was unanimously decided that F.M. is better than A.M. for use on frequencies above 25 mc. and that the use of wide bands permits greater noise reduction. It is also said that such bands will permit *facsimile* transmission on the same channel.

This new arrangement has caused television to be booted off the 44 to 50 mc. channel. The fact

that this is the band being used by RCA-NBC television station W2XBS in New York has caused considerable consternation, not only at the station but also among the approximately 3,000 television receiver owners receiving programs in that area. Also lost in the shuffle is the 156 to 162 mc. television channel. The scrambling, claimed necessary to afford a continuous band for F.M., also upsets various other bands.

"In considering these changes," explains the Commission, "it was necessary to weigh the particular needs and problems of the various non-Federal services as well as the Government's requirements, and to determine the permissibility of the allocation under our international undertakings; also to have regard for the future of radio operation in the services involved, from an international standpoint, so far as could be foreseen. The changes should result in improved service for all stations which are affected by the Commission's order and will fully meet the varied situations presented of a national and international character."

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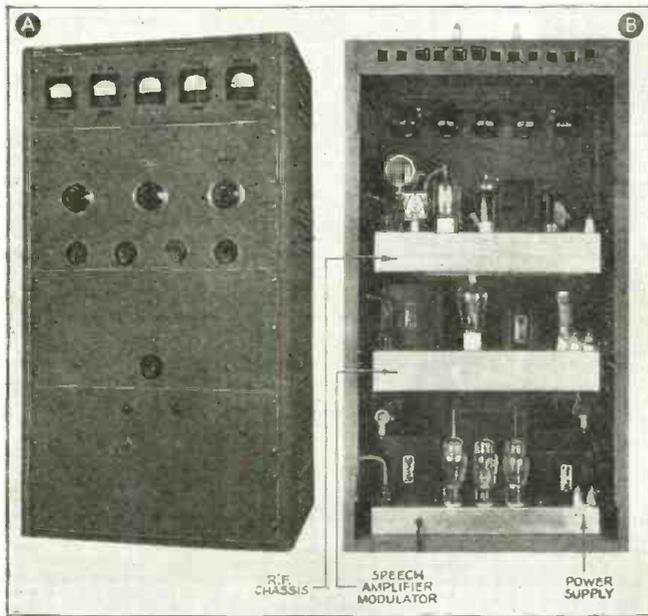
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Please Mention This Magazine When Writing Advertisers

100 Watt Phone Xmitter

C. T. Koltz, Jr., W2BKZ*, and Gene Turney, W2APT*



● **INSULATED** was the word for it! A few weeks ago a local ham friend of ours came bouncing into the shack with a four-page circular showing one of the new commercial transmitters for amateur use. He was in high spirits and just couldn't wait until daybreak, for the XYL had just okayed the necessary appropriation and our hero admitted he was through building amateur gear for life. "But why?" we asked. "Surely you are not going to forfeit all that is holy amongst us and stop building?" Yes, he was; because in the first place he had yet to see a ham rig as nice as the one illustrated in his folder and besides—think of the impression it would create upon the visiting fraternity. We thought that he might have something there, but being a bit skeptical

*Kenyon Transformer Co., Inc.

R.F. chassis is placed directly below it, with the speech amplifier-modulator and power supply positioned in that order. Two ceramic feedthrus are provided at the top rear for connection to a low impedance transmission line.

R.F. Chassis

The R.F. position of the rig consists of a 6L6 crystal oscillator which excites an RK-39, straight amplifier or frequency doubler depending on the crystal and output frequencies. The output of this stage is capacity coupled to an HK-54 final stage. The unit is mounted on a 12 x 17 x 3 chassis secured to a standard 10½" panel by means of a pair of mounting brackets. Placement of parts can be readily seen from close inspection of photos. The three tuning condensers are mounted on ceramic standoff

we decided to see how really good a ham rig could be built—and the result was so gratifying it seemed only fitting that we record our 100 watt rig on paper.

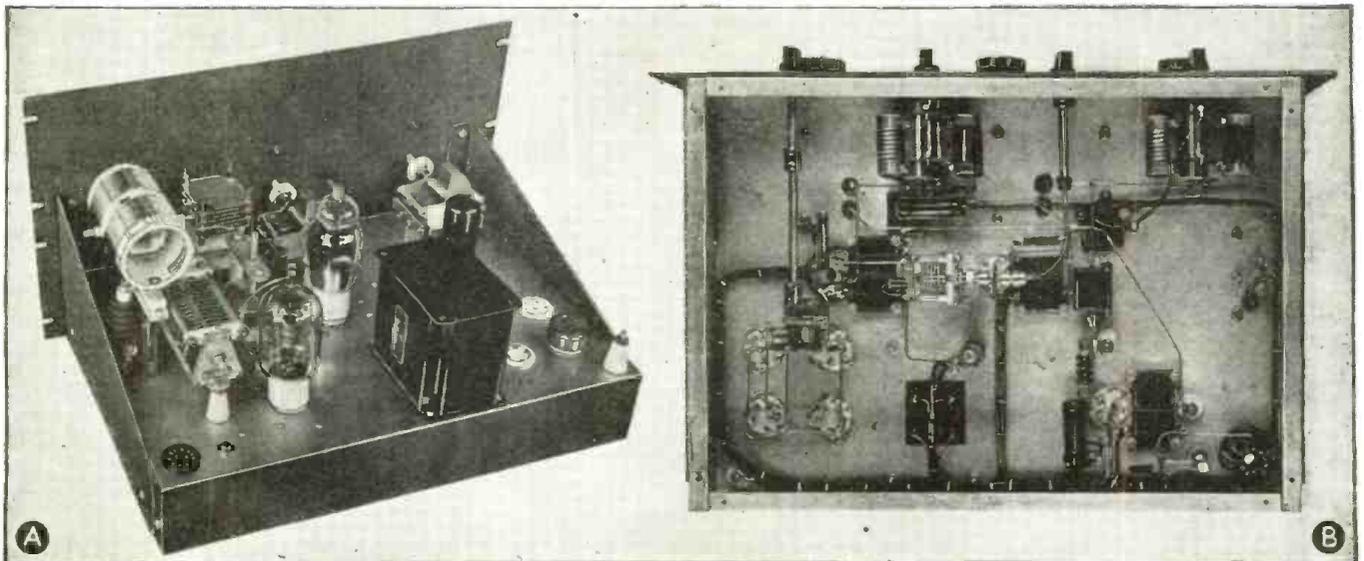
So here it is—and we think it represents all that amateurs could desire—both in appearance and performance. Yes, even to awing the brother OMs. Our rig consists of three units mounted in an enclosed 36" cabinet. As can be seen from Fig. 1, the meter panel with its five grouped instruments is placed in the top position. The

insulators even though connections to their rotor plates are made to ground. This apparent waste of good insulation is a means to an end. In the efficient operation of modern, high gain vacuum tubes short and direct ground circuits are almost as essential as the tubes themselves. Hence, the insulation of the tank condensers with their rotor connections being brought down through grommets in the chassis and made to the actual ground at the bypass condensers grouped at the socket. Fig. 4 clearly shows the parts placement as well as the position of the cables and ground buses. Four 5 prong sockets are provided for as many crystals and are located directly back of the 6L6. A four-position rotary switch connected by a long shaft is mounted to the underside near the crystal socket. The final

The average ham, and especially the beginner, will be greatly pleased with this 100 watt transmitter as it covers all the usual bands—10, 20, 40, 80 and 160 meters. Data is included for a well-designed speech amplifier-modulator and a well-filtered power-supply. Instructions are given for tuning up the transmitter.

stage filament transformer is placed on this deck to forestall the possibility of filament voltage drop always present when long leads are used in the inter-chassis cable. As will be noted in Fig. 3, all of the final stage components except the filament bypass condensers, are grouped together on the topside of the chassis. The final tank coil is mounted

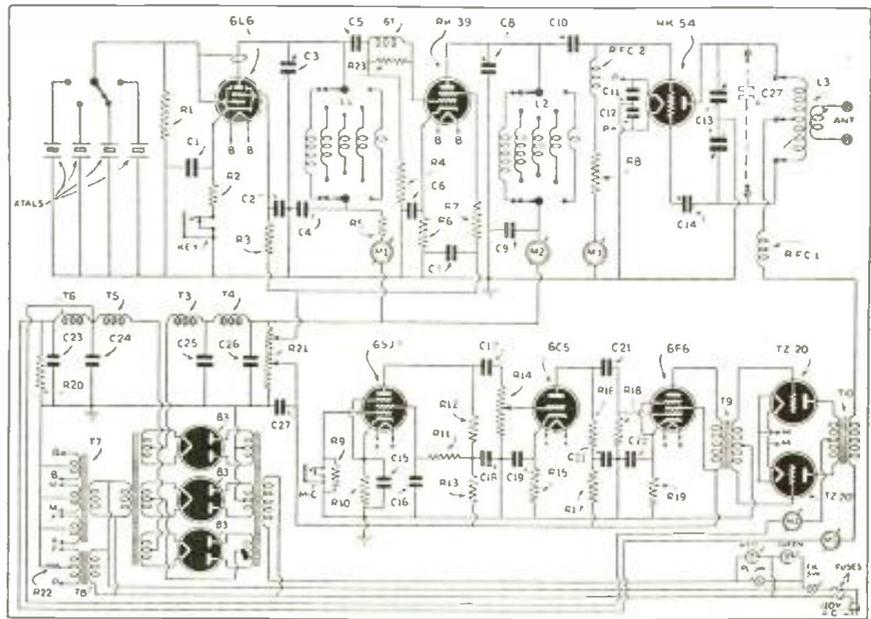
Below—rear and bottom views of the radio frequency unit.



on two polystyrene standoff insulators up close to the tuning condensers, making for short tank leads and an ideal location for the plate choke which is mounted beneath it. Directly to the right of the condenser is a fixed 75 micro-microfarad condenser which is used only for 160 meter operation. When operating on all other bands, the padder is removed. A closed circuit jack adjacent to the eleven point socket is for the insertion of a key for break-in keying of the oscillator. The oscillator and amplifier-doubler incorporate band-switching turret assemblies which simplifies immensely the rapid changing from one band to another. Variable coupling between the 6L6 and the RK-39 in the form of a small condenser, aids greatly in optimum adjustment on the highest frequencies of the ten meter band and the lowest frequencies of 160. For an arbitrary midscale setting of the capacity, overdrive to the RK-39 on 160 meters as well as insufficient drive on ten meters was evident, causing inefficient operation in both cases. An increase or decrease in capacity depending on frequency has a marked effect on proper amplifier-doubler operation. Of course, due to its loading effect on the oscillator tank circuit, the same circuit may have to be re-resonated with each adjustment of the coupling capacity. Such changes can be made from the panel front by virtue of the flexible and insulated shaft coupling between it and the condenser mounted on the underside of the chassis between the RK-39 and 6L6 sockets.

The Speech-Amplifier-Modulator

This unit is mounted on a 12 x 17 x 3 light gauge steel chassis and fastened to a standard 8 3/4 inch panel by means of side brackets. The tube line-up consists of a high gain 6SJ7 resistance coupled to a 6C5 which is also coupled similarly to a single 6F6, pentode connected. This 6F6 driver supplied sufficient signal to swing the TZ-20 modulators. The over-all gain of this unit makes it adaptable for use with any high impedance microphone, having a level no lower than 75 db. below the reference point of .006 watt. A frequency response curve was taken on the unit and showed a flat response within 2 db, from 300 to 11,000 cycles! A sharp drop beyond 300 cycles was apparent and due largely to the use of the 6F6, pentode driver tube. The selection of the tube in the design was prompted by economical reasons due to its high amplification qualities at a comparatively low plate current with a consequent saving in power equipment. A decision between economy of apparatus and loss of low frequency response went in favor of the former because no definite advantage from amateurs' angle could be gained by the inclusion of frequencies below 200 cycles, while the saving in equipment certainly presented tangible results. Layout of components is easily seen in Figs. 5 and 6. The 6SJ7 input tube can be seen close to the panel and on the right side of the chassis. The 6C5 is placed to the left of it with the 6F6 driver just back of the driver transformer. The larger transformers on the left side of the chassis are the modulation and filament transformers. The filament unit is mounted towards the panel and supplies the heaters of modulators, speech and exciter tubes. The 11 point socket at the left rear is for the inter-chassis-cable connection while the three



Wiring diagram of the complete 100-watt phone transmitter, including the speech amplifier-modulator section.

feedthrus at the right are high voltage and modulation voltage connections. It would be wise to shield both leads from the gain control in the centre of the panel. Two jacks are provided on the panel front, one for the microphone and the other for monitoring purposes.

The Power Supply

The power supply consists of a multi-winding power transformer employed with three 83 type mercury vapor rectifiers. For the higher voltages two of the rectifier outputs are connected in series. The remaining supply is for the lower voltages of the exciter and speech amplifiers. This method has not been universally employed probably because amateurs in general haven't been informed heretofore as to its many advantages. Primarily it definitely is more economical, both from the tube complement and physical size standpoint. Then, too, rectifier filament transformers decrease in numbers, physical size and price, the last item being rather important to the ham. And last, but not least, a transformer of this type has a decided universal flavor in that voltages may be increased or decreased within reason, by merely changing taps or using the method of connecting the various secondaries. It is a component which cannot become obsolete. All the power supply parts are securely bolted to a 12 x 17 x 2 heavy duty, steel chassis. A standard 10 1/2" panel is fastened by means of side brackets and mounts both the filament and plate switch with their associated pilot lights. Both supply bleeders are secured by the supporting clips to convenient mounting holes above deck as can be seen in Fig. 8. The transformer position of the inter-chassis-cable and high voltage connections are also apparent from the same photograph. The completed chassis is carefully wired and cabled with a strong waxed cord presenting a neat and commercial looking unit as evidenced by a view of the underside in Fig. 7. It is suggested that all leads to the various components be brought out of the cable in a small loop. This makes for easier removal of each part in case of possible difficulty.

Tuning

In view of the simplicity of design and layout, tuning is a relatively easy matter. Assuming that all tubes and crystal or crystals are in their proper places, selection of the desired crystal, oscillator and amplifier-doubler plate coils is made by means of the selector switches found on the lower part of the R.F. panel. In other words for 20 meter operation, the crystal selector could be set with 40 meter quartz plate and the oscillator plate tank at the same band with the RK-39 stage using a 40 meter coil. Or, by the flip of a hand, a 20 meter crystal could be employed for *straight-through* operation. This latter method is not recommended due to the ease with which beam type tubes have a tendency to go off into self-oscillation. It has been found much more advantageous to always try to operate this stage as a *doubler*. Of course, this is quite impossible in the 160 meter band. The variable coupling or excitation control can be set arbitrarily at midscale for early adjustments. The operator soon learns from experience its proper setting for each different band. Obviously, less capacity will be required on the lower frequencies than on the higher ones, due to the presence of higher driving power available from the oscillator with lower frequency crystals. Power is now applied to the exciter stages, each being resonated at its fundamental or harmonic frequency, depending on the particular setup. This resonance is indicated by a dip in plate current of the stage under adjustment and a rise in current of the stage ahead of it. Initial adjustment should be made with the final stage B plus voltage disconnected at the feedthru insulator. With the filaments heated, final tank coil in its correct position and an indication of grid current, neutralization of this stage should be attempted. It is suggested that neutralization be accomplished on the highest frequency of normal operation for best results. Final plate voltage can now be applied and the stage resonated and loaded with an antenna. For 160 meter operation it will be necessary to use a 75 micro-microfarad fixed

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padder condenser, in conjunction with an 80 meter coil, which plugs into a ceramic holder mounted adjacent to the tuning condenser. Coupling in the final stage coil can be increased or decreased by altering the position of the rotating link coil provided in all P.A. tank coils. The oscillator plate current under normal operation should be between 20 and 40 ma. depending on frequency. The RK-39 current is approximately 60-80 ma. with P.A. grid and plate currents of the order of 25 ma. and 125 ma., respectively. Modulator plate current should swing to approximately 120 ma. to fully modulate the carrier. When all stages are properly tuned, it would be wise to recheck the voltages supplied by the variable taps on bleeder R-21 and final adjustment made, based on results found there.

I.R.C.

| | | ohm | | |
|------|---------|--------|------|------|
| R1 | | 100M | 1/2 | Watt |
| *R2 | 507-397 | 200 | 10 | Watt |
| R3 | 507-412 | 10M | 10 | Watt |
| R4 | | 50M | 2 | Watt |
| *R5 | 507-436 | 5000 | 20 | Watt |
| R6 | 507-334 | 500 | 10 | Watt |
| R7 | | 100 | 1/2 | Watt |
| *R8 | 507-339 | 2500 | 10 | Watt |
| R9 | | 3 Meg. | 1/2 | Watt |
| R10 | | 1000 | 1/2 | Watt |
| R11 | | 1 Meg. | 1/2 | Watt |
| R12 | | 250M | 1/2 | Watt |
| R13 | | 50M | 1/2 | Watt |
| R14 | 13-133 | 500M | Pot. | Watt |
| R15 | | 3000 | 1/2 | Watt |
| R16 | | 50M | 1/2 | Watt |
| R17 | | 10M | 1/2 | Watt |
| R18 | | 250M | 1/2 | Watt |
| R19 | | 500 | 2 | Watt |
| *R20 | 507-459 | 35000 | 50 | Watt |
| R21 | 507-748 | 20M | 100 | Watt |
| R22 | 507-423 | 200 | 20 | Watt |
| R23 | | 300 | 1/2 | Watt |

*—Ward Leonard

Parts List for 100-Watt Transmitter

CORNELL-DUBILIER

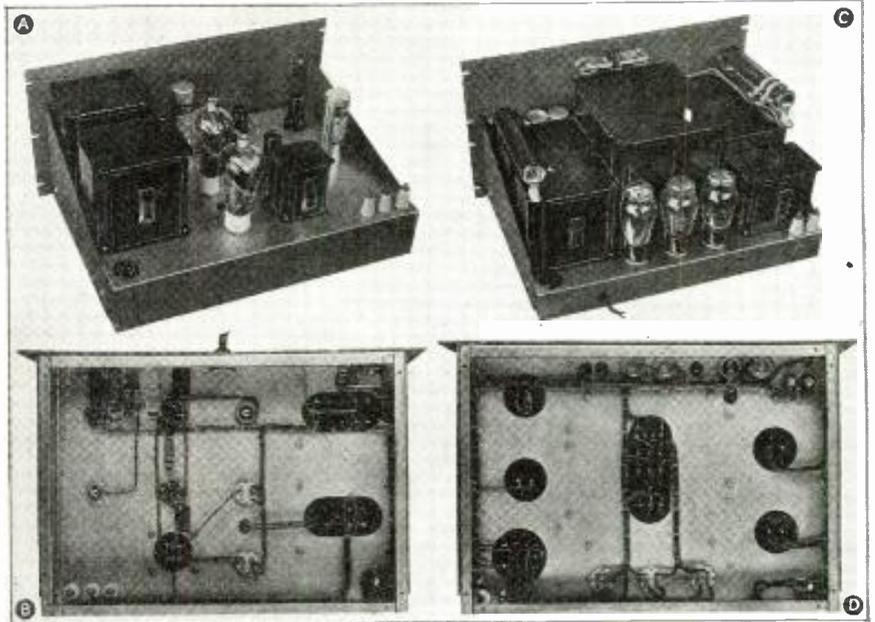
| | | | | |
|-----|-----------|-------|------|-----|
| C1 | | 4-6D2 | .002 | Mf. |
| C2 | | 4-6D2 | .002 | Mf. |
| *C3 | MR 150 BS | 4-6D2 | .002 | Mf. |
| C4 | | 4-6D2 | .002 | Mf. |
| *C5 | ZR 50 AS | 4-6D2 | .002 | Mf. |
| C6 | | 4-6D2 | .002 | Mf. |

KENYON

| | | | |
|----|-------|-----|-------|
| T1 | T-659 | T6 | T-168 |
| T2 | T-355 | T7 | T-371 |
| T3 | T-166 | T8 | T-380 |
| T4 | T-166 | T9 | T-254 |
| T5 | T-514 | T10 | T-469 |

BROWNING

L1—5-PL Bandswitch
L2—5-PL Bandswitch



Above, at left, rear and bottom views of the speech amplifier. Right—rear and bottom views of the well-filtered power-supply unit.

| | | | | |
|-------|-----------|-------------|-------|-----|
| C7 | MR 150 BS | 4-6D2 | .002 | Mf. |
| *C8 | | 4-12D2 | .002 | Mf. |
| C9 | | 4-12T1 | .0001 | Mf. |
| C10 | | 4-6D2 | .002 | Mf. |
| C11 | | 4-6D2 | .002 | Mf. |
| C12 | | 4-6D2 | .002 | Mf. |
| **C13 | 100FD30 | | | |
| *C14 | ADN | Neut. Cond. | | |
| C15 | | BR102AS | 10 | Mf. |
| C16 | | DT4P1 | .1 | Mf. |
| C17 | | DT6S1 | .01 | Mf. |
| C18 | | EP9080 | 8 | Mf. |
| C19 | | BR102AS | 10 | Mf. |
| C20 | | DT6S1 | .01 | Mf. |
| C21 | | EP9080 | 8 | Mf. |
| C22 | | BR102AS | 10 | Mf. |
| C23 | (2) | TLA 10010 | 1 | Mf. |
| C24 | | TLA 10020 | 2 | Mf. |
| C25 | | TLA 6040 | 4 | Mf. |
| C26 | | TLA 6040 | 4 | Mf. |

*C27 JD800S (for 160 meter band only)

JOHNSON

| | | |
|-----------|-----|----------------|
| L3—"Hi-Q" | 669 | Mounting Base |
| | 660 | 10 meter band |
| | 661 | 20 meter band |
| | 662 | 40 meter band |
| | 663 | 80 meter band |
| | 664 | 160 meter band |

RFC2—750 Choke

*—Cardwell

**—Johnson

TRIPLETT

| | | |
|---------|-----------|-------|
| M1—227A | 0-100 Ma. | Meter |
| M2—227A | 0-150 Ma. | Meter |
| M3—227A | 0-50 Ma. | Meter |
| M4—227A | 0-200 Ma. | Meter |
| M5—227A | 0-300 Ma. | Meter |

BUD

RFC1—CH569 Choke

AMPHENOL

| | |
|----------------|-------------------|
| 1—SS8 socket | 1—DL-3513 Cabinet |
| 5—SS5 sockets | 1—MG-52 Panel |
| 4—SS4 sockets | 2—G-3605 Panels |
| 3—S11 sockets | 1—G-3604 Panel |
| 2—S4 sockets | 1—C-4516 Chassis |
| 3—S8 sockets | 2—C-4517 Chassis |
| 3—PM11 sockets | 3—SB711 Brackets |

BUD

| | |
|------------------------------|------------------|
| 7—436 Feedthru Insul. | 1—6L6 |
| 3—FC795 Couplings | 1—RK39 |
| 2—JL1695F Pilot Lights | 3—83 |
| 2—SW1115 | 1—6F6 |
| 3—J1325 Clsd. Ckt. Jacks | 1—6C5 |
| 2—TC490 Tube Caps | 1—6SJ7 |
| 1—4 Pos. Isol. Rotary Switch | |
| 3—D1732 Dials | HEINTZ & KAUFMAN |
| 8—Indicator Plates | 1—HK54 |
| 2—Dial Plates | TAYLOR |
| | 2—TZ20 |

Learning The CODE Made Easy

John T. Frye, W9EGV

● I AM sick and tired of listening to you fellows who whimper, "I'd like to be a ham, but I just can't learn the code. I think that the government is an old meany for asking me to learn the code before giving me a license."

Get this straight: No one but yourself cares a hoot whether you become a ham or not. A radio amateur license is a privilege accorded to those who earn it; and it is not, as some of you think, something that the government owes you and refuses to pay. The amateur bands are a little too crowded for comfort anyway; so if you insist on continuing to yell and wring your hands, that is just dandy. It will mean that much more room for the rest of us. If you had put half the energy you wasted trying to get around learning the code into actually learning it, your ticket would have been adorning the walls these many months.

If that shoe fits, wear it. If, however, you cannot coax your little eleven into the leather, stop your crying a minute and think this over: In order to secure your license, you have only to learn the dot and dash combinations for twenty-six letters, ten numerals, and about ten other marks of punctuation and operating signals. In all, there are less than fifty combinations that must be mastered before you secure your license. Fifty little memory exercises standing between you and your ticket! Why, the average flaming youth has that many telephone numbers on the tip of his tongue. If you let a little thing like learning the code stop you, you would never make a ham anyway. The first time your crystal oscillator refused to perk, or a parasitic oscillation developed in your amplifier, you would be through.

Now, if you are not lower than a moron in intelligence, if you are not bluffing about wanting to be a ham, and if you are willing to make a small investment of effort in order to secure a large return in enjoyment, I can tell you how to learn the code in a few hours. Note, though, that I do not say that I can teach you the code. I say, using my words advisedly, that I can tell you how to learn the code. The final success or failure of the attempt is strictly up to you.

Many books suggest that you learn the letters in some particular order, such as alphabetically, the dot letters together and the dash letters together, etc. This is wrong, in my opinion. Anyone who advises you to learn the code in this manner does not have a clear conception of what kind of a process learning the code really is. He considers it a remembering process in which the mnemonic device of association of ideas is a help. An illustration of this device is the association of a man's name, Brown, with colors. In trying to recall the name, one first remembers that it is associated with colors and then quickly selects Brown as the required name.

In recalling ideas that are seldom used and which one has plenty of time to consider, this device is an excellent aid to the memory; but it is of little use in learning the code because that process carries beyond the region of memory into the borderland of conditioned reflex. When first learned, the copying of a letter consists of three steps: hearing "dit-dit-dit" in the

earphones, reasoning that this sound represents s, and writing the letter s. Mastering the code is simply the eliminating of the second step. As soon as the ear hears "dit-dit-dit," the hand must start writing s; and the thinking mind must not be called upon to play any part in this process. Copying code must be as divorced from thinking as is eating or whistling; and it should be

VITAL AIDS FOR LEARNING CODE!

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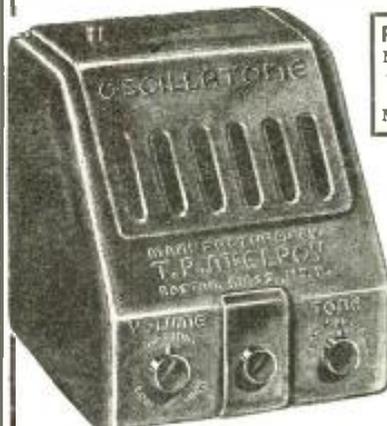
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learned in such a manner as to make the association between sound and letter purely automatic, depending not at all upon memory or memory aids.

Now that you know what we are trying to do, let's do it!

First, cut out fifty little slips of cardboard or heavy paper and print a letter, numeral, or operating signal upon one face of each. Upon the opposite side of each, write out the dot and dash equivalent of the symbol appearing on the face, using the word "dah" to represent the dash and the word "dit" to represent the dot. For example, the card that has C on one side will have "dah-dit-dah-dit" on the other. Never speak or think of the letters as being represented by dots

and dashes. Always consider them as being composed of "dits" and "dahs," the nearest phonetic equivalents to the sounds these symbols have when heard over the air.

Next, lie yourself down in the cellar, out in the orchard, up in the haymow, or to any other place where you can have sufficient privacy to be able to talk to yourself without raising questions concerning your sanity. Arrange the cards with the "dit-dah" sides up and shuffle them. Take the top card; examine both sides of it; then say aloud the inscription on the top while you write the letter on the bottom. For instance, if the top card should be that of K, say "dah-dit-dah" and at the same time write "K." In saying the inscription, pronounce it just as rapidly as you can and still keep the separate syllables distinct. Do not leave long, uneven spaces between the "dits" and "dahs" but try to say the combination as a complete, well-articulated unit. Repeat this process ten times; then do the same thing with the next card and the next through the entire pack. After you have gone through the entire deck, reshuffle it and start over. Keep this up, making no attempt to remember which combination belongs with what letter, until you are tired; then call it a day!

Each day devote an hour or so to this practice. At the end of the third or fourth day, you should find yourself starting to write the letter that belongs with a particular combination as soon as you read the combination aloud and before you have turned the card over. When this occurs, really try to write the letter belonging to each combination before you look at the other side of the card. Those which you can do without the least hesitancy, lay to one side; continue to practice on those about which you are not quite sure. Every once in a while, run through the entire pack to make certain that you have not forgotten some of those that you thought you knew.

When you can go rapidly through the pack, writing each letter or numeral quick-

ly and correctly without having to think about it, you can throw away the cards and pick up the earphones. From here on, you will learn to copy by copying.

Turn your receiver to one of the amateur code bands and listen for "dah-dit-dah-dit dah-dah-dit-dah." This "CQ" will be repeated several times; then it will be followed by "dah-dit-dit dit" (de) or "dit-dit-dit-dah" (v) and the call letters of the station, very probably consisting of "W" followed by a numeral from 1 to 9 and two or three identifying letters. This call will be repeated three or four times, and then the station will start calling CQ again, only to follow this with a repetition of the call letters. This process will continue for a length of time inversely proportional to the operator's quality and will be terminated by the letter "K."

When you hear that, hunt up another CQ and see how long it takes you to figure out the call letters of the station. Keep doing this until you can get the call the very first time it is sent. When you can do this, you are ready for the next step.

After a station has called CQ and sent K, continue to listen on its frequency for a minute or so. If he has any luck, you will hear him come back on the air in a short time calling another station and signing his own call. Then the odds are slightly better than 199 to 2 that he will send the following verbatim: "-...- Tnx fer cl om -...- ur sigs RST (1-5) (1-9) (1-9) hr in (city) (state) -...- wx hr (warm, cool, cold) es (clear, cloudy) -...- QRK? QRA? -...- Then he will sign his call and sign "K."

As you can see, hams like to make things tough: they further complicate the difficulties of learning to read code by employing many weird and arbitrary abbreviations. However, these are easily mastered and can be figured out at your leisure after you have written them down. When copying, concentrate on getting each letter written down correctly and do not try to figure out words in advance. Use the same system in copying words that you employed in copying call letters in which there was no logical connections between the different numerals and letters. Under no circumstances try to copy in your head. Always use pencil and paper.

After you have become able to copy the average ham at a fair speed and have learned how the letters should really sound, you are ready to learn to send. Up until this time, you should not have touched a transmitting key, for, not knowing how sending should be spaced, you would have

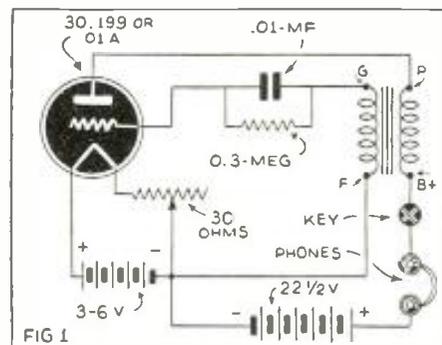


Diagram of code-practice oscillator.

learned some bad sending habits that you would now have to forget—a long and wasteful process.

The equipment that you will need to practice sending is a good key and some piece of apparatus that will produce a steady, musical note in earphones. Either a buzzer or an audio oscillator will serve this purpose. So many code practice devices have been described in detail in this magazine before that I shall not elaborate on them here, but the audio oscillator shown in Fig. 1 is a standard circuit and a dependable performer.

In learning to send, you must reverse the process you used in learning to receive. You learned to copy individual letters, but I want you to practice sending whole sentences. The reason is simple: sending is composed of spacing, spacing between the parts of a letter, spacing between letters, and spacing between words. Each of these spaces is different in length, and the sooner you learn to distinguish between them the better. In sending complete sentences, you must use all three of these spaces side by side; and this enables you to recognize their comparative lengths in a short space of time.

It is of first importance that you start by holding the key correctly. The thumb is on the left side of the key; the "pointing" finger is on the top; and its neighbor is on the right side of the key. The hold is "gentle but firm." You do not grab hold of the key as though you intended pulling it up by the roots; neither do you "slap" it. The spring is adjusted so that very little effort is required to depress the key, and this spring is permitted to do its job of raising the lever.

Sending is a "push-push" affair and not, as some seem to think, a "push-pull" business. The contacts are spaced about a sixteenth of an inch. Too close spacing will result in chattering, and too great spacing will make your sending sound as though you took the phrase "pounding brass" too literally.

Prepare some short sentences of five or six words and practice sending them. In doing this, try to imitate the mechanical sending of a machine. Pay particular attention to your spacing. Technically, a dash is equal to three dots; the space between the parts of a letter is equal to one dot; the space between letters is equal to three dots; and the space between words is equal to five dots. The practical equivalents of these things are as follows: a dot and the space between the parts of a letter are as short as they can be made; a dash is long enough that it will never be mistaken for a dot and no longer; the spaces between letters and words are sufficiently different in length to preclude any possibility of one being mistaken for the other. Learn to send each letter as a single, compact unit. Vary your sending speed by lengthening the space between letters, but always send each letter in the same manner and at the same speed.

Do not practice until your arm becomes tired and starts to perform erratically. As soon as you feel your arm and wrist muscles begin to tighten up, stop practicing! You will find that the use of a wrist movement in sending will be less tiresome than if the entire forearm is used.



"Honor" Plaque Awarded

For Best HAM Station Photo

To Theresa Pessoney W5GXT

- TWO "rigs" are employed in the shack.

The large rig to the right is a Gross CB55, which is used exclusively on 10 meter phone, with a power input of 80 watts. The tube lineup of this rig is as follows: 42 crystal oscillator, a 6L6 buffer-doubler, and two T20's in the final. The modulator consists of 6C5, 6N7, 6C5s and 6L6s. Type 83 tubes are used in the power supplies. Break-in is used, and an antenna change-over relay switches the antenna, which is a

Mimms Signal Squirrel, from transmitter to receiver. Mike is an Astatic D 104.

The receiver is a Hallicrafter Super Sky-rider SX17. To the left is a DB20.

(MISS) THERESA PESSONEY, W5GXT,
411 So. Sycamore Street,
Palestine, Texas.

(Miss Pessoney is the only woman in Texas to become a member of the Army Amateur Net.)

Here is the new "Award of Honor" Plaque which measures 5" x 7" in size. It is handsomely executed in colors on metal, and is framed, ready to hang on the wall. The name of the winner will be suitably inscribed.

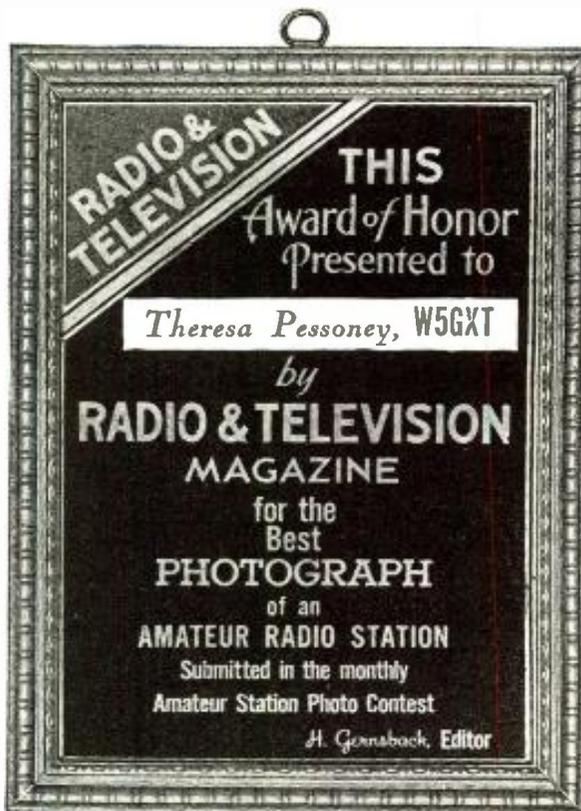
Note These Important Rules

Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name of receiver.

State briefly the number of continents worked, the total number of stations logged or contacted, and other features of general interest. Mention the type of aerial system and what type of break-in relay system, if any.

Important—Enclose a good photograph of yourself, if your likeness does not appear in the picture!

You do not have to be a reader of RADIO & TELEVISION in order to enter the contest. Address all photos and station descriptions to Editor, Ham Station Photo Contest, c/o RADIO & TELEVISION, 20 Vesey Street, New York, N. Y.

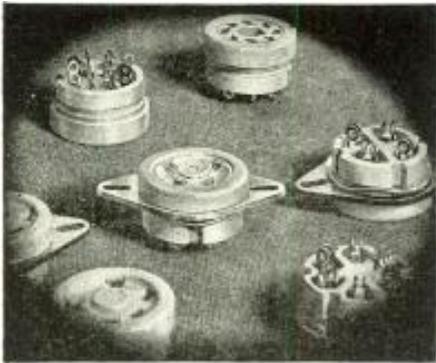


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Fourth Article on New York World Fair Amateur Station

Arthur H. Lynch, W2DKJ*



DESIGNED for APPLICATION

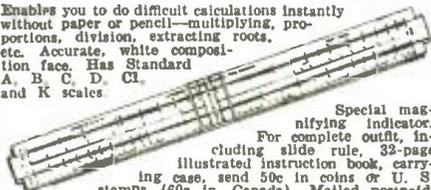
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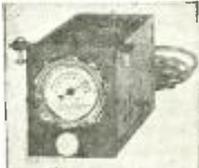
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● PICTURES 1 and 2 are of the installation owned and operated by Dorothy Hall, W2IXY. It is doubtful if there is any amateur station in the world which is better known. You may remember that Dorothy was very active in securing assistance for the inhabitants of Pitcairn Island during the time they had a typhoid epidemic, or were supposed to have had one. Essential details in connection with Dorothy's station are as follows:—

She has verified two-way phone contacts with 103 different foreign countries. She has worked 33 zones—there are only 34—and she is the only woman member of the A.R.R.L. Century Club. On two-way phone she has worked all Continents and worked every State in the Union. Dorothy is the only woman member of the W.A.C. and W.B.E. Clubs. On two-way phone she is also a member of the A-1 Operators Club, as well as being the first woman to work KC4USA and KC4USC of the Byrd Antarctic Expedition. She has 27 complete sets of Worked-All-Continents QSL cards, and has held a class "A" operator's license since Nov. 4th, 1936. She kept schedules with VR6AY Pitcairn Island for 270 days, during which time she only missed two contacts, and she has worked HK5AR in Cali, Colombia, every day for two years, and VU2CQ at Bombay, India every day during the past three winters! She has worked OX2QY, the MacGregor Expedition at the North Pole on October 5th, 1937, taking a message from one of the men on the expedition, and on April 8th, 1940 she did the same thing for the same man, who was then a member of the Byrd Expedition at KC4USA, Little America (South Pole).

The antenna suspended between the two steel towers is a Lazy-H array, composing four half-waves in phase. The small antenna in the background is a single element rotary beam for 10 meter operation, while the horizontal single element unit in the foreground is a rotary beam used for 20 meter operation.

Strange as it may seem, this 20 meter horizontal antenna was used during the recent ARRL DX Contest to work XUSAM, Shanghai; KA4LH in the Philippines; PK4LZ, Java; K7GFC, Alaska; K6NYD, Hawaii; KF6JEC, Canton Islands, South Seas; K6NYD operating portable as KE6 at Puka Pinnacle Reef in the Mid-Pacific; CP2AC at Bolivia; YS1MS in Salvador; ZP6AB in Paraguay; when it was impossible to raise any of those stations using the large four-element beam.

The transmitter shown to the left of the photograph (interior), is a one kw. outfit designed and built especially for W2IXY by the Erco Radio Laboratories of Hempstead, Long Island, and the receiver is a National HRO. The monkey shown in the photograph is the station mascot and does everything but talk and throw the switches. W2IXY is located at Springfield, Long Island, New York. Dorothy Hall is the 2nd district chairman of the "YLRL" (Young Ladies' Radio League) which is affiliated with the A.R.R.L. It is a newly formed organization of amateur lady operators, which has made very rapid progress.

Picture 3 is Viola Grossman, W2JZX. Hers is indeed a radio family since her husband, Samuel J. Grossman is W2JJD, and her 16 year old son, Kenneth J. Grossman is W2LJJ. "Vi," as she is known on the air, was an official phone station and an official broadcasting station for the A.R.R.L. She won the All-Season cup for official phone station activity for 1939. She is a member of the Second Corp Area of the Army Amateur Radio System and was staff artist for the Second Corp Area Radio Amateur Bulletin, called the "Scarab." Only

*Managing Director, W2USA Radio Club.

a short time ago she was Emergency Co-ordinator for Nassau County and Chairman of Communications for the American Red Cross Disaster Committee for Nassau County. During the hurricane which struck Long Island last year, she and her son Kenneth were active at Bayshore and Fire Island, where they remained at the Police Barracks for five days. For this work, her name was nominated for the 1939 Paley Award by the radio editor of the Brooklyn Daily Eagle, and the Second Corp Area AARS.

Sam Grossman operates an official phone station on 75 meter phone, and Kenneth Grossman is active on 2½ meters. "Vi" operates a 250 watt rig, built for her by Byron Kretzman, W2JTP, while the receiver is a Hammarlund HQ-120-X. W2JZX is located at East Rockaway, Long Island.

Photographs 4, 5 and 6 show the transmitter, operating position and the four-element, 10-meter rotary array at W1KTF, the de luxe station owned and operated by Dave Kendall at Stamford, Conn. The two de luxe racks shown in photograph 4 house the one kw. radio frequency unit with its power supplies, in the cabinet to the right, while the left-hand cabinet contains the modulator and all of its power equipment.

In addition to re-transmitting messages and QSTs from W2USA on the 160 meter band, W1KTF is extremely active on the 5 meter band with stations up to 2500 miles distant. The 5 meter converter designed by Frank Lester is shown immediately before Dave at the operating position, and it is used in conjunction with an R.M.E. 69 receiver.

Immediately above the peak of the house is the very business-like looking 10-meter array at WK1TF, while to the right, atop the thin pole, may be seen the 5 meter double-extended zepp, which has been used to excellent advantage at this station.

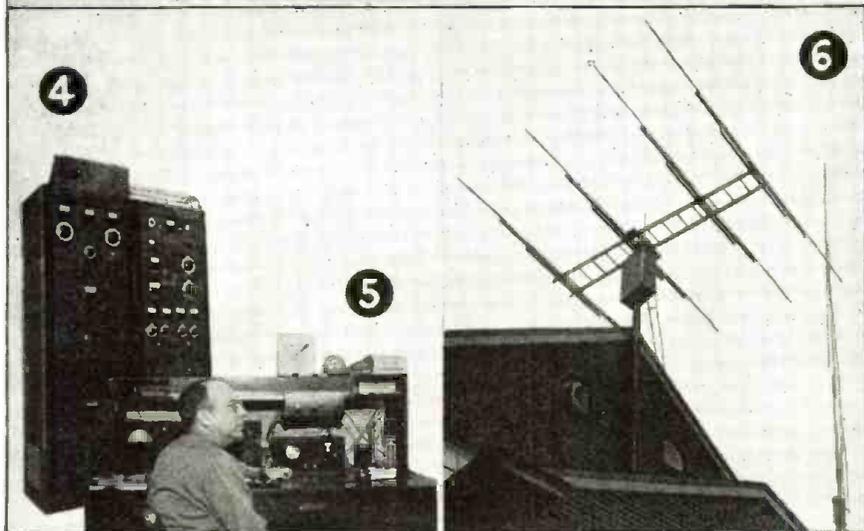
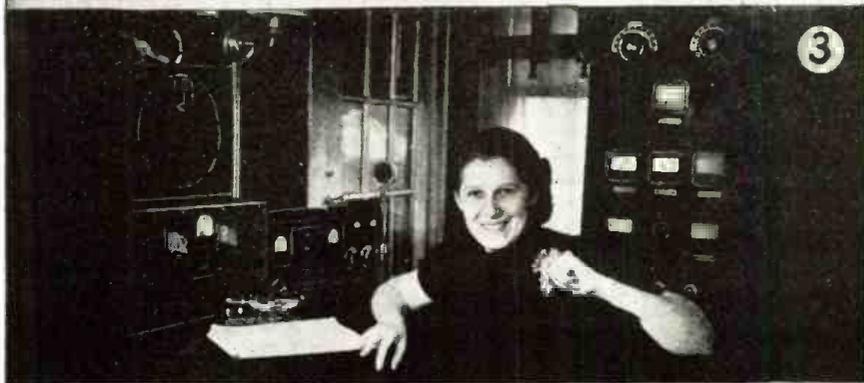
Picture 7—It is doubtful that any 5 meter station anywhere in the world is better known than W2AMJ, owned and operated by Frank Lester, and located at Bergenfield, N. J. Frank uses a pair of HK-54s in his final, running 350 watt input. For receiving he uses one of the famous Lafayette converters, which he designed, in conjunction with a Hallcraft SX-25.

W2AMJ was the first station in the New York area to contact W4EDD at Coral Gables, Florida, on 5 meters, and this extraordinary feat has been accomplished three years in a row. Operating on 5 meters, this station has worked 25 different states. It may be remembered that Frank Lester is the man who has popularized the double-extended zepp antenna for 5-meter operation.

Picture 8—Station W2AV is owned and operated by Mr. John Iines, who is one of the active members of the now famous Garden City Radio Club. W2AV is also a member of the A.R.R.L. Century Club.

He has lived in Garden City for about a year and a half, and most of the more than 100 different foreign countries that he has worked have been contacted during that time. The transmitter is a one kw. job and he uses a National HRO for receiving. The one surprising feature of the installation at W2AV is the fact that very small and very low antennas are used. Actually they are the two half-wave doublets 30 feet high, and set up at right-angles to each other, so as to cover all directions.

Picture 9—Dr. Lawrence J. Dunn is a member of the Garden City Radio Club, former Director of the Hudson Division of the A.R.R.L., Major in the U. S. Army, former Chief Signal Officer of the U. S. Army, and holder of transport pilot's license and an active member of the Army Amateur Radio System. Some of the equipment shown in



1 and 2—Dorothy Hall, W2IXY; 3—Viola Grossman, W2JZX; 4, 5 and 6—Dave Kendall and his station, WIKTF.

the accompanying photograph has been replaced by more elaborate and modern equipment and a separate transmitter is used for each of the bands on which the station operates. For 20 meters, for instance, an Erco one kw. transmitter is employed and a National HRO receiver is used for receiving on all of the low frequency bands, while a Hallicrafter 5-10 is used for 5 meter operation.

Picture 10—W2WD is the station of Stanley McMinn. He is the Secretary of the Garden City Radio Club and the Editor of Automotive Merchandising magazine. Among other things, he is a photographer of no mean ability, and proof of that statement may be found from the picture of his own station.

The equipment shown in "Mac's" station is the National NTX-30 transmitter and the National NSM modulator which he uses

for both phone and c.w. on the various amateur bands. His receiver is a Hammarlund HQ-120-X. Our hero does not confine his photographic exploits to the ground, and as may be seen from the photo directly above the desk light, he does a certain amount of aeronautical photography. W2WD is located at Stewart Manor, L. I.

Picture 11—W2HXQ and W2EOA are the stations owned and operated by Kay and Charlie Kibling (Mrs. and Mr.). Kay is the Secretary of the W2USA Radio Club and her husband, W2EOA, is the Field Engineer for the Mutual Broadcasting System. Their home is in Rye, New York and they have frequently re-transmitted signals from W2USA to several bands simultaneously. Kay is shown at the control desk, above which we have to the immediate left the all-band frequency meter. Next to the right is the SW3 which is used as a preselector feeding the RME 69



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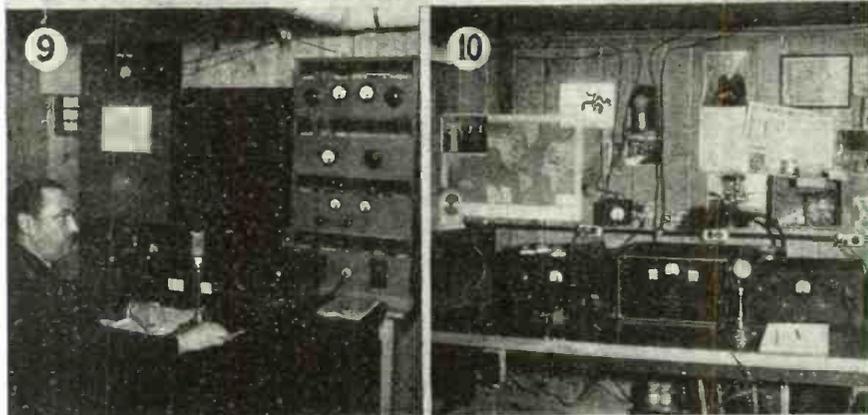
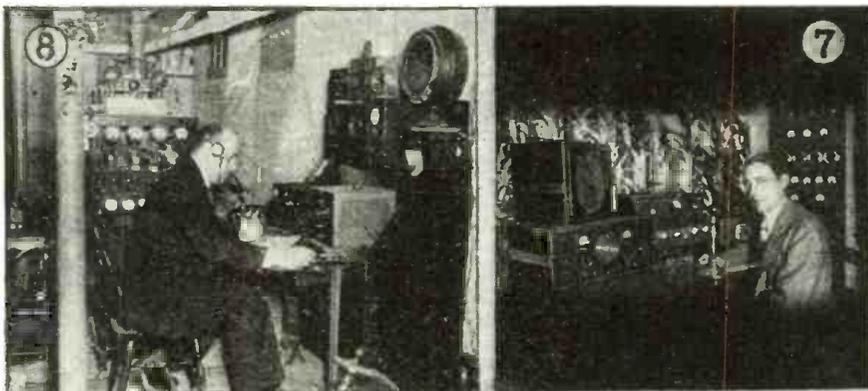
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receiver. Directly beneath the globe is the modulation meter. The transmitter to the left is the one kw. rig which is used on 20 and 10 meter phone. The transmitter to the right is the 250 watt rig which is used on 40 and 80 meter c.w. as well as 75 meter phone. Both transmitters are equipped with automatic modulation control. The transmitters are fed into three "V" beams, each leg of the beams being three wavelengths long on the lowest frequency; a four-wire transmission line coming into the shack makes it possible to select any of the beams, and the result is that world coverage is obtained.

In addition to being the Secretary of the W2USA Radio Club, Kay is the Westchester Emergency Coordinator of the American Red Cross. She holds the distinction of having won the American Radio Relay League DX Contest in 1938, and she has won several

of the A.R.R.L. Official Phone Station Contests; during the last such contest she made the highest score which has ever been made in such a contest.

During the New England hurricane, Kay handled over 700 messages.

When Don Fendler was lost on Mt. Katahdin, Maine, for nine days, W2HXQ maintained contact with the various searching parties so that his family would be advised of the progress being made in his search. Fendler lives at Rye.

Another Rye boy, Bobby Bolpi, was stricken by a streptococci infection and through Kay's station, arrangements were made for 100 blood transfusions by donors from many parts of the country.

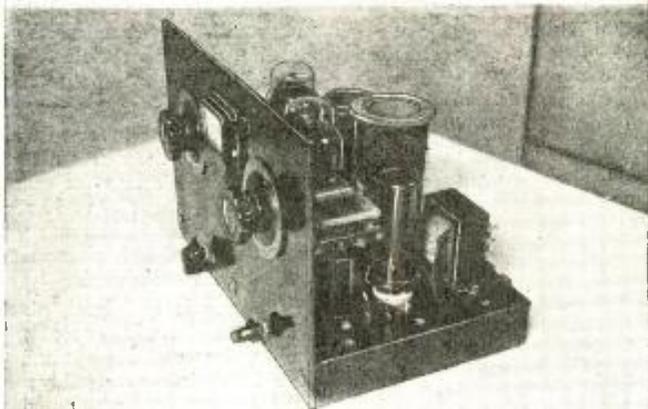
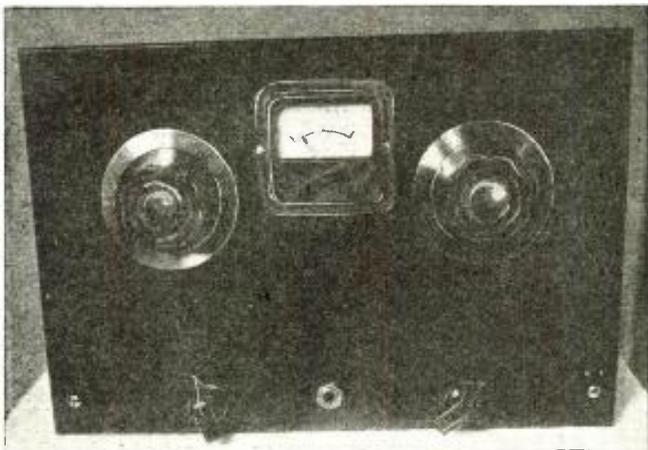
In addition to her amateur activities, Kay is now writing script for three commercial broadcast programs.

Fifteen Watts

on 160 METER PHONE



C. B. Lester, W9ECN



Photos at left show front, side and back views of the 160 meter phone transmitter. This is a low-cost job which can be built from parts readily available.

frequency bands, as you probably know.

Amplifier

The biggest bugaboo for young hams is neutralizing the final, so we got rid of that in a hurry by using a pentode in that position. The 59 used is run a bit over its normal ratings, but in the characteristic efficiency of class C circuits, it is not overloaded as much as it might seem at first glance.

Grid leak bias is used even though battery bias might be better. However, if batteries are used, it will complicate the rig and make it more bulky.

The plate and screen by-pass circuits may seem odd, but if it is remembered that the final is plate-screen modulated, the reason immediately becomes apparent. If larger bypass condensers were used, the audio would leak off to ground and it would be next to impossible to get sufficient modulation. We used .002 mf. for both plate and screen with a .5 mf. across the screen dropping resistor to lower the audio impedance across it.

This stage must be perfectly tuned for proper results, so study the operation of the final as described under "Tuning Procedure" before trying to get on the air.

We don't have all the capacity in the plate tank we could use, and if a 220 or 250 mmf. condenser is lying around, it might be better to use it instead of the 150 mmf. shown in the diagram. If this is done, it will be necessary to remove a few turns from the final tank coil to make the stage tune properly.

Modulator

There are all sorts of queer things in this modulator.

In the first place, it is not operated Class A like any self-respecting modulator using a single tube, but is operated in a cross between Class A and Class AB¹. The bias resistor is adjusted so that the plate current of the modulator rises about 12 ma. when the mike is spoken into. A value somewhere in the vicinity of 600 ohms seems to be about right, but the value had best be arrived at by experimentation in each transmitter. This small change from the ordinary introduces no appreciable distortion, but it does increase the output enormously. Hi-fi is of practically no use on 160 except as a matter of pride, and the way this rig cuts through QRM is sometimes the equivalent

unconventional — not in design but in its use. Inasmuch as a 6L6 oscillator with 450 volts on the plate will put out anywhere from 20 to 40 watts of R.F., it seems queer that it should be used to drive a tube that needs at most a watt or so for excitation.

However, this was for a purpose. Because we had not the time, money, nor energy to use in constructing a buffer stage, it stood to reason that the oscillator used should be so designed that variations in current

drawn would not affect appreciably its output or output frequency. It can readily be seen that one or two watts out of thirty is a relatively small part of the whole, and it can be seen also where the rig's T-9 tone comes from. We have never had any complaint of frequency modulation or frequency shift, and we have been checked on several oscillographs with no indication of either evil.

We had to have some means of controlling the output of the oscillator to keep it from blowing the grid out of the 59, but that wasn't so hard. We resurrected an old "carbon-pile" resistor (R-1) out of the junk box and hung it in the screen voltage lead. Thus, by varying the screen voltage and consequently the current drawn by the plate, it became an easy matter to adjust the output to the point where the final was getting just the right amount of excitation.

It might be mentioned here that it is just as necessary to bypass all points that might need it on 160 as it is on the higher

● THIS baby fone was designed to be built by a young ham who is a good friend of mine. It was his first rig, so it had to be made as simple and fool-proof as possible; this meant the elimination of all unrequired controls and gadgets. Cost was also a factor, and this rig was built entirely of parts sneaked out of the junk box at 9ECN, and the total cost was \$3.35 for a good 160 meter rock. This isn't one of those "junk-box" rigs that end up costing fifteen or twenty bucks in hard cash, and it takes a back seat to no job in its power class.

Practically everybody has a couple of 6L6's lying around not in use, and the 59 used in the final is a fond reminder of the days when a 59 Tri-Tet was the tops in ham oscillators. This took care of tubes, but building a transmitter around them was a matter that caused the author to sprout a few more gray hairs.

Oscillator

The oscillator is what might be called

The editors have received frequent requests for a 160 meter phone transmitter—C. B. Lester tells you how to build a simple low-powered rig and the cost is well within the average amateur's budget.

of doubling the power, believe it or not.

The mike transformer is merely an old universal output transformer turned around; i.e., with the voice coil winding connected to the mike input, and the plate winding used for the grid winding or secondary. The modulation choke is another old output transformer with nothing but its primary used. It should have a wattage rating of about 10 or 12, and one taken out of an old receiver using P.P. 6F6's is swell.

The mike battery is two small flashlight cells connected in series and mounted under the chassis. A switch is provided to cut off the drain on the batteries when the rig is not in use.

Construction

The photographs and diagram show all there is to see about the actual construction of this rig. The chassis is of 1/4" Presdwood with three coats of Duco sprayed on. It is approximately 8 by 5 1/4 inches and the panel, made of the same material, is 8 by 6 inches.

The two tuning condensers are mounted on the panel with their original studs and the plate meter for the 59 is hung in the center of the panel between them. Directly below the two main dials are the two switches; the one on the left controls the power and the right-hand one controls the button current to the microphone. In the middle of the panel on a line with the two switches is the mike jack.

All the oscillator components are in a line directly behind the tuning condenser and the parts for the final are in a line through

the center of the chassis. The modulator tube, with its two transformers, is the same distance from the right-hand edge of the chassis as the oscillator components are from the left side, thus lending themselves to the symmetry of layout most hams strive for.

We use a tuned antenna coupler to connect to the antenna, so there is no coupler incorporated in the transmitter proper, but a two-turn link is used to couple to the antenna inductance.

One small change that could be made would be to tap the final tank coil and make a balanced output circuit. Some antenna systems seem to work better out of a balanced tank and this change can be made without altering any of the components. Of course, when using this circuit, all the by-pass circuits go to the center of the coil and not to the cold end as shown in the diagram.

Tuning Procedure

It is advisable to test all units progressively as they are built, adjusting them as you go. A 0-200 ma. meter will be needed, and, if two are available, tuning will be greatly simplified.

First break the oscillator plate circuit at the point marked "1" on the diagram. Insert the meter and apply voltage, tuning for greatest dip (least ma. draw) with the oscillator tuning condenser.

Next break the final plate circuit at point "2" on the diagram, and again tune for dip, this time with the final tank condenser. Now, with the meter in the same place,

tune the oscillator tuning control for greatest ma. draw. The excitation control (R-1) should be set at about half scale for the above operations.

Now connect the antenna. The tuning for this part of the line-up will vary according to the type of antenna employed, but this can be obtained from any handbook that deals with antennas and antenna tuning systems. Tune the antenna and the final tuning condenser so that the 59 draws about 80 ma. when both are in resonance. If the current is greater than this value, reduce the oscillator output by lowering the voltage on the oscillator screen. If this value cannot be reached, reverse the operation.

Now, with the antenna coupled and tuned and the modulator tube out of the socket, slowly lower the resistance of R-3 until the screen of the 59 begins to show color. When this condition is reached, reduce the voltage by raising the resistance until the color just does disappear and let the resistor remain at this point.

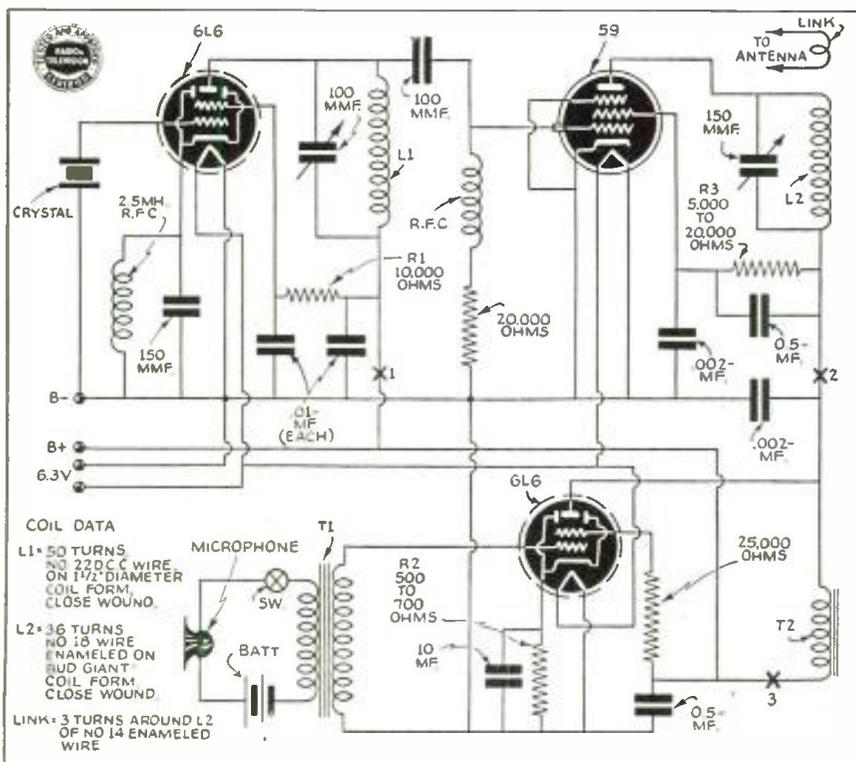
Now replace the modulator tube and take the final tube out. Insert the meter at "3" on the diagram and speak into the mike. The current should rise about 10 to 15 ma. If it does not rise that much, increase the value of bias resistor R-4. If it rises more than that, its value must be reduced.

When all the above is completed, place a flashlight bulb in series with one of the antenna feeders and speak into the mike. The bulb should brighten perceptibly; if it does not, the antenna loading and grid drive should be adjusted until this takes place.

Now for a final touch, load the final until it draws between 80 and 90 ma. With this current at 450 volts, the output will be around fifteen watts.

This rig will hold its own with any in its power class no matter what the cost—so let's hear from you on 160!

Here's the hookup for the 160 meter phone transmitter.



List of Parts

Lester's 160 Meter Phone

AEROVOX (Condensers)

- 1—.00015, mica
- 3—.0001, mica
- 2—.01, paper
- 1—.1, paper
- 1—.5, paper
- 1—10 mfd. audio by-pass—50 volts wkg. voltage
- 1—100 mmf. midget variable
- 1—150 mmf. variable

I.R.C. (Resistors)

- 1—20,000 ohm, 1 watt carbon
- 1—25,000 ohm, 1 watt carbon
- 1—20,000 ohm wire sound—10 watts with slider used in screen of 59
- 1—Bradlyohm, Clarostat or other variable carbon-pile resistor for control of screen voltage on oscillator
- 1—600 ohm, 10 watt wire-wound—cathode of modulator

TRANSFORMERS

- 2—Output transformers—one for use as mike transformer; one for use as modulator choke
- 2—2.5 mh. R.F. chokes; 125 ma.
- 2—Octal sockets
- 2—5-prong sockets
- 1—Large 7-prong socket
- 1—4-prong socket
- 1—Phone jack (for mike connection)
- 2—Switches (power and mike battery)
- 1—0-150 M.A. meter

Checking and Overhauling Communication Receivers

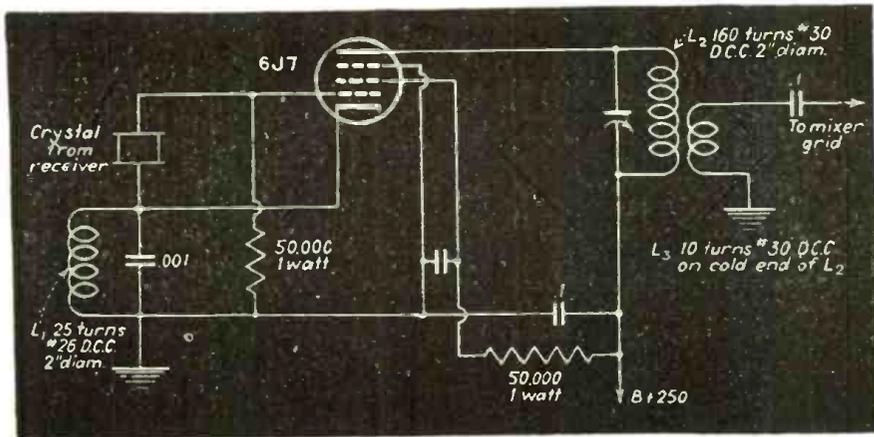


Fig. 1—Using crystal filter to check communication receivers.

● **HINTS** on how to check and overhaul communication receivers have been thoroughly outlined in *Electronics and Television & Short-Wave World* of Britain. The author points out that most of these receivers are superhets and consequently standard procedures can be employed. However, many sets of the communication type contain crystal filters as shown in Fig. 1. The article recommends the following procedure to check this circuit:

The following is a general outline of the procedure recommended: If the receiver includes a crystal, place the crystal in a separate oscillator and align the I.F. circuits. Before aligning either the R.F. or I.F. circuits, be sure that the A.V.C., crystal filter and beat oscillator switches are in the "off" positions, the selectivity control in the "sharp" position, the audio and R.F. gain controls set at maximum, and the band switch is on position "one" with the tuning condenser open.

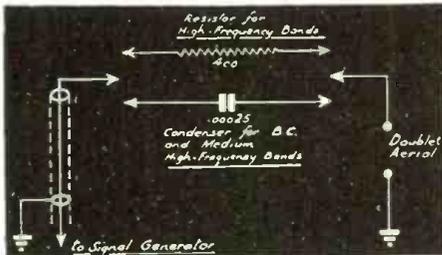


Fig. 2—Methods of coupling signal generator to receiver input.

To adjust the control, the following procedure is recommended: Tune in a steady carrier, unmodulated if possible, with the crystal switched in, and then detune the receiver to produce a beat note of about 5,000 cycles. It is usually necessary to increase the gain to make the signal audible.

The elimination control should then be adjusted until the beat note is weakest, and the setting noted. The process should be repeated with the beat note on the other side of zero, and the reading again noted. A setting midway between the two readings is the correct one which gives normal crystal action. The I.F. circuit may be aligned to secure maximum signal strength and direct calibration by using standard oscillators and following manufacturers' instructions. It is suggested that coil L2 may be of the plug-in type in order to permit the plate circuit of the 6J7 to be tuned to various harmonics of the crystal frequency. Fig. 2 shows how the output of the signal generator may be coupled to the input of the receiver for medium and high frequency bands.

Remove the oscillator from its socket. Remove the cap from the control grid of the mixer and feed the test signal directly to the valve through a 0.1 mf. condenser. Adjust the I.F. trimmers for maximum output.

If the receiver is aligned from the crystal oscillator output, re-inserting the crystal in the circuit will show little difference in output whether the crystal is "in" or "out."

For the R.F. alignment proceed as follows: Use either a .00025 mf. condenser or a 400-ohm resistor in series with the output lead from the signal generator to the receiver as shown in Fig. 2. One of the doublet terminals should be connected to ground during alignment.

Check the calibration against accurately known frequencies (broadcast stations may be used if the oscillator is inaccurate) and adjust the high-frequency oscillator padder and trimmer condenser until the several known frequencies are received at corresponding points on the dial.

Adjust the paddlers only for recalibrating the low-frequency ends of the bands; the trimmers are for aligning the high-frequency portions (Fig. 3).

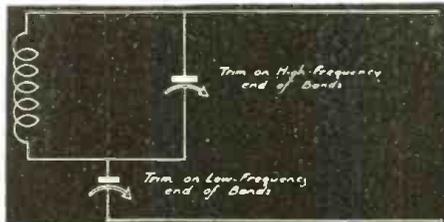


Fig. 3—Which trimmer to adjust for the end of the band on the tuning dial.



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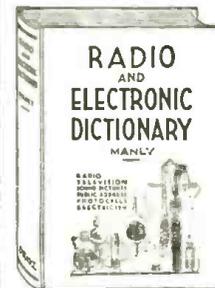
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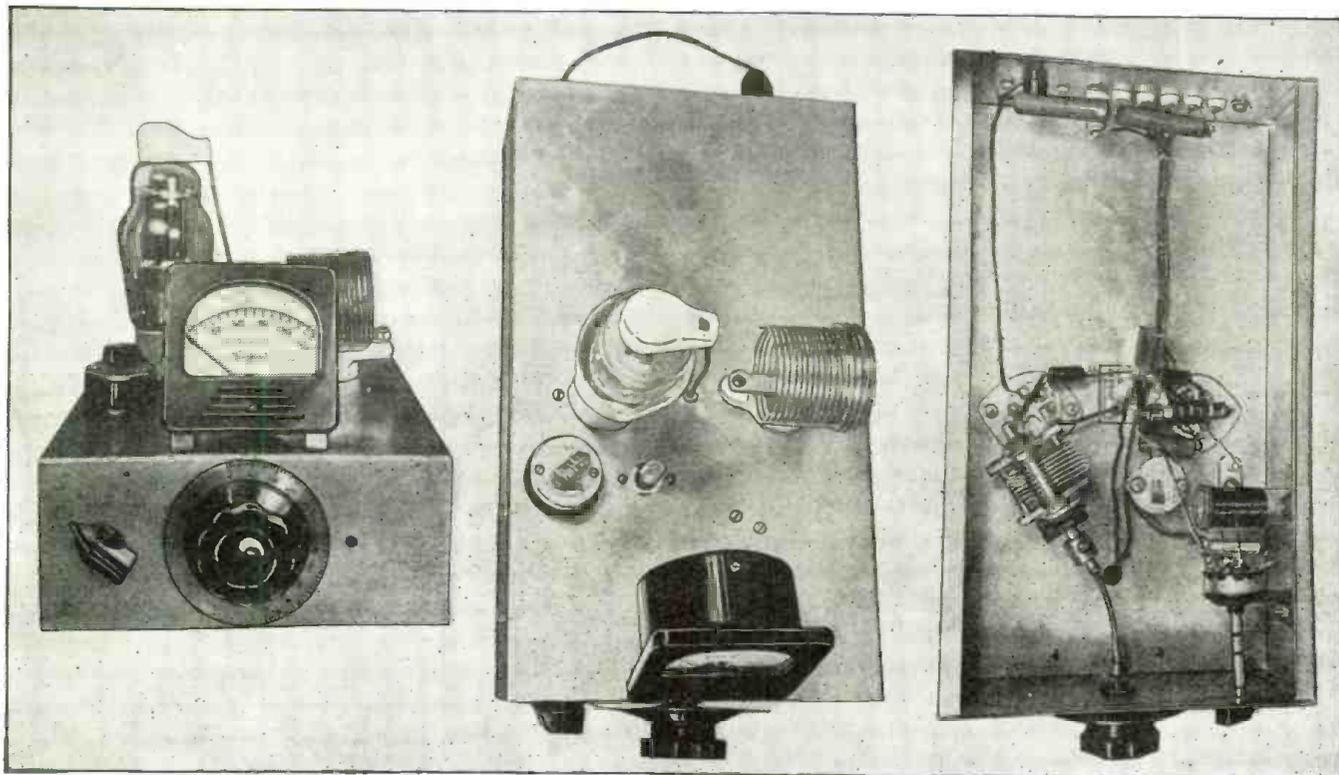
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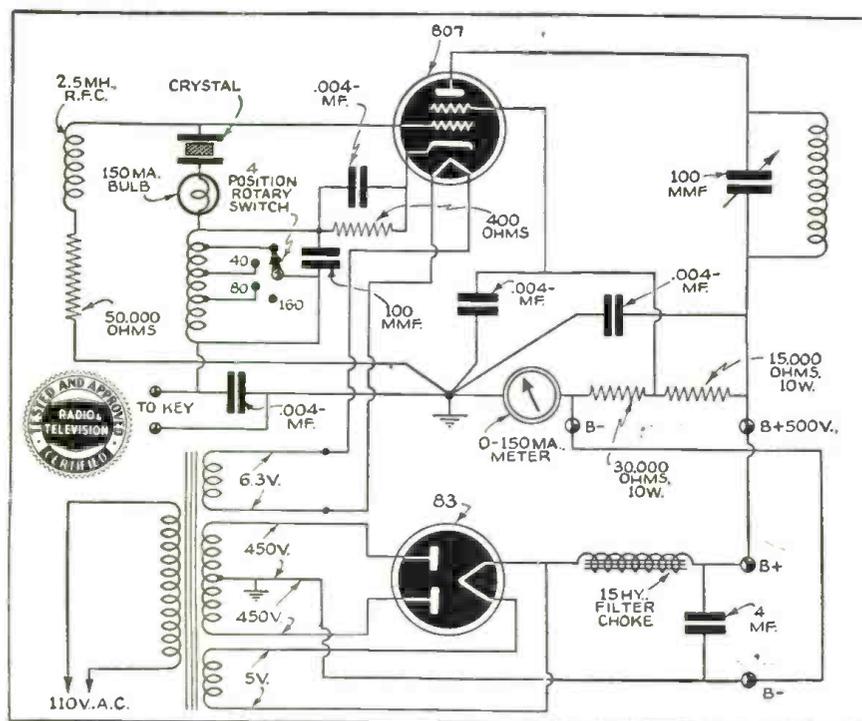


Front top and bottom view of the "Economy" transmitter.

Beginners' Economy Transmitter



Herman Yellin, W2AJL



Wiring diagram for the beginners' transmitter.

● AFTER acquiring his license, the amateur newcomer is frequently faced with the problem of what kind of transmitter to build. While he would like to have a high-power rig, other factors prevent him from immediately bursting out with a half kilowatt. Lack of experience with multi-stage equipment, a desire to acquire experience with simple gear, a depleted pocketbook all may combine to check the immediate acquisition of high power.

With this in mind, the writer designed a small yet efficient *oscillator-transmitter* that need not become obsolete because additional units or sections can be added to it to increase its flexibility and power. Each unit will be built on a 7" x 12" x 3" chassis and the several units can be bolted together to make a single compact transmitter. In this, the first of several articles, the oscillator section will be described. When adding any of the future units, none of the original equipment will have to be scrapped.

Tri-tet Circuit Used

For flexibility and efficiency, the *tri-tet* oscillator circuit is hard to beat. Second harmonic output is almost as great as the output on the crystal's fundamental frequency, while fourth harmonic output is about 25% of fundamental output. While

a receiving type tube such as the 6V6 or 6L6 could be used in this section, a larger tube such as the 807 gives quite a bit more output and is to be preferred when feeding the oscillator directly into the antenna. Later on, when we add the *buffer-doubler* section, we can substitute a smaller tube for the 807 in the oscillator and use the oscillator in the second section. A disadvantage of the *tri-tet* has been the ease with which abnormally high crystal currents could be encountered, with improper adjustment of the tuned cathode circuit. However, since this circuit is not at all critical, it is quite feasible to employ a *fixed-tune* cathode circuit, thereby avoiding having to tune it with its resultant tendency toward mistuning. It was found convenient to use a single tapped coil with a small rotary switch shorting out the unused portion of the coil. By shorting out the entire cathode coil, the oscillator is turned into a simple pentode oscillator with the plate circuit tuned to the crystal frequency.

A small 60 milliamperes pilot light bulb is in series with the crystal, serving as a crystal current indicator. On extreme overloads, it will burn out, protecting the crystal. With the number of turns specified for the cathode coil, no trouble should be experienced with high crystal currents. The

A dandy transmitter for the beginner is here described by Mr. Yellin. Not only is it low-priced and efficient, but other units may be added to it later, and thus give the amateur a more powerful transmitter, without having to eliminate any of the parts previously used.

bulb will never light up to more than half its normal brilliancy. The crystal used by the writer is a Bliley VF1 variable crystal, capable of a small amount of frequency variation—sufficient to slide out of any QRM encountered while operating. This method of frequency variation is much to be preferred over the use of a variable frequency electron-coupled oscillator which presents enormous problems in attaining frequency stability, comparable to crystal control. The 80 meter crystal can be varied about 6 kilocycles from its normal frequency, while the 40 meter crystal unit can be varied 12 kc. from its minimum frequency. Harmonic operation, of course, increases the variation.

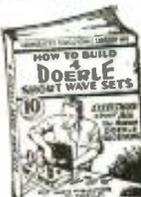
Coils Can Be Home-made

The single tuned circuit in the plate of the oscillator employs a 100 mmf. receiving type condenser and *plug-in* air-wound coils. These sturdily built and neatly constructed coils can be purchased quite cheaply, but for the constructor desirous of rolling his own, complete information is appended.

Inspection of the photos will show that although the tuning condenser is mounted at the side of the chassis near the coil socket, its dial is in the center of the chassis. A short length of flexible shafting

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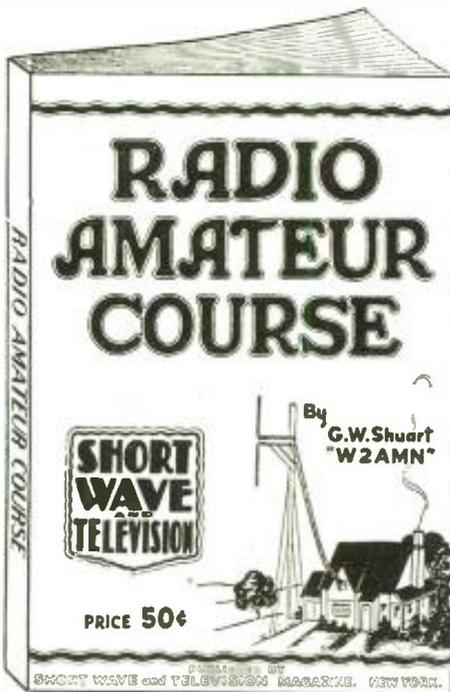
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was used to couple the two together, since it was desired to place the dial in the center of the chassis. If the constructor aims at simplicity, he can dispense with the flexible shaft and use a straight shaft extension, with the dial then off to one side.

The 7 x 12 x 3 inch chassis is really larger than necessary to mount all the parts, but will match the future units in size. Too, if the beginner feels that this oscillator transmitter is as far as he wishes to go, he could easily build a small power supply on the rear portion of the chassis. A diagram of a suitable power supply is shown.

Meter Permanently Connected

The permanently connected 150 milliamperere meter has been mounted above the chassis on a pair of angle brackets, to avoid cutting a large hole in the front of the chassis. This meter is in the B minus lead so that there is no high voltage on its terminals. Note how all parts have been mounted close together in order to keep the R.F. leads as short as possible, yet not unduly crowding the various components. The *cathode coil switch* was mounted on a bracket fastened to the side of the chassis close to the cathode coil. At the rear chassis drop are the power and key terminals. A five terminal isolantite strip takes care of the keying leads, filament supply and B minus, while a Millen bakelite high voltage terminal is used to feed the plate and screen voltage. This terminal is really a plug-in gadget with no exposed metal. The plate cap for the 807 is also made of isolantite to afford protection against accidental contact. However, the plug-in plate coil carries high voltage and could be made safe by covering it with a celluloid bag. The two resistors used as a voltage divider to obtain screen voltage are supported at their junction by the small standoff insulator furnished with the R.F. choke coil.

Particular care should be used in wiring the unit to bring all grounds to a single point on the chassis, which should be at the tube socket.

| Plate coil | TURNS | DIAMETER | LENGTH | WIRE SIZE | LINK |
|------------|-------|----------|--------|-----------|---------|
| 160 meters | 56 | 1 3/8" | 1 3/4" | No. 24 | 4 turns |
| 80 meters | 32 | 1 3/8" | 1 3/4" | No. 19 | 3 turns |
| 40 meters | 18 | 1 3/8" | 1 3/4" | No. 16 | 3 turns |
| 20 meters | 9 | 1 3/8" | 1 3/4" | No. 14 | 2 turns |
| 10 meters | 6 | 1 3/8" | 1 3/4" | No. 14 | 2 turns |

All coils space wound to specified length. Link wound at end of coil.
 Cathode coil 53 turns No. 24 enameled wire wound on 3/4" diameter tapped 24 turns from the end for 80 meters, and tapped 10 turns from end for 40 meter crystals. These turns are the ones actually used.

How to "Tune Up"

Tuning up this little outfit is quite simple. If output is desired on the crystal frequency, short the cathode coil by turning the switch to the proper position and insert the proper plate coil. Starting with the plate condenser at its minimum capacity setting, turn the condenser, increasing its capacity until a dip in plate current occurs. The condenser should be backed off from the position of maximum dip because of

the tendency of the oscillator to break out of oscillation when a load, such as an antenna, is applied.

If output is desired on a crystal harmonic, set the switch on the tap corresponding to the crystal frequency (this will be about 1 1/2 times the crystal frequency). With the proper plate coil inserted in the coil socket, vary the plate condenser for minimum plate current or if a meter is not available, for maximum R.F. output, as indicated by a neon bulb or single turn loop attached to a small lamp bulb (flashlight bulb) brought near the output coil.

The plate coil is furnished with a link coil which can be used when coupling to an antenna having twisted pair feeders or a concentric line. The single wire fed matched impedance type of antenna can be coupled to the plate coil by tapping it at some point near the plate end of the coil. It should be connected at some point where the plate current will be the normal plate current at the operating voltage. The tap can be soldered to the coil and brought down to the unused prong on the five-prong coil form.

In a forthcoming issue the second unit, containing a buffer-doubler with a built-in power supply for the two units will be described. The third unit will contain a 500 watt amplifier.

Parts List

BUD RADIO, INC.

- 1—Chassis No. 703
- 1—Set of OEL coils; 10-160 meters
- 1—100 mmf. tuning condenser No. 905
- 1—Tuning dial No. 1732

JAMES MILLEN MFG. CO.

- 2—5 prong steatite sockets, No. 33005
- 1—Steatite crystal socket, No. 33002
- 1—High voltage bakelite safety terminal, No. 37001
- 1—Steatite 5 terminal strip, No. 37105
- 1—Isolantite plate cap for 807, No. 36002
- 1—2.5 mh. R.F. choke, No. 34100
- 1—3/4" diameter coil form, No. 47003

RCA MFG. CO.

- 1—807 tube

BLILEY ELECTRIC CO.

- 1—VF-1 crystal unit

TRIPLETT ELECTRICAL INSTRUMENT CO.

- 1—0-150 D.C. Milliammeter, No. 327A

I.R.C.

- 1—50,000 ohm, 1/2 watt resistor, type BT 1/2

SPRAGUE PRODUCTS CO.

- 1—100 mmf. silvered mica fixed condenser, No. SM-31
- 4—.004 mf. mica condensers, 1FM-24
- 1—400 ohm, 5 watt resistor, type 5K
- 1—15,000 ohm, 10 watt resistor, type 10K
- 1—30,000 ohm, 10 watt resistor, type 10K

P. R. MALLORY & CO.

- 1—Single-pole 5-position rotary switch, No. 3215J

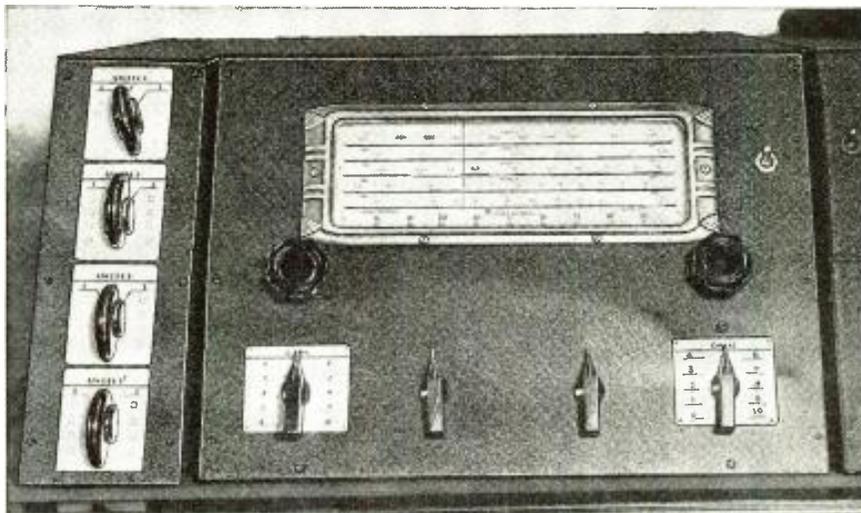
Needle Scratch Filter

● IN A NEW British phonograph noise-scratch reducer reported in *Wireless World*, the fact that high notes in speech and music are of short duration as compared with the lower notes and with needle scratch noise is utilized. The special circuit consists of two rectifiers in series, the second

of which feeds the storage condenser of a pre-determined time constant. The potential thus built up is used as the control voltage and when the noise level is low the attenuation of the upper audio frequencies is at a minimum, increasing automatically as the noise level rises.

Extending the Tuning Range of YOUR Receiver

Charles R. Leutz



Front view of the author's all-wave receiver, as reconstructed in the manner here described. Note the Meissner multi-wave tuning dial. The switch control panel at the left is for the directional antenna system (described in "RADIO-CRAFT" for November, 1939. Fig. 5

MANY good receivers in operation are designed to tune to only the broadcast band, or possibly, the broadcast band and one or two high frequency bands. This is particularly true in the case of *tuned radio frequency* receivers.

A few years ago, it was a difficult and expensive proposition to alter a standard receiver for extended tuning range. Today, with standard and efficient, matched antenna, radio frequency and oscillator coils together with numerous different types of band *gang* switches, the problem is greatly simplified and can be solved at a reasonable cost.

To extend the frequency coverage of a standard superheterodyne receiver, that part of the circuit containing the intermediate R.F. amplifier, second detector, audio system and power-pack need not be changed. The alterations are confined to the antenna input, direct R.F., oscillator and mixer circuit.

In the case of a tuned radio frequency receiver, the changes to the existing tuner circuit are very simple and the all-wave coverage is secured by adding an additional unit, in a separate cabinet. The necessary change to the TRF receiver is shown in Fig. 1, wherein C1 is a 480/1640 mmf. padder condenser and S1 one section of a gang switch. One padder and switch section is required for each section of the TRF gang condenser, and the switches are all controlled by one shaft. With the TRF gang condenser adjusted to its maximum position,

the padders are adjusted until the receiver is aligned to 456 kc. and that is best accomplished using a signal oscillator. The switches are of course closed for the 456 kc. position and when open the TRF set tunes in the normal manner.

Fig. 1a shows the necessary connections to change over from straight TRF to *all-wave* superheterodyne operation, in the latter position the TRF receiver supplements the all-wave unit and completes the superheterodyne set-up; the TRF stages acting as the I.F.

Fig. 2 shows the schematic wiring diagram for a 5 band all-wave superheterodyne tuning unit consisting of the antenna input, R.F. stage, oscillator and mixer circuits. Individual antenna, R.F., and oscillator coils are available to cover a wide range of frequencies and the builder can make a 5 band arrangement to suit any special requirements. The coils, completely wired to a 5-band gang switch and associated gang condenser are also available (factory pre-aligned) to cover the following standard ranges, viz.:

| Band | Using 3 gang 280 mmf. condensers | Using 3 gang 410 mmf. condensers |
|------|----------------------------------|----------------------------------|
| 1 | 540 - 1580 kc. | 133 - 406 kc. |
| 2 | 1.5 - 4.5 mc. | 537 - 1754 kc. |
| 3 | 4.1 - 12.2 mc. | 1.68 - 5.96 mc. |
| 4 | 7.3 - 18.8 mc. | 5.85 - 18.2 mc. |
| 5 | 11.2 - 31.6 mc. | 17.6 - 42 mc. |

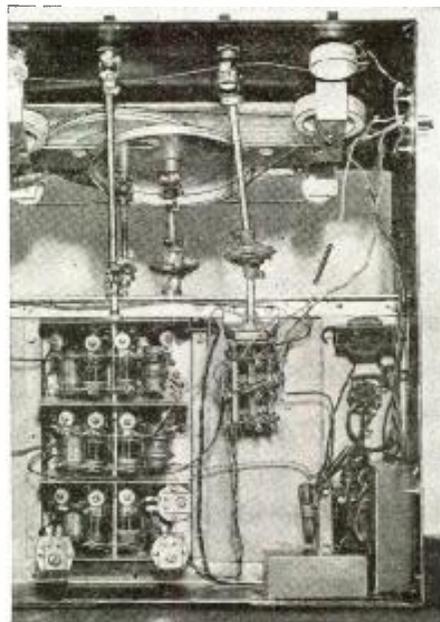
Calibrated slide-rule dials are also available to match the above two frequency coverage combinations.

Numerous different new tubes may be used for the R.F., oscillator and mixer circuits. The 6AB7/1853 is recommended for the direct R.F. stage due to having very favorable noise characteristics and high uniform gain when associated with properly designed input and output circuits. The 6SA7 as suggested is an excellent mixer and associated with a 6AB7/1853 oscillator, provides a separately excited mixer circuit evenly efficient over the wide frequency range involved.

By providing the first direct R.F. stage with a manual volume control, that stage and the mixer can be operated at maximum gain and by using correspondingly less gain in the intermediate amplifier, the most favorable noise-to-signal ratio is obtained. This manual volume control consists of a 2000 ohm potentiometer, connected between the Brown lead (Fig. 2) and ground.

The necessary voltages for the all-wave tuning unit can be taken from the TRF receiver's power supply, or a separate power supply can be incorporated with the multi-wave section. A suggested separate power supply is shown in Fig. 3. In this modern circuit, the VR 150 voltage regulator tube is used to supply the oscillator and mixer, insuring freedom from frequency drift in operation. The voltage regulator also raises

Fig. 4 Bottom view of the author's all-wave receiver showing the Meissner "all-wave" tuning unit with change-over switch, and also the built-in power-pack.



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Folder No. 2. The "Harmonic Frequency Locator"—Transmitter radiates low frequency wave to receiver, tuned to one of Harmonics of transmitter. Using regenerative circuit. Emits aural signals. Tubes used: one 1G6G—one 1N5G.

Folder No. 3. The "Beat-Note Indicator"—Two oscillators so adjusted as to produce beat-note. Emits visual and aural signals. Tubes used: Three type '30.

Folder No. 4. The "Radio-Balance Surveyor"—a modulated transmitter and very sensitive loop receiver. Principle: Balanced loop. Emits visual and aural signals. By triangulation depth of objects in ground can be established. Tubes used: Seven type '30.

Folder No. 5. The "Variable Inductance Monitor"—a single tube oscillator generating fixed modulated signals and receiver employing two stages R.F. amplification. Works on the inductance principle. Emits aural signals. Tubes used: six type '30.

Folder No. 6. The "Hughes Inductance-Balance Explorer"—a single tube Hartley oscillator transmitter and sensitive 3-tube receiver. Principle: Wheatstone bridge. Emits aural signals. Tubes used: two type '30—one type '32—one type '33.

Folder No. 7. The "Radiodyne Prospector"—a completely shielded instrument. Principle: Balanced loop. Transmitter, receiver and batteries enclosed in steel box. Very large field of radiation and depth of penetration. Emits aural signals. Tubes used: two 1N5G—one 1G4G—one 1H5G—one 1Q6—one 1G4.

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The author explains how to change over a tuned radio frequency or a superhet receiver for *all-wave* coverage.

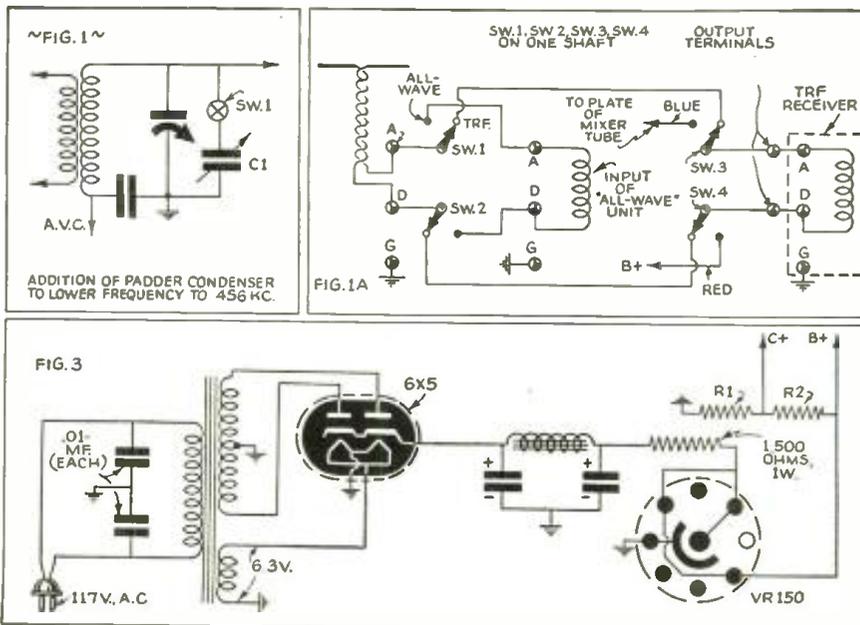


Fig. 1. Addition of padder condenser to lower frequency of T.R.F. circuit to 456 kc. 1-A shows switch arranged to change from T.R.F. to superhet operation. Fig. 3. Rectifier circuit for plate supply.

the degree of stability of the R.F. amplifier operation. The B voltage is divided by the resistors R-1 and R-2 to secure the proper screen grid voltages.

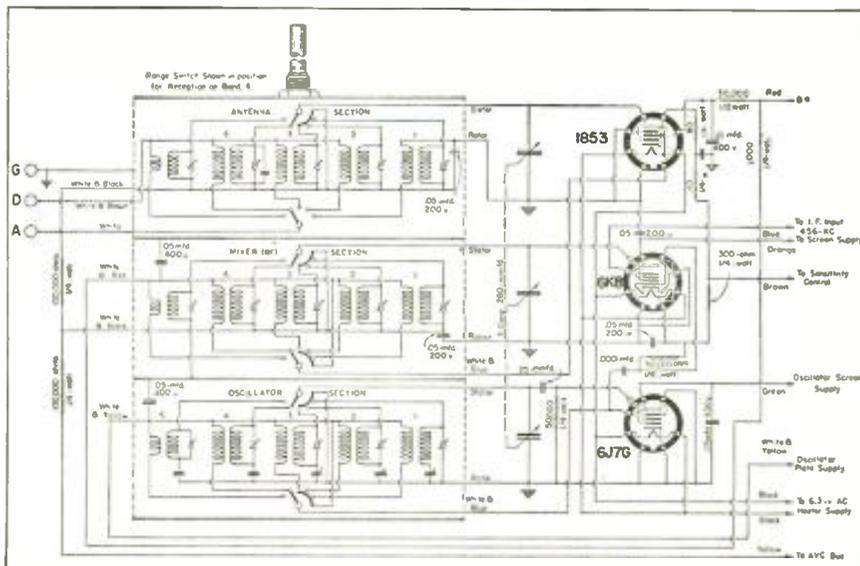
Fig. 4 shows a view of a factory assembled and pre-aligned 5 band multi-wave unit and Fig. 5 shows a view of the complete unit as used with a TRF receiver. In this application, on account of the cabinet's slanting panel, universal joints are required between the dial controls and gang condenser. With a straight panel, the dial controls fit directly into the ganged condenser shafts and all the universal joints are eliminated.

The alterations to an existing superheterodyne are quite simple, the main problem

being the necessary space, so the new all-wave coil and switching assembly can be installed to replace the receiver's existing coil and switching arrangement. Provided the necessary space is available, it is a simple matter to install the new equipment. The ideal arrangement is one where it is possible to insert not only a new set of coils and the gang switch, but also the gang tuning condenser and calibrated dial to match. The connections between the multi-wave tuning unit and the receiver to be altered are the same as shown in Fig. 2.

After all changes have been made the entire assembly should be aligned on all bands, following the standard procedure in this part of the work.

Fig. 2 Multi-wave coil assembly and tuning unit (Meissner).



Experimental Lie Detectors

Measurements of fluctuations in pulse, blood pressure, respiration and body resistance show mental disturbances when subject lies while undergoing tests on simple home-built "Lie Detectors."

Robert Eichberg

● THE so-called *lie-detector* which is winning increasing interest from the police of the nation is, nevertheless, still in the stage where it offers a fertile field to the electrical and radio experimenter.

Several types of "lie-detectors" have been used with varying degrees of success. These may be broken down into four major types. The first, the simplest—and according to all accounts the least accurate—is simply a sensitive vacuum tube voltmeter which measures the (electrical) resistance of the person undergoing the test. Next, in order of estimated accuracy and simplicity, is that which measures the rate of respiration, giving a permanent record of the number of breaths which the subject takes per minute. The two last types have to deal with heart action and, as this is not subject to the control of the will, are generally considered to give a more accurate indication of psychological strains in the subject's mind.

The lie-detectors which give indications of heart action may be further subdivided into two major types. The first of these indicates the rapidity of the subject's pulse and the variation of this rate caused by psychological stress. The second might best be described as a recording sphygmomanometer, and measures variations in blood pressure.

By far the most important part of the equipment, however, is the intelligence of the operator. An unskilled man, given the finest of equipment, can obtain no significant results, while a skilled technician can

obtain highly impressive indications even with comparatively crude equipment.

Perhaps the easiest of the apparatus to construct is the resistance meter, a diagram of which appears in Fig. 1. The indicating meter utilized in this circuit is a 0-500 microammeter. This lie-detector utilizes a type 30 tube as current regulator and another as vacuum tube voltmeter, while the 32 is employed as a direct current amplifier to give greater sensitivity. Batteries are used to assure stability of voltage supply. The other parts required are one 5,000 ohm resistor, one 250,000 ohm potentiometer and one 30 ohm rheostat.

A 3-point switch allows the unit to be turned OFF, ON, or ON WITH BIAS. When put into use, it is first switched to the latter position in order that the meter be protected from possible burn-outs. In fact, the bias must be put on before the plate and filament voltages are applied and must be left on until after they have been removed. As further protection a 5 ma. fuse is used in series with the microammeter.

When the unit is put into operation, the large wire mesh electrodes are firmly strapped to the palms of the subject's hands. Next the control dial is turned to give maximum bias to the volt meter tube and the ON-OFF switch is pushed to BIAS ON. Next the 30 ohm rheostat is advanced until the 1 milliammeter reads .2 ma. After the set is warmed up, the control dial is turned counter-clockwise until the plate current of the final tube reads 100 microamperes. If

it varies, it can be brought into position by means of the potentiometer. When the subject is asked a question which causes emotional stress, the body resistance alters, causing a deflection of the meter needle. The needle will return to normal after each deflection and, if it does not, it signifies that stress is of relatively long duration. Unfortunately there is a time delay of from 1 to 2 minutes between the time of the emotional disturbance and the resultant reading.

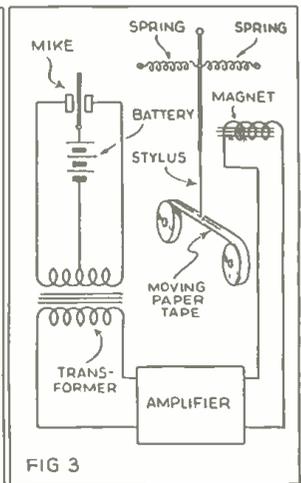
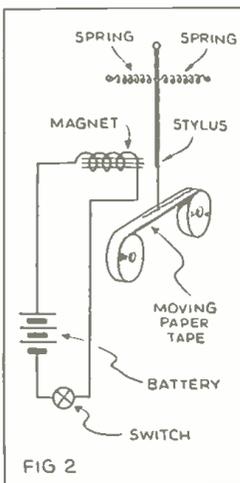
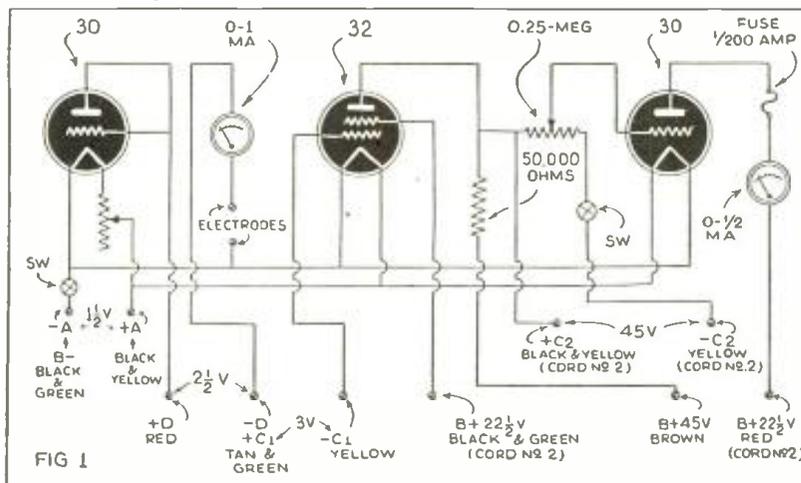
A meter which registers the respiratory rate is a highly complicated piece of apparatus if made for actual police work. However, one which will suffice for home or club entertainment can be made with but little effort. In this form it need be little more than an adjustable strap to fit snugly (but not tightly) about the chest and to bear on it a pair of contacts which close a circuit when the subject inhales. This make-and-break arrangement is connected in series with a magnetically operated stylus that makes a record on a uniformly moving paper tape. A deflection of the stylus shows each breath, and a pause of longer than normal duration before a breath is taken as indicative of mental stress.

The pulse rate indicator can be made in a number of ways and, like the respiration indicator, is complicated and expensive when constructed in precision form. Nevertheless, a simple device can be made by using a sensitive microphone strapped over the heart of the subject and connected to a high gain amplifier, the output of which is fed into a magnetically controlled stylus as described in the former paragraph. Irregularity of heart action is, in this case, an indication of psychological disturbance.

The recording sphygmomanometer, which shows a rise of the subject's blood pressure under mental strain, is too highly technical a device for construction by the average experimenter.

With the apparatus described herewith, however, the amateur sleuth can gain much knowledge and entertainment.

Fig. 1—Circuit for body resistance measurement. Fig. 2—Method of observing respiration. Fig. 3—Pulse rate indicator.



Television Brings Circus to Bedridden

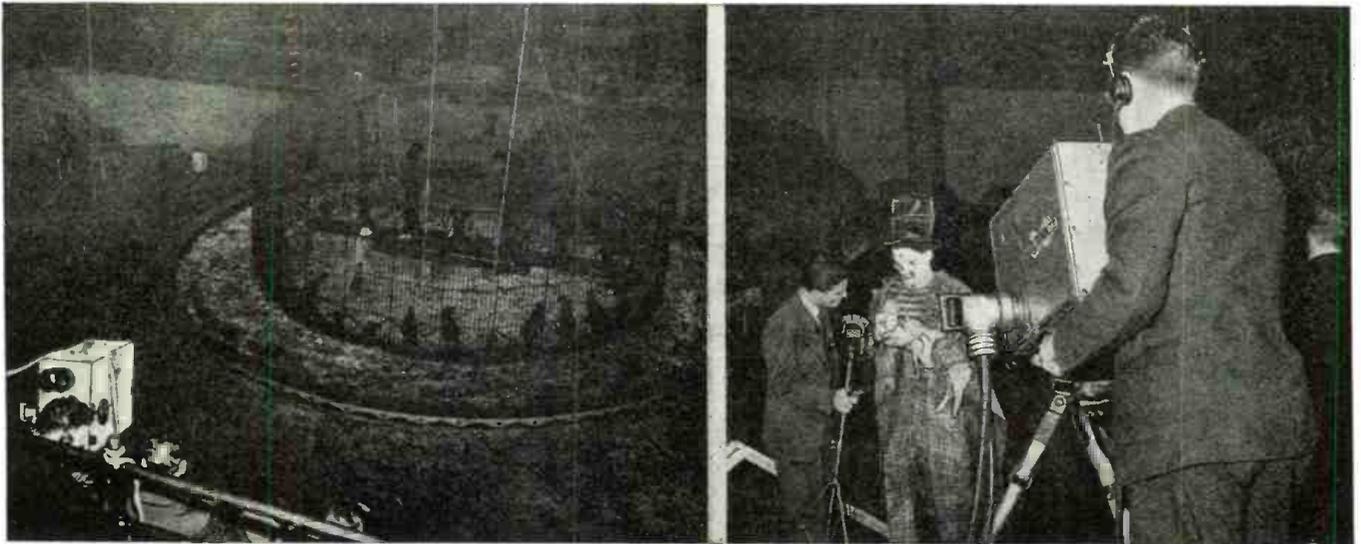


Illustration at left shows camera set-up at Madison Square Garden to televise circus animal acts. Reception was slightly less clear than this picture. At right: Set-up for "freaks" and "specialty" acts which, adequately lighted, went over well.

● ALL the bedlam that goes to make up a circus under the big top (in this case Madison Square Garden, N. Y. City) was brought to children lying ill in the city's hospitals, as well as into the homes of the several thousand television set owners in the metropolitan area. Two set-ups were used—one commanding a ringside view of

the acts and trapeze artists in the main arena, the other down in the basement for *closeups* of freaks, special performers and personalities.

The trapeze artists appeared at the receivers merely as white silhouettes against a black background; the "arena acts" were extremely small and not particularly clear;

the part of the performance picked up from the basement was much the best, technically speaking, which goes to prove that images are best when television engineers have some control over the illumination. When they are able to "pour on" light and to set their cameras fairly close to their subjects, television is at its best.

Projection Tube for Large Television Images

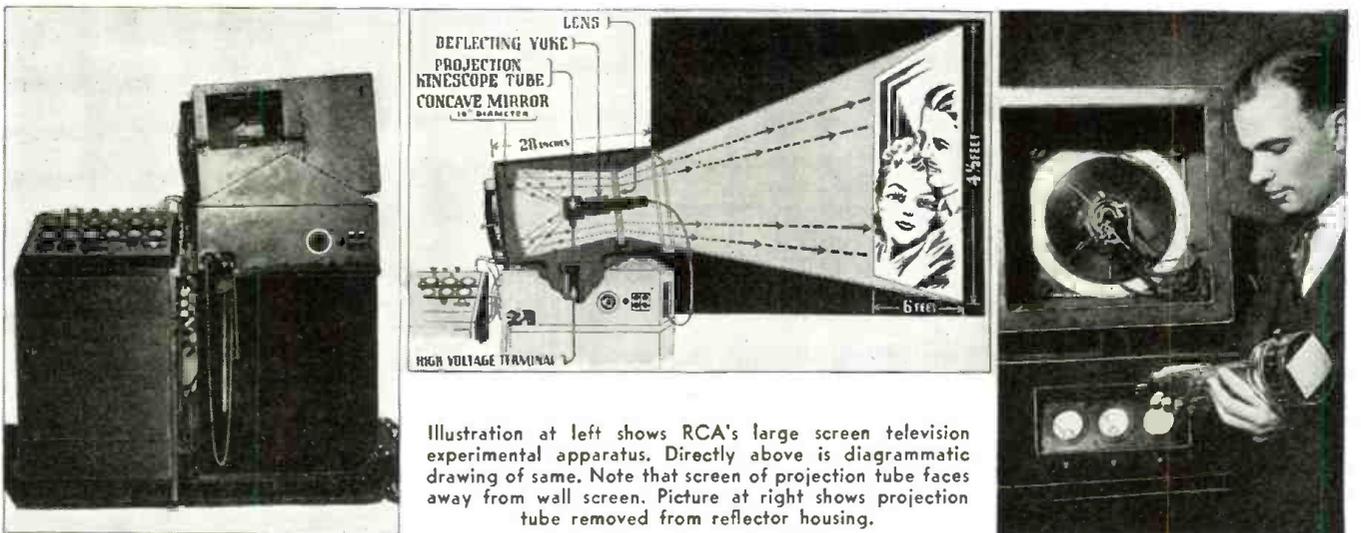


Illustration at left shows RCA's large screen television experimental apparatus. Directly above is diagrammatic drawing of same. Note that screen of projection tube faces away from wall screen. Picture at right shows projection tube removed from reflector housing.

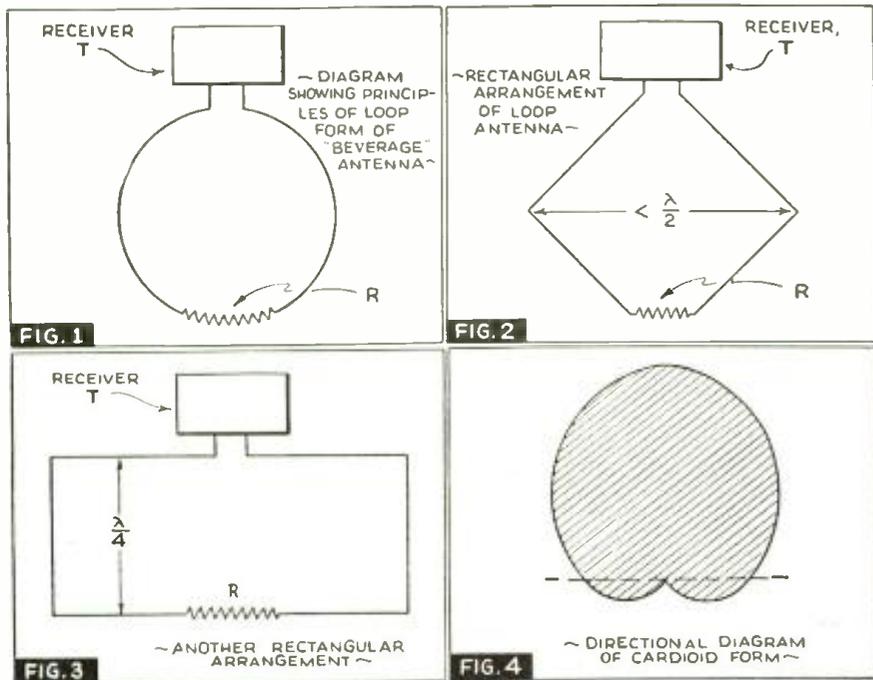
● TELEVISION images $4\frac{1}{2}$ by 6 ft. in size were projected onto an ordinary beaded motion picture screen at a demonstration held for RCA stockholders. The projection apparatus consists of three major parts—a newly developed kinescope projection tube together with its optical system, a high voltage power supply and a group of amplifiers, electric circuits and

controls. The overall dimensions of the apparatus are 6 ft. long by 2 ft. wide by $5\frac{1}{2}$ ft. high.

The optical system has an effective aperture of F 0.7 which is more than four times the speed of the usual high quality projection lens. This affords quadruple brilliance on the screen. The actual size of the image is 2.4 by 3.2 inches on the screen of the

kinescope which requires 56,000 volts for its operation. This brilliant image is thrown upon a concave mirror 16" in diameter, which magnifies the picture $22\frac{1}{2}$ times. The image is then projected back through the lens which surrounds the neck of the kinescope and is projected 20 feet to the wall screen. Observers describe the images as excellent.

Loop Aerials Being Developed for Television Use



Above—Diagram shows connections for loop aerials designed for television use.

● THE use of ultra short waves will, it is expected, be made more convenient if the plan now undergoing development in

the RCA laboratories is brought to perfection. It is believed by many engineers that small loop antennas will be far more con-

venient and more efficient than the di-poles commonly employed. As the dipole is a resonant system it may tend to attenuate the outer edges of the side bands of a wide band transmission such as television, causing loss of high frequencies and therefore fine detail in the image. As the Beverage antenna (shown in Fig. 1) is aperiodic and can be designed to be highly directional, it is believed that it will prove superior to the dipole. In Fig. 1 the antenna proper is a circular loop feeding the transmission lines T. Opposite the point of their connection is a resistor R of such value that it matches the characteristic impedances of the arms of the loop as does the transmission line.

The loop may be made other shapes than circular as shown in Figs. 2 and 3. In Fig. 2 it is necessary that the loop's diagonal should be less than half the wave-length in order to obtain the directional field shown in Fig. 4. In Fig. 3 the length of each conductor which combine to form the loop are approximately $\frac{1}{4}$ wavelength in length. It is suggested that if the loops are constructed of metal tubing, approximately $\frac{1}{2}$ " in diameter, it will be sufficiently rigid as to be self-supporting. Should this material be used, a 700 ohm resistor at R will be found satisfactory. Tests conducted with such antennas show a practically flat curve for the frequency range from 45 to 100 mc. A fine field for experimenters.

Broadway Show and Grand Opera Brought to Television

A major milestone in the recent progress of television entertainment was a broadcast of an act from the opera "I Pagliacci" by stars of the Metropolitan Opera Company over W2XBS, New York. This was the first time that a television station in the U. S. had put on so musically enterprising a program. The fact that the ultra high frequencies are used for television sound permits high-fidelity reception and are virtually unaffected by local inter-

ference, which adds greatly to the televiewers' enjoyment of the broadcast.

Another major entertainment achievement of the same station was the broadcast "When We Are Married," a currently running Broadway play, the original cast of which appeared under the microphones and before the iconoscopes. Although this show was not one of the major hits of the theatrical season, it was one of the most important and entertaining programs yet to reach the television kinescopes.

Acc news commentator Lowell Thomas now makes his Wednesday, Thursday and Friday broadcasts (which are carried over an NBC network) from a point of origin in a television studio. Mr. Thomas is televised from several angles and views of Hugh James, the commercial announcer, also appear. Likewise does a sign large enough to cover the entire television screen with Thomas' sponsor's trademark.

Another news broadcast but featuring "Spot Coverage" rather than a résumé is also presented by the station one night a week. This broadcast is illustrated with rather redundant printed sub-titles and highly welcome photographic material. In addition live models are used whenever the "story" permits. The commercial portion of the sponsored broadcast gives an actual demonstration of an advantage of the sponsor's product—a gasoline—and follows it up with signs advertising the product. Newspapers do not seem too happy about this form of competition.



"When We Are Married" cast faces "ike."



Pagliacci performed with Sight and Sound.

Cathode-Ray Tube Application Contest

● A PRIZE contest open to engineers, physicists, laboratory workers, servicemen, experimenters and others, dealing with new and practical applications of the cathode-ray tube and allied equipment, is announced by Allen B. Du Mont Labs., Inc., of Passaic, N. J.

"Miss Television" Winners Chosen



Three Television Queens—left to right: Patricia Fitzgerald, Patricia Murray and Starr Martin.

The winners are Patricia Murray of Philadelphia, Starr Martin of Winston-Salem, N. C., and Patricia Fitzgerald of Philadelphia. The three girls were selected for their beauty, poise, talent and personality. Ballots were mailed in by the television audience after the unique beauty contest telecast over Station W2XBS. The three winners will preside over the Radio Corporation of America's television demonstrations at the New York World's Fair this summer.

All three girls have had previous dramatic experience and were selected after preliminary tryouts from a field of 16 contestants. Starr was almost in Bermuda when word of her good fortune reached her. She sailed on the S.S. *President Roosevelt* to participate in the first *shore-to-ship* television demonstration, during which opening ceremonies of the New York World's Fair were picked up aboard the Bermuda-bound liner.

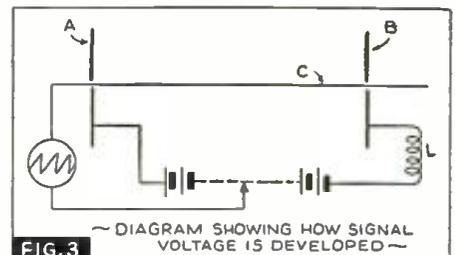
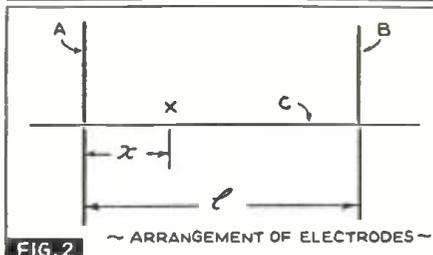
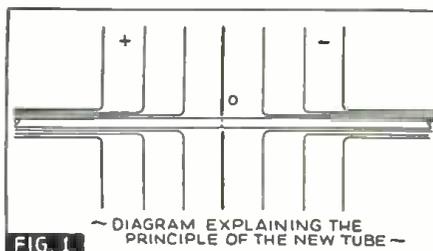
● THE winners of television's first popular-poll girl contest for three titles of "Miss RCA Television," picked by some

2,000 owners of television receivers, were recently announced by Alfred H. Morton, vice-president in charge of N.B.C. television.

NOVEL ELECTRONIC TELEVISION PICK-UP

● SOME 3 years ago Russian scientists described a novel system of television pickup, which—while electronic—operates on a radically different principle from the iconoscope, no deflecting fields being employed. The *Electronics and Television & Short-Wave World* (London) describes the latest refinements of this system in a recent issue. Fig. 1 illustrates the principle of the new tube. To understand it imagine two plane electrodes to which a potential difference is applied. Equi-potential planes can be imagined in the field of force set up between these electrodes, and if a body is interposed in this field the equi-potentials will become deformed unless the body is infinitely small or the potential at any point of the body is identical with that of the field immediately surrounding it. A very thin wire is employed causing very little distortion as shown in the first figure. The tube is arranged as shown in Fig. 2, in which the wire C is stretched between but insulated from electrode A, which is at a high positive potential, and electrode B.

If the wire is made photo-sensitive and is illuminated, practically all the photo-electrons emitted from the surface of the wire to the left of X will be drawn to the anode A. Very few of the photo-electrons emitted to the right of X—in fact only some



Diagrams explaining, with text, action of new television pick-up.

emitted very close to X—will be able to do the same, all the others returning to the wire.

The electrons impinging on A at any instant will constitute a photo-current, the strength of which depends on the distribution of the light over the wire and on the length of the portion of the wire which may emit at that instant. The voltage across the

self-induction L (Fig. 3) is proportional to the intensity of illumination at any point of the wire C as the equi-potential X sweeps across that point.

It is claimed that the definition can be made as high as that possessed by any other electronic pick-up tube, and satisfactory television transmission has been achieved with the device.

It is doubtful whether this pick-up tube, as it stands, has much practical value. The scheme, however, is of real value in pointing out new ways of attacking a problem by an entirely unconventional approach; it may prepare for similarly original solutions of electronic problems of a future day.

TO TELEVIEW REPUBLICAN CONVENTION

● TELEVISION will enter the political arena for the first time this month to bring the National Republican Convention to viewers from Massachusetts to Pennsylvania, according to NBC.

Sound-and-sight programs from Convention Hall, at Philadelphia beginning June 24, executives said, will constitute the most elaborate television coverage ever given anywhere in the world to a single event. Two complete mobile television units are to be dispatched to the Quaker City for daily program relays.

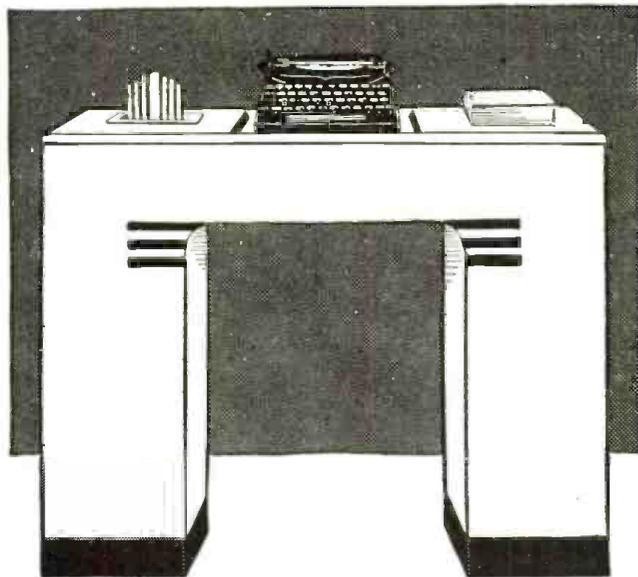
The programs will be relayed to New York for broadcast over NBC's transmit-

ter in midtown Manhattan. It was estimated that a maximum audience of nearly 40,000 persons would see telecasts from the Republican Convention site.

NBC based its estimate of the 40,000 television viewers on the belief that from eight to ten persons would constitute a maximum audience before television receivers located at various points from Springfield, Massachusetts, to Philadelphia, New Hope, and other points in Pennsylvania, now being served by NBC's New York transmitter. The W2XBS audience is located in lower New York State, parts of

Massachusetts, a large part of Connecticut, a corner of Pennsylvania and in New Jersey.

The relay from Philadelphia to New York is to be made over a *coaxial cable* installed by the Bell Telephone Laboratories and the American Telephone and Telegraph Company. Although capable of transmitting several hundred telephone messages simultaneously, the cable will handle only a single television program. Experimental wire line circuits will connect NBC's television equipment at Convention Hall with the Bourse Building terminal of the coaxial cable in Philadelphia.



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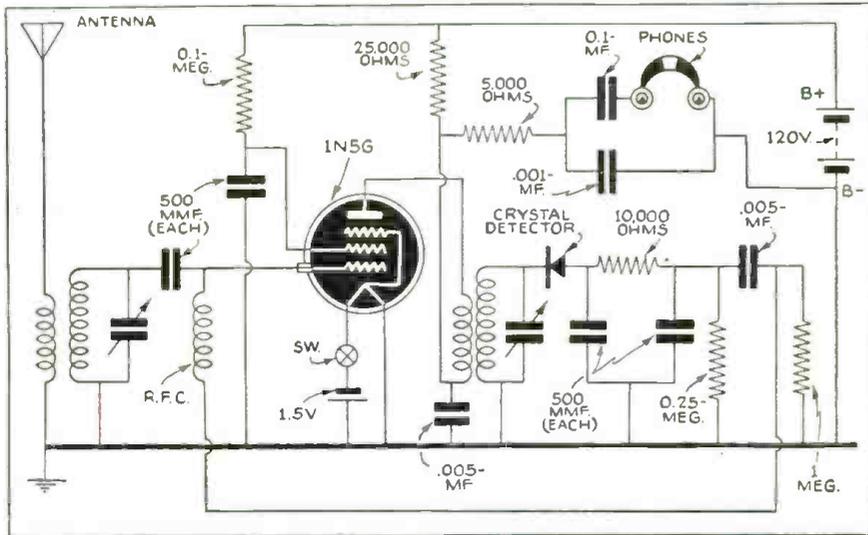
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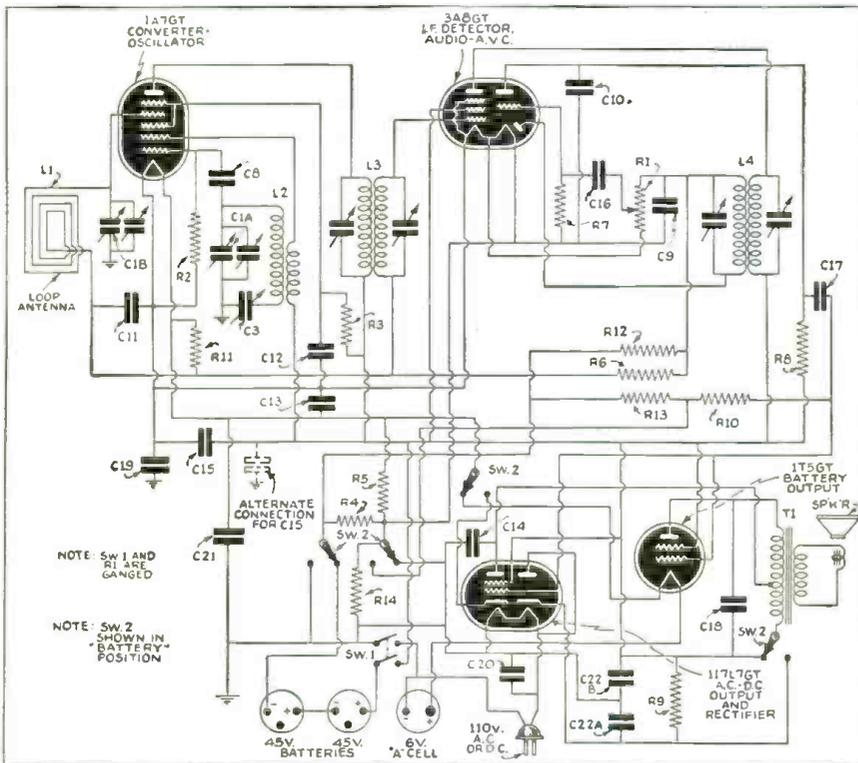
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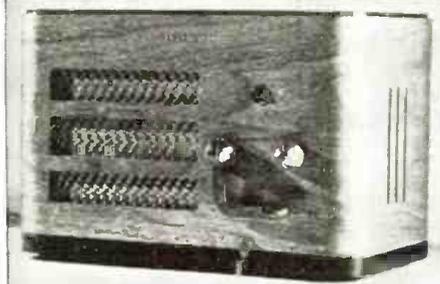
TUBE SAVER is what they used to call the Reflex circuit, back in the days when tubes were costly. Now the reflex principle, with current fed through the same tube at R.F. and A.F., is used mostly to save weight and space.



TRICKY FILAMENT circuit employed in this efficient 3-way receiver may fool you for a moment. The 1A7GT and 3A8GT draw their filament current from the cathode of the 117L7GT, when the receiver is drawing its power from the A.C. or D.C. lines. Courtesy G. E. Co.

- | | | |
|-------------------------------|--------------------------------------|------------------------------------|
| C-1A Oscillator tuning cond. | C-20 .01 mf. line capacitor | R-4 150 ohms |
| C-1B Antenna tuning cond. | C-21 100 mf. 5 V. dry electrolytic | R-5 560 ohms |
| C-3 Oscil. padding capacitor | C-22A 40 mf. 150 V. dry electrolytic | R-6 2.2 meg. |
| C-8 47 mmf. mica capacitor | C-22B 20 mf. 150 V. dry electrolytic | R-7 15 meg. |
| C-9 220 mmf. mica capacitor | L-1 Beam-a-Scope | R-8 1.0 meg. |
| C-10 220 mmf. mica capacitor | L-2 Oscillator coil | R-9 1800 ohms |
| C-11 .05 mf. paper capacitor | L-3 1st I.F. transformer | R-10 470,000 ohms |
| C-12 0.1 mf. paper capacitor | L-4 2nd I.F. transformer | R-11 3.9 megohms |
| C-13 0.1 mf. paper capacitor | R-1 1.0 meg. volume control | R-12 680,000 ohms |
| C-14 220 mmf. mica capacitor | Carbon Resistors | R-13 1.5 megohms |
| C-15 0.1 mf. paper capacitor | R-2 220,000 ohms | R-14 27 ohms |
| C-16 .002 mf. paper capacitor | R-3 47,000 ohms | S-1 Power switch (on vol. control) |
| C-17 .01 mf. paper capacitor | | S-2 AC-DC or Battery switch |
| C-18 .004 mf. paper capacitor | | T-1 Output transformer |
| C-19 0.2 mf. paper capacitor | | |

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The Lawrence Secret Code Outfit provides endless hours of useful, constructive entertainment. The usual games, such as Treasure Hunts, Scavenger Hunts, G-men, Spies, etc., can be considerably "pepped-up" by the use of this coding and decoding outfit. Just imagine getting the following note:

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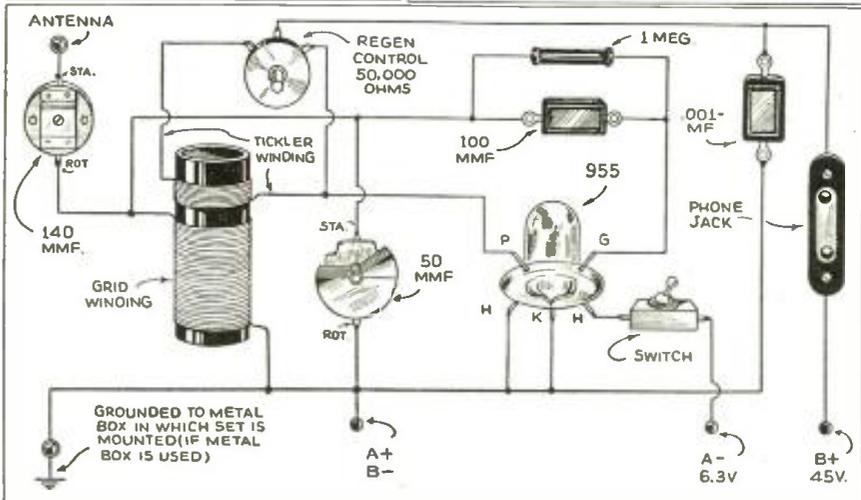
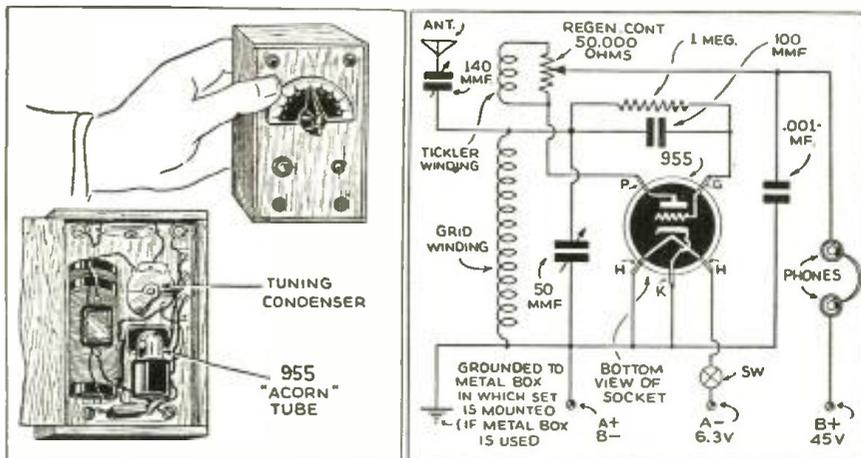
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NELSON COMPANY, 500 Sherman, Dept. G-210, Chicago

Vest-Pocket 1-Tube Short-Wave Receiver

Henry Townsend



Tests have shown remarkable DX reception on this 1-tube portable. The Acorn tube gives it extra high efficiency on the short waves.

● EUROPEAN war news on short waves can be heard direct with this vest pocket set, utilizing a type 955 Acorn tube which is especially suited to short wave reception.

The batteries for operating the set may be carried in the pocket, or in another case, or supported in a canvas or leather pocket sewed onto a belt at the waist. This tube requires 6.3 volts on the filament and this current may be furnished by 4 small flashlight cells connected in series. The plate or "B" voltage may be furnished by connecting 30 small cells of the type used in fountain pen flashlight batteries in series. Connection between the cells may be made by soldering short lengths of wire to them. Connection between the battery case and the vest pocket receiver may be conveniently made by means of a 3-wire flexible cable; phone tip jacks can be provided at either end of the cable if desired.

The headphones can be connected to the set by means of a jack and plug, if desired, and a phone tip jack may be employed to attach the antenna wire. Good results were obtained using a medium length outdoor antenna wire, while in other cases just a few feet of wire lying on the floor

inside the house proved surprisingly effective. For local station reception a few feet of antenna wire was sufficient, the free end of the antenna being connected to a spring wire belt worn by the operator. For those desiring to make the set as small and inconspicuous as possible, the ordinary pair of high resistance headphones may be substituted by one of the high-impedance ear-type phones now supplied for use with electric hearing aid apparatus.

The tuning coil is made as follows: The coils may be wound on a piece of bakelite or other tube measuring $\frac{3}{8}$ " in diameter and $2\frac{1}{2}$ " long. To cover the 49 meter band and quite a space on either side of it, the coil consists of 43 turns of No. 24 double silk covered wire, close wound; the tickler or regeneration plate coil comprises 37 turns of the same size wire. The tickler coil is placed $\frac{1}{8}$ " away from the grid coil. If the set does not regenerate, the two leads connected to the tickler coil should be reversed. If desired a 50,000 ohm potentiometer may be connected across the tickler coil to provide regeneration control, and a small knob fitted on the outside of the case to adjust this potentiometer. If

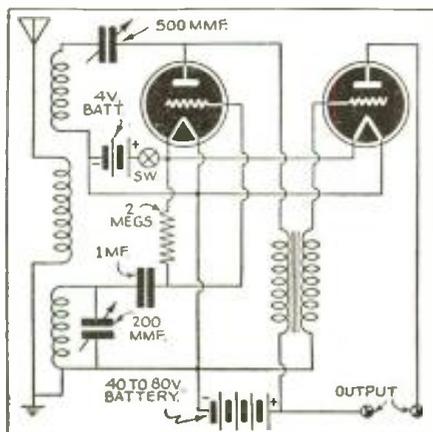
the set does not regenerate well as manifested by the usual steaming or hissing sound heard in the headphones when the set is operated, you may try a few more turns or a reduction in the number of turns of wire on the tickler coil. Don't forget also that in some cases the series antenna condenser needs to be adjusted, in order to make the set work well with the particular type of antenna in use at the moment. If you change the length of antenna wire this antenna condenser will usually need readjustment.

Parts List for Vest Pocket Set

- RCA (Tube)**
1—955 Radiotron ("Acorn" tube).
- HAMMARLUND**
1—50 mmf. midget tuning condenser No. APC-50.
1—140 mmf. mica-dielectric trimmer condenser.
- SOLAR**
1—.001 mf. mica midget condenser.
1—.0001 mf. mica midget condenser.
- I.R.C.**
1—1 megohm, ½-watt, resistor.
- CANNONBALL**
One pair headphones (or Trimm high-impedance single earphone, of the type used for hearing aid apparatus).
- Battery—Burgess or National Carbon Co.
- MISCELLANEOUS**
1—midget single-pole, single-throw toggle switch.
1—3-gang phone-tip jack.
1—2-gang phone-tip jack.
1—single insulated phone-tip jack.
1—indicator plate, numbered 0 to 100.
1 small knob for ¼" shaft.
1—Bakelite tube, ⅝" diameter, 2¼" long.
1—Bakelite tube, 1" diameter, ⅝" long.

TWO TUBE PORTABLE MIDGET SET

● A SIMPLE two-tube battery-operated receiver which will operate a loud-speaker and is small enough to carry wherever one goes is described in *Le Haut-Parleur* of France. The parts required are extremely simple, there being but one easily wound coil which contains the primary, secondary and tickler windings. This coil is wound on a form 1⅜" in diameter, number 24 enameled wire being used. The grid coil consists of 96 turns, spaced ¼" from the antenna coil. The plate coil is similarly spaced and consists of 40 turns. The antenna coil consists of about 20 turns. If the set fails to function when first hooked up, reverse the connections to the various coils until it oscillates satisfactorily. Regeneration is controlled by means of the 500 mmf. variable condenser. The speaker should be a midget one of the magnetic type.



Hook-up of 2-tube portable.

Answers to "What's Wrong with This Hook-Up?"

1. R.F. tuning condenser T-1 incorrectly connected. It doesn't tune the secondary of the antenna coupler.
2. RFC-1 choke doesn't belong in filament circuit.
3. Rheostat R is "short-circuited."
4. RFC-2 is connected on wrong side of tickler circuit.
5. Grid leak R1 connected wrong! Should connect direct to grid of tubes.
6. No regeneration control is included in the circuit.
7. "B" battery shown reversed. (B- is connected to the B+ post.)
8. TR (output) transformer is superfluous (detector plate circuit should feed directly into P1 of speaker transformer ST). Undue loss would result by use of circuit shown.
9. Loud-speaker shown in place of phones—the usual equipment for a two-tube set like that shown.
10. Filament circuit should be grounded to wire C.
11. By-pass condenser C "kills" detector tube filament circuit.
12. By-pass condenser C1 should connect to ground.
13. No "cut off" switch shown to open filament circuit.

Credit On Set Construction

Credit is due Andrew Tait for his able work in building the Television Signal Booster described by Ricardo Munitz in the May issue, page 12.

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Edited by Herman Yellin, W2AJL

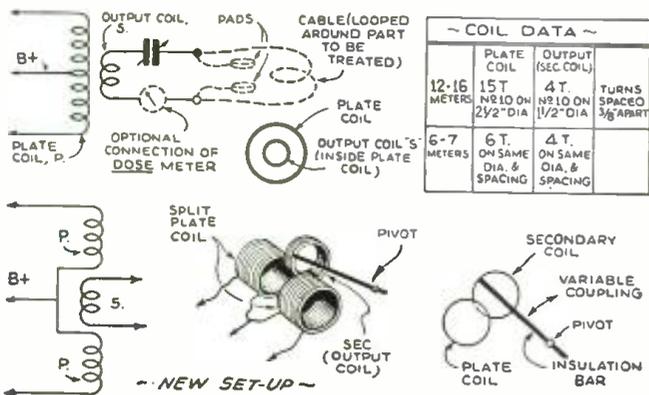
Hum in Pick-Up Circuit

? I recently built an audio amplifier for use with an electric guitar, using a home-made pickup unit. When the pickup is attached, I get quite a bit of hum. Can you suggest any remedy?—R. Williams, Ontario, Canada.

A. The hum is caused by using an unshielded cable between the pickup and amplifier. Ground the shield to one terminal of the pickup and to the chassis, not forgetting to ground the chassis to a good water pipe.

S-W Diathermy

? How can I connect an insulated cable to the output terminals of the short-wave diathermy machine, described in the February issue of RADIO & TELEVISION.—H. F. Smith, Buffalo, N. Y.



Improved hook-up of S-W Diathermy output circuit. No. 1220.

A. The accompanying diagram shows how a heavily insulated cable may be connected to the output terminals in place of the usual treatment pads. Note that a high voltage variable condenser is connected in series with one of the terminals, which will help to control the treatment current passing through the cable. The cable should be a heavy (flexible) copper wire cable with a piece of rubber tubing slipped over the outside.

The coil data for the H.F. output transformer for the diathermy apparatus is given herewith. A good method for varying the output current is to mount the secondary coil on a lever, so that it can be moved into or out of line with the two sections of the primary or plate coil. An optional connection of the dosage meter is shown by dotted line in the diagram.

Ore and Metal Locator

? Please show simplified diagram for the Bettis ore and metal locator described in the February issue, page 587.—H. Swenson, Detroit, Mich.

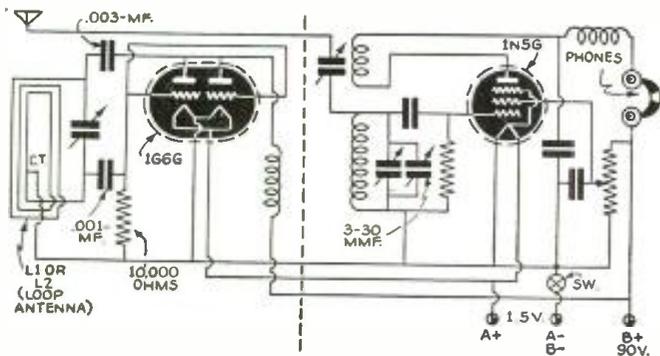


Diagram of ore locator. No. 1221.

A. Herewith diagram showing improved hook-up supplied by Mr. Bettis. The changes made convert the transmitter from push-pull to Hartley type. This makes it easier to tune, as the signal is broader and the harmonics are more distinct, especially the second,

fourth, and so on. The only change made in the receiver section was to parallel a 3 to 30 mmf. trimmer condenser with the tuning condenser, to make tuning more accurate, which is necessary for efficient operation. Tune the receiver to one of the harmonics and with the receiver slightly off zero beat (or a weak signal in the headphones), place metal in field of loop, and it will cause signal to increase or get weaker (or quiet). The other side of zero beat will cause the reverse in signal. Tune to the side where the signal will increase and operate locator with weak signal in phones. The locator should be tuned in the position it is to be operated in. The loop should be in position with distance from ground about as it is to be operated.

Grid-Leaks for Transmitters

? Is there any method of calculating grid-leak resistance values for amplifiers in transmitter applications?—J. Solms, Ridge-wood, N. J.

A. The value of the grid-leak (where grid-leak bias is desired) is determined by the amount of bias needed and the value of the grid current. Where the desired grid current and bias are known, the grid-leak resistance is found by dividing the bias voltage by the current in amperes. Where receiving type tubes are used and the maximum grid current is not known, it would be best to use an adjustable grid-leak resistance and measure the voltage across it with a high resistance voltmeter or a vacuum-tube voltmeter. Naturally the amount of grid bias will be determined by the type of amplifier.

Beginner's Receiver Query

? I am building the S.W. and B.C. 2-tube Beginner's Receiver described in the March issue, and although the parts list calls for three 4 mf. condensers, I can't find them on the diagram.—B. Rinker, Deposit, N. Y.

A. These condensers were incorrectly included in the parts list. Omit them.

Dipole Antenna Dimensions

? What is the spacing between the two sections of a five meter dipole antenna, using twisted-pair transmission line?—P. Robertson, Springfield, Mass.

A. The spacing should be about five inches, with the twisted pair transmission line fanned out for about 5 inches, making a small equilateral triangle about five inches on a side. This will improve the impedance match. If the line is a long one, it is suggested that a transposed open wire line or a concentric line be used, in order to keep line losses at a minimum.

Frequency Modulation

? If frequency-modulation is widely adopted, will it cause present broadcast sets to become obsolete?—R. A. Rice, Alhambra, Calif.

A. With regard to frequency-modulation, we believe that if it is adopted by radio stations that this will follow along in a slow and orderly fashion and owners of the present day sets will have nothing to fear therefrom.

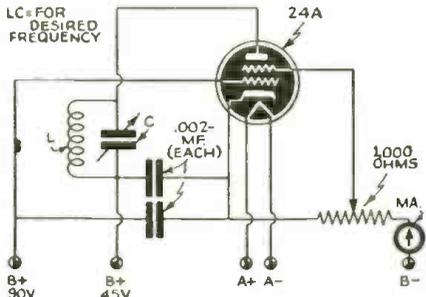
The Radio Manufacturers' Association will undoubtedly watch over the development of the F/M broadcasting. Moreover, it would be physically impossible to put this system into operation "overnight." As F/M comes into more everyday use, adapters will find their way into the market in our estimation and there are several available on the market now.

Queries to be answered by mail (not on this page) should be accompanied by fee of 25c (stamps, coin or money order). Where schematic diagram is necessary, our fee is 50c up to 5 tubes; for 5 to 8 tubes fee is 75c; over 8 tubes, fee is \$1.00. No picture diagrams can be supplied.

Dynatron Oscillator

? What is a dynatron oscillator?—Joseph Riley, Oklahoma City.

A. A dynatron oscillator is characterized by the use of a tetrode tube having a screen voltage about twice as high as the plate voltage. Operating in this manner, there will be a reduction of plate current when the plate voltage is increased, as though the internal plate resistance were negative. Oscillations will be set up and its frequency determined entirely by the resonant circuit in the plate circuit. Unlike other types of oscillators, there is no feed-back between plate and grid circuits. Although a stable oscillator, it has been largely replaced by the electron-coupled oscillator.

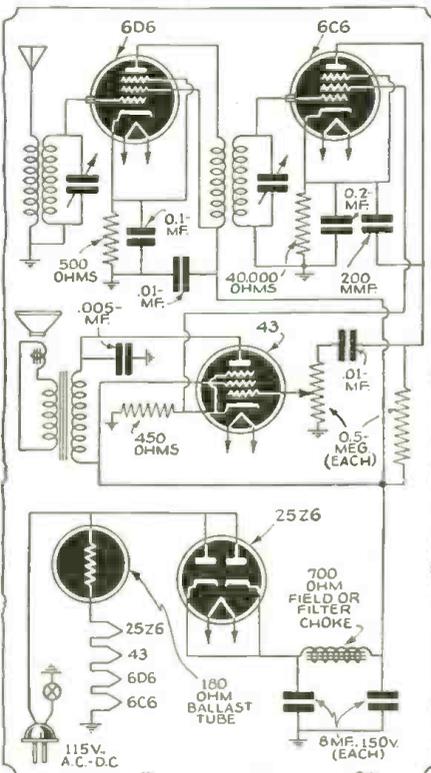


Dynatron oscillator hook-up. No. 1222.

4-Tube A.C.-D.C. Receiver

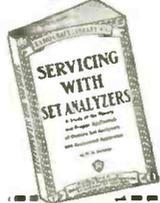
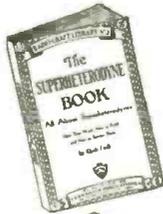
? Please publish a diagram of an A.C.-D.C. T.R.F. receiver using a 6D6, 6C6, 43 and 25Z6 tubes.—H. Charles Odell, Trenton, N. J.

A. The A.C.-D.C. T.R.F. receiver shown herewith uses the 6D6 as an R.F. stage, the 6C6 as a detector, and the 43 as its power amplifier, while the 25Z6 is employed in its usual position as rectifier.



Standard coils and condensers are used for tuning. No. 1223.

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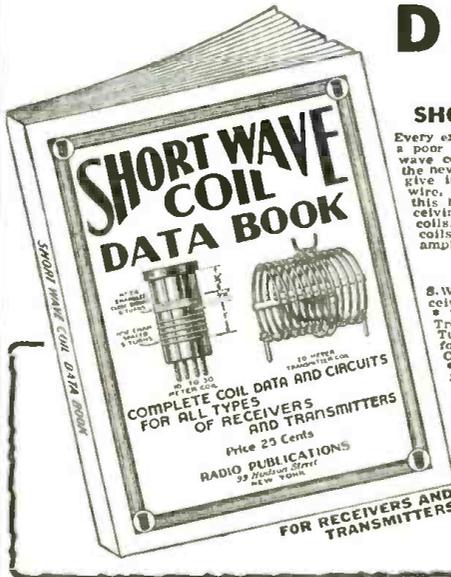
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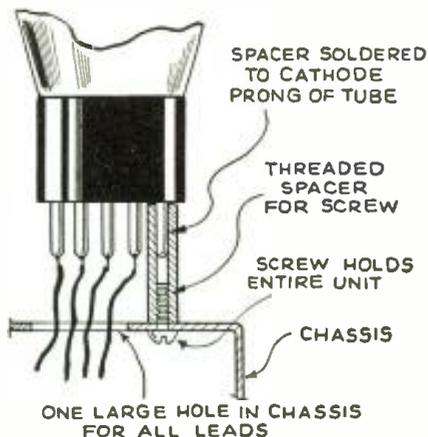
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Novel Tube Mounting

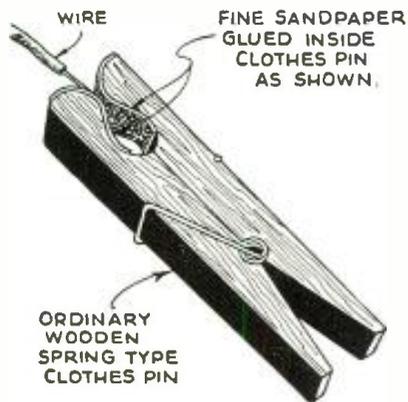
In circuits where the cathode prong of a tube is to be grounded, this may be used as an efficient mounting for the tube. A metal stand-off or spacer drilled and tapped to take a screw is soldered directly to the cathode prong; this is done by holding the iron to the side of the spacer. This is then mounted directly on the metal chassis through one hole by means of a machine screw. The other leads to the tube



are soldered directly to the remaining prongs. If lower capacity between these prongs and ground is desired a large hole may be cut in the chassis beneath them. If all grounds are to be brought to one point, this may well be the screw which holds the spacer to the chassis.—James Solms.

Fine Wire Scraper

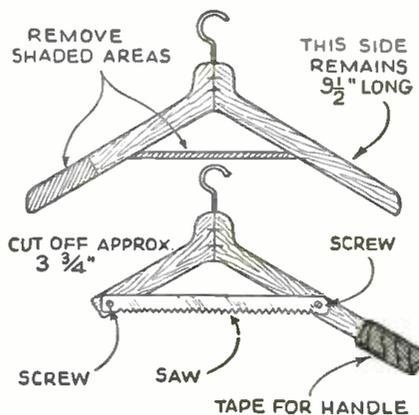
While it is easy to remove an enamel coating from the larger sizes of copper wire before making connection, it is very hard to do with the hairlike wire such as is found in the windings of head phones, audio transformers, etc. If one has a clothes-pin of the spring type and two small pieces of fine sandpaper, a scraper for fine enameled wire is easily made. The two pieces of sandpaper



are glued on the inner surfaces of the clamp end of the clothes-pin as shown. The wire is then gripped with even tension and the enamel removed as the wire is drawn between the sandpaper surfaces. Should the wire break, weaken the tension of the spring a trifle.—Sam Garner.

Home-Made Hacksaw

An emergency hack-saw frame is made from a wooden coat hanger. First drill a hole through each of the legs at a distance which will permit the blade to be fastened with some tension. Next saw one of the legs off just below the blade and remove the center stick that is used as a



trouser rack in the hanger. Finally the blade is attached with two screws as shown. If the handle of the improvised hack-saw is then wound with friction tape a better grip is afforded.—Reinaldo Ghigliotti.

Personalized QSL Cards

QSL cards which bear your name or call letters and address in attractive spatter print are easily made from standard U.S.

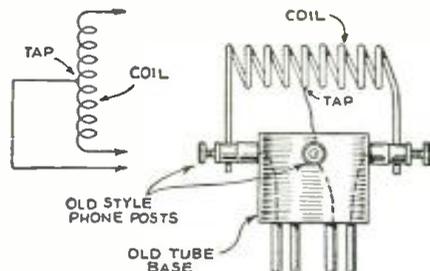


penny postcards. First, make a full size design on an old postcard, sketching your call letters and QRA and other design and then cutting these out to make a stencil. Second, put the stencil over the postcard on which the design is to appear and fasten it firmly in position with thumb-tacks or Scotch drafting tape. Finally, dip a toothbrush into ink or thin poster paint of the desired color and stroke the toothbrush with a finger or small stick so as to spatter the color through the stencil and onto the card.—Donald Johnson.

On the Cover

U. S. W. Plug-In Coil

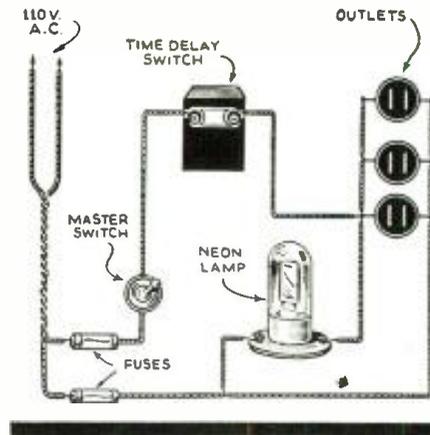
In order to convert a plug-in coil receiver to ultra short work on the 2 1/2 and 5 meter bands, it is necessary only to make special coils. I had very good results with the type shown herewith. Three old-style phone binding posts are mounted on a tube base. The coil, wound out of heavy enough wire to be self-supporting, is mounted in these posts in the manner illustrated. I



have used this kink on my super-regenerative receiver with excellent results.—John W. Planinac.

Wiring Work Bench

One who experiments with electricity or radio is likely to blow the house fuses, or perhaps to walk off and leave soldering irons, power-packs, etc., operating. But not with the stunt described. The fuses shown are of the automobile type and of a lower current carrying capacity than the house fuses. If excess current is drawn, these fuses will blow first. A master switch is installed in the line and also a time-delay switch, which will shut off the power to the outlets in about 20 minutes, unless reset. This makes it unnecessary for you to wonder whether you have left the iron on or apparatus connected when you go to bed or are called away. A 1 1/4 watt neon lamp indicates when the current is on, and a convenient number of outlets are provided in parallel with it. The whole system can be built in a compact box and mounted on the bench or on the wall.—Raymond Zitta, W2MOA.

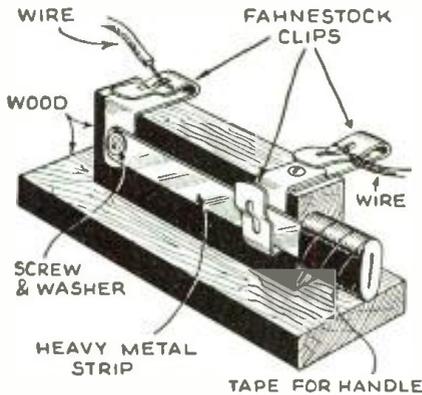


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Improved Knife Switch

In a time of emergency I needed a switch and had none. However, I did have a handful of Fahnestock clips and some heavy



brass strip together with a little wood. The brass strip and clips were mounted on the wood block as my sketch shows and the end of the strip was wound with several layers of friction tape to form a safe and convenient handle. The clips not only afford convenient connections but the one into which the blade fits has sufficient tension to insure a firm wiping contact.—*Ananias Locillo.*

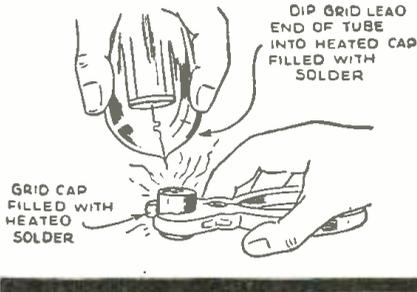
Calibrating Dial

When calibrating a small regenerative receiver it is not necessary to be able to pick up a signal at numerous points on the

dial, for a set using a "magic-eye" can be used as a monitor. Turn on the set to be calibrated and set the receiving condenser at zero, while the regeneration control is turned up full. Scan the band with the larger receiver, until the magic eye closes but no voice or music is heard. This will indicate the carrier frequency at which the regenerative set is oscillating. Note the frequency as indicated by the larger set at which this occurred. Then retune the smaller set a few divisions of the dial and repeat the process until the complete dial is calibrated.—*C. H. Leary.*

Grid Cap Repair

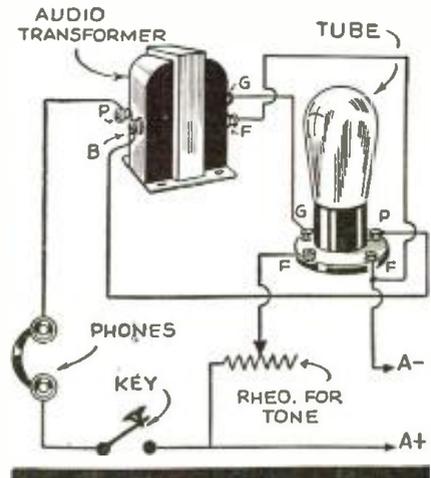
If the grid cap of a tube becomes loose and the connecting wire breaks off so short that you cannot make a connection to it in the usual way, try this kink. Clean out the



grid cap, invert it, and fill with molten solder, then press the tube tip into this solder and hold the tube in place until the solder has hardened.—*Graham Polonsky.*

One-Battery Oscillator

No source of power other than a single dry cell or other A battery is needed with this code practice oscillator. Generally speaking, a 30 ohm rheostat will provide ample resistance, although it may not give sufficiently fine control when some of the new low voltage tubes are used. The key may be of the standard commercial type, but can also consist of a strip of spring brass bent to form momentary contact with a brass screw head. Any type of phones may be used but if crystal phones are employed, they should be connected to the secondary of an output transformer, the primary of which is connected where the phones are shown in the accompanying diagram. (*Unsigned.*)



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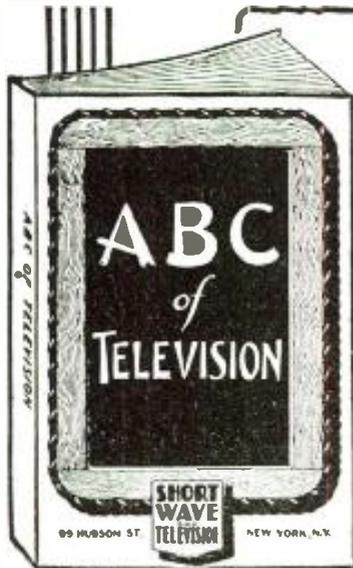
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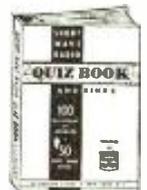


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Experiments With

Ultra-Violet Light

M. Harvey Gernsback

● ONE of the most fascinating fields of experimentation is with *ultra-violet* radiation. Ultra-violet rays produce remarkable effects on many minerals and common everyday objects. Many substances, when viewed under ultra-violet light in a dark room, fluoresce or glow in startling fashion. In addition to the purely theatrical effects obtainable, these rays have many practical applications. To mention but one: certain chemicals dissolved in water can be used for *invisible writing*, which becomes clearly visible when exposed to ultra-violet radiation. This principle is used today in invisible laundry marks stamped on clothing.

There are several effective sources of ultra-violet light which are within the reach of the pocket-book of the average experimenter. First of all is the Argon lamp. These bulbs, when screwed into the usual electric light socket, give off a light rich in ultra-violet rays. Many substances, when viewed under the light of an Argon bulb, will fluoresce with striking brilliance. However, to get the most effective results from an Argon bulb it is best to place a filter between the Argon bulb and the object to be examined. This filter is made of a special glass which absorbs most of the ordinary light and passes only the ultra-violet light. When this is done, a great many other substances will fluoresce. Another source of ultra-violet ray for the experimenter is in the use of a special incandescent lamp, the bulb of which is constructed of a special filtering glass. When this bulb is inserted into the electric light socket and turned on, most of the visible light is absorbed by the glass and only the ultra-violet light shines through.

The third source of light which, however, is much more expensive, is a mercury vapor tube used in connection with a suitable filter.



All sorts of weird effects are obtainable by the use of an ultra-violet lamp. The teeth, buttons, and other objects fluoresce under the effects of ultra-violet light.

The mercury vapor arrangement will deliver a higher intensity of ultra-violet light.

Fluorescent Substances

Of the easily secured fluorescent chemicals, the ones giving the most striking effects are uranium nitrate, quinine sulphate, eosin, rhodamine and sodium salicylate. Sodium salicylate is found in considerable quantity in the ordinary aspirin tablet. Quinine sulphate gives a pale blue fluorescence in powder form, but when dissolved in water together with a small amount of citric acid, it glows brilliantly. This solution can be used for invisible writing and is completely invisible under ordinary lighting.

Eosin fluoresces a pale yellow color when dissolved in water. With rhodamine you can obtain a red fluorescent effect which is very effective. Rhodamine may be dissolved either in alcohol or water. When dissolved in alcohol, a little shellac may be added to make a fluorescent paint for use on signs

or pictures which will show up very strikingly under ultra-violet light.

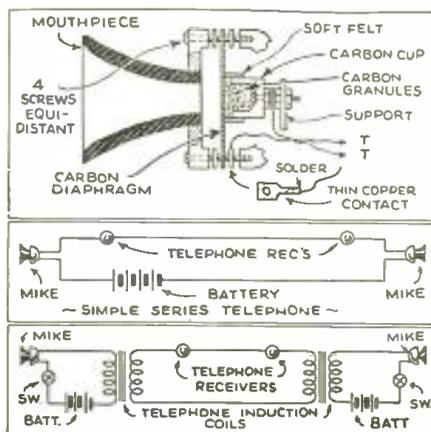
Certain minerals also fluoresce in ultra-violet light. Among the common ones are fluorite, wernerite, semi-opal and willemite. Wernerite appears with a yellow glow under ultra-violet rays, whereas willemite has a greenish radiation. The fluorescent property of these minerals makes it a relatively simple matter to identify different minerals which look alike in ordinary light, since they will fluoresce with different colors under ultra-violet light.

Among the common household objects which can be used for experimentation are such things as the pearl buttons on shirts, ordinary kitchen glassware (particularly green glassware), mineral or olive oil, butter, cheese, and some toilet soaps. Dissolve a bromo-quinine tablet in a tumbler of water. When placed under ultra-violet light you will find that the solution fluoresces a brilliant pink. The fluorescent action is due to the quinine in the water. Ordinary vaseline fluoresces a bright blue color, as do most lubricating oils. A novel make-up effect is had under the ultra-violet lamp by smearing a small dab of vaseline on the lips and cheeks.

Probably the most startling effects of all are those which occur with the finger nails, eyes and teeth when exposed to ultra-violet light. One interesting thing about the fluorescence of teeth is that real teeth fluoresce, false teeth do not. If you suspect any of your friends of having false teeth, this is an easy way to check up on them. You will find that real teeth as well as the eyes, etc., mentioned will glow a pale blue shade. This demonstration with teeth is particularly startling if the room is made completely dark for a moment and then the ultra-violet lamp is suddenly turned on.

SIMPLE MICROPHONE

● THE young experimenter often desires to have a microphone but does not have the money with which to purchase one. An experimental microphone may be made as here shown. A thin carbon diaphragm (these are available from radio and electrical supply dealers) is carefully but rigidly supported between two circular members or shells, which may be of wood and provided with four clamping screws. The front and rear shells or cases may be turned from wood in a lathe, if you are handy with tools, or an old microphone case may be picked up from your local radio dealer or telephone exchange. The carbon granules should be purchased, as they come in highly polished form, and a quantity of them is placed in a carbon cup. This cup member may be made from a piece of arc or battery carbon or else taken from an old telephone microphone.



Simple microphone construction and circuits for rigging up your own telephone line.

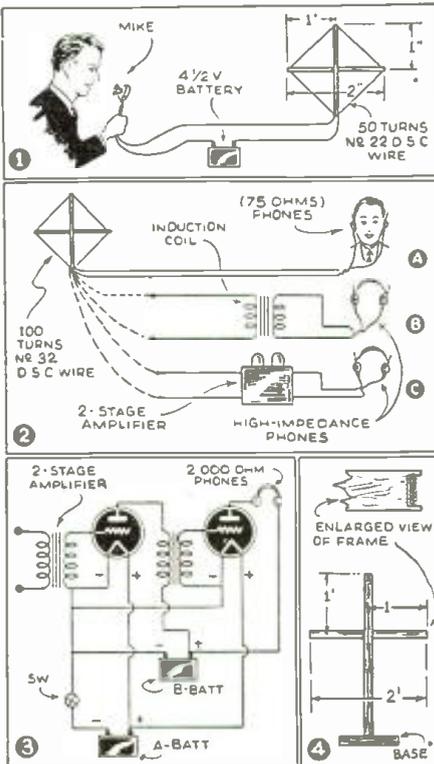
A piece of very soft felt is tied around the carbon cup electrode with a few turns of thread, so as to hold the carbon granules in place. Do not place so many granules in the cup that they will tend to pack, but just a sufficient quantity so that they have room to move whenever the carbon diaphragm vibrates when the mike is spoken into. A little experimenting will determine the proper quantity.

A couple of diagrams are shown herewith, whereby the experimenter can try out his home-made microphone; the receivers should be of the 75 ohm telephone type. In the series telephone circuit, no induction coils or transformers are used, while in the second diagram regular telephone induction coils (or mike transformers) are employed. A couple of dry cells is usually sufficient to supply the talking current.

INDUCTION LOOP TELEPHONE

● HERE is an induction loop radio-phone which comes in handy every now and then, either for demonstration purposes or for talking from one room to another. The loop antennas measure 2 ft. square, the transmitting antenna having about 50 turns of No. 22 D.S.C. wire. The receiving loop is also 2 ft. square and contains 100 turns of No. 32 D.S.C. wire.

At the transmitter a single-button microphone may be connected in series with a battery of 4½ volts or so, and the loop antenna. For a simple receiving circuit you may experiment with a pair of 75 ohms headphones connected directly to the receiving loop. A better impedance match, and therefore stronger signals, can be obtained by connecting a matching transformer or induction coil between the loop and pair of phones. This transformer is particularly desirable if you should happen to use a pair of 2,000 ohm or higher impedance headphones, which would make a considerable mismatch with the loop impedance.



The induction loop telephone requires no federal license; it is useful for short distances.

Where a longer distance than 15 ft. or so are to be negotiated with this induction type radio-phone, the receiver may have its sensitivity increased by using a stage or two of audio amplification, as shown in the diagram. The A.F. transformers may be of about 3 to 1 ratio, while battery type tubes, such as the new 1.4 or else 2 volt tubes can be used, with about 90 volts of B battery to supply the plate current. With such an amplifier, a sensitive permanent-magnet type loud-speaker may be substituted for the phones if desired.

Another suggestion, where greater range is required, is to make the loops larger (say about 4 to 5 ft. square, instead of 2 ft.) and a vacuum tube amplifier stage or two may be inserted between the microphone and the loop at the transmitter.

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This battery-less flashlight generates its own power merely by pressing handle. Gives strong light whenever needed. Costs nothing to maintain. A amazing new miniature dynamo operates flashlight. Pocket size, 4¾" x 2" x 1". Shp. Wt. 2 lbs.



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Built by Honeywell as a temperature regulator for coal fired furnaces but ideal for many other uses, especially for rotating beam antennas on the roof for directional beaming and reception of radio signals. Built-in commutator switching permits turning antenna from north-south to east-west direction from remote point. Constructed for hard usage. Has double-end shafts geared down to about one revolution per minute. Ideal for window displays and other slow moving mechanical motions. 110 volts, 60 cycles. A.C. only. 6½" x 6½" x 4½". Shp. Wt. 10 lbs.

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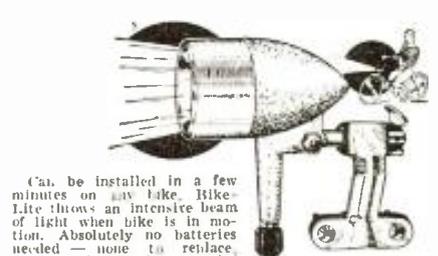
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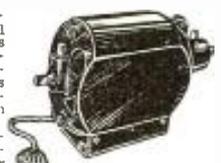


Can be installed in a few minutes on any bike. Bike-Lite throws an intense beam of light when bike is in motion. Absolutely no batteries needed - none to replace. Costs nothing to operate. Small, built-in generator, turned by the bike wheel saddle, unfailing current. Most economical headlight yet. Guaranteed for lasting performance. All metal construction with beautiful silver finish and polished chromium-plated reflector. Armature operates with a powerful Alnico General Electric permanent magnet. Measures 4" x 5¾". Complete with bulb and instructions, ready to attach. Shp. wt., 3 lbs.

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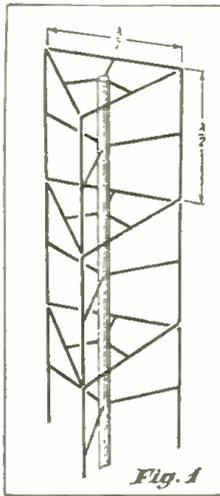
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DIGEST OF RECENT RADIO PATENTS

NON-DIRECTIONAL ANTENNA



● THE directional properties of the short-wave broadcast antenna, and the polarization of its signals are utilized effectively in point-to-point communication for commercial purposes. However, for broadcast purposes, where they benefit one listener, they disadvantage another. A non-directional broadcast antenna for short waves, in the form of a skeleton tower is described in a patent (No. 2,197,051) issued to Nils E. Lindenblad and assigned to R.C.A., wherein three radiating conductors are arranged in a triangle around a central support; each being divided into half-wave sections, at right-angles to each other, successively horizontal and vertical. Thus each is a spiral, and the interaction of the fields of the three is to produce a circularly polarized field, and a more uniform distribution of signals. "Reception over water," observes the inventor, "is in general better when a vertical polarized signal is used, and horizontal polarization gives better results over land." For his invention, he claims a combination of advantages for land and water.

DUAL CRYSTAL CONTROL

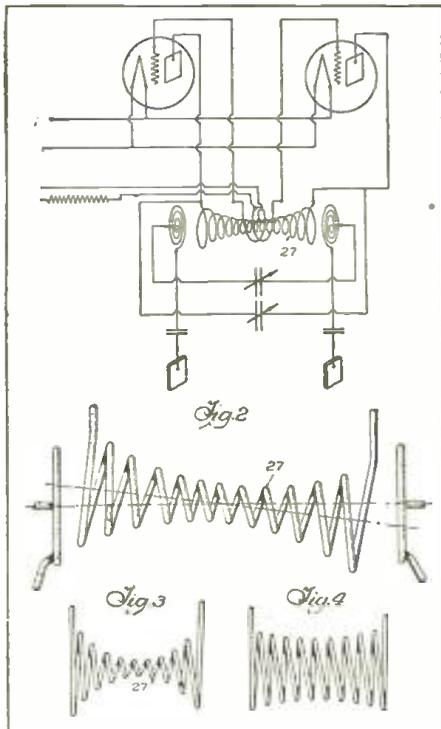
● THE principle of using a quartz crystal to control, by its fundamental vibration, the frequency of a carrier wave is known to all. A two-crystal set-up for a filter, one crystal regulating the upper frequency and the other the lower which the circuit will pass, is described in a patent (No. 2,199,921) issued to Warren P. Mason and assigned to the Bell Telephone Laboratories.

Look for These Features in July RADIO-CRAFT

- Replacing I.F. Coil Windings
- Rebuilding Transformers Is Profitable
- Your Fellow Serviceman Builds a "Signal-Tracer" Test Unit
- How to Build a Practical Tube Tester and Set Analyzer-Adapter
- A Triode Direct-Coupled Amplifier, with Non-Frequency-Discriminating Scratch-Suppressor
- "Transitional" P.A. System (Uses Radio Set)
- The ABC of Electronic Automatic A.C. Voltage Regulators
- A "3-in-1" Battery Portable
- Choosing an F.M. Antenna

DIATHERMY TUNER

● OLD-TIMERS in radio remember the variometers and variocouplers of assorted types then in use. Some may even have a few of them in the back of a drawer somewhere. For the purpose of adjustment of medical short-wave therapy apparatus to the frequency desired by the doctor, Messrs. Bayless, Bauer and Fisher of Chicago have obtained a patent (No. 2,198,073) on peculiar coupling coils. These, as shown, are of metal tubing, as they carry considerable current, with turns of small diameter in the center and large at each end; and may be adjusted at different angles with each other and with the pancake spiral coupling coils connected to the electrodes, which are applied to the patient. With these, it is claimed,



Method of tuning diathermy output.

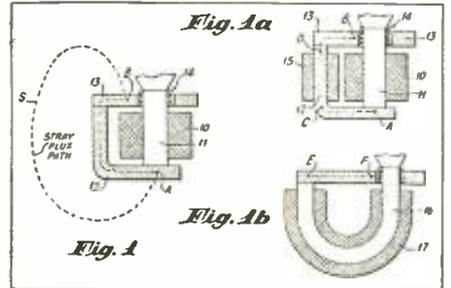
tuning from 30 meters down to a fraction of a meter is obtained, by the aid of only two variable condensers, without the need of changing a coil.

TWO-WAY TELEVISION

● LATEST of the patents (No. 2,197,005) on television devices issued to Alexander McLean Nicholson, prolific inventor, is one describing a two-way system intended to be operated by persons of only lay experience and perhaps, like the domestic telephone, in a large system; though requiring in this case a "central" for a source of synchronism. As it operates in both directions at the same time, each transmitter scans with ultra-violet or infra-red radiation, to avoid interference with the action of the receiving scanner. A special device, styled by the inventor the "metronome," is used to insure the proper framing of the image at the receiver: while a "synchronome" ties the motors to a common step,

MAGNETIC SHIELD FOR LOUD-SPEAKER

● TO eliminate the effect of the magnetic field of the dynamic speaker on the cathode-ray beam, which sometimes produces distortion when the speaker is located too close to the television tube, Robert



Prevents speaker field from affecting CR beam.

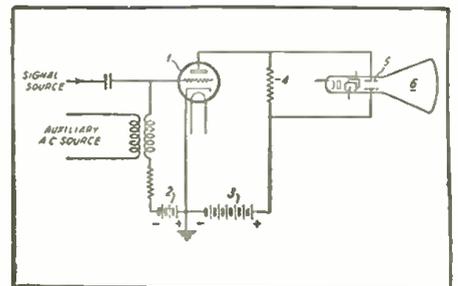
Andrieu (assignor to Telefunken) obtained patent No. 2,197,329 for a speaker with completely enclosed field. This is obtained by providing an additional pot-shaped element of iron as a return path for stray magnetic flux.

MOSAIC SCREEN

● A NEW construction for the photo-electrode, or "mosaic screen" of the television transmitting tube, to reduce secondary emission effects, appears in patent No. 2,198,327, issued to Bandringa and Teves, and assigned to R.C.A. The sheet of mica has a film of metal (aluminum, platinum, gold or chromium) so thin that its resistance is at least 10,000 megohms per centimeter of length for a width of 10 centimeters, over which are distributed the photoelectric particles. This film of metal is intended to suppress the secondary electron emission of the mosaic under the bombardment of the cathode ray.

DIRECTION FINDER

● THE principle so much used in the adjustment of radio receivers—that is, determination of minimum output with the aid of the serviceman's oscillograph, is the subject of a patent for the construction of direction-finding equipment (No. 2,197,353) issued to Gunther Ulbricht and Rudolf Weber, and assigned to Telefunken. When the radio compass is at right-angles to the direction of the incoming signal, the latter is weakest and the fact is apparent

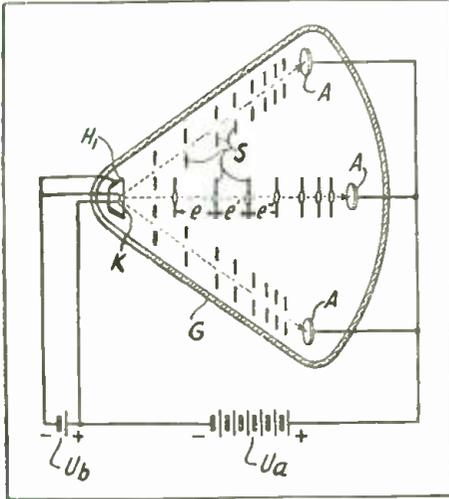


CR tube used in Direction Finder.

on the screen of the cathode-ray tube, more exactly than by the use of headphones to check an audible signal.

MICRO-WAVE RADIATOR

● FOR about eighteen years waves of one millimeter (.04 inch) length have been known as laboratory curiosities. Obviously, they cannot be generated by the ordinary type of transmitter; instead, small bits of metal are "shocked" into resonance by a spark discharge. A recent patent (No. 2,197,338) issued to Karl Fritz of Berlin, and assigned to the Telefunken Co., pro-



Radiates waves .04 inch in length.

poses a means of utilizing this on a practical scale. The radiating bodies, S in the illustration, are half-wavelength, insulated from each other and parallel at distances decreasing as they get further and further away from the source of energy K. The latter sends out charged particles past the radiating bodies, at right-angles to their length. The patent specifies "charged free molecules"; but discusses the use of secondary electrons, liberated by the primary electrons of a spark discharge. These are to be sent out "in pulses having a harmonic relation to the natural resonant frequency of said radiators." It may be commented that such microwave radio must require a distinct technique of its own. Radiation at 300,000 megacycles is "infra-red," being as much higher in frequency than 1/2-meter ultra-short radio, as it is lower than visible light. In addition to this, the wave must necessarily be extremely broad—not "monochromatic" or confined to one frequency—as will be seen when the effect of variance of as little as 1% on the dimensions of the resonating radiator is considered in terms of cycles.

RADIO NAVIGATION SYSTEM

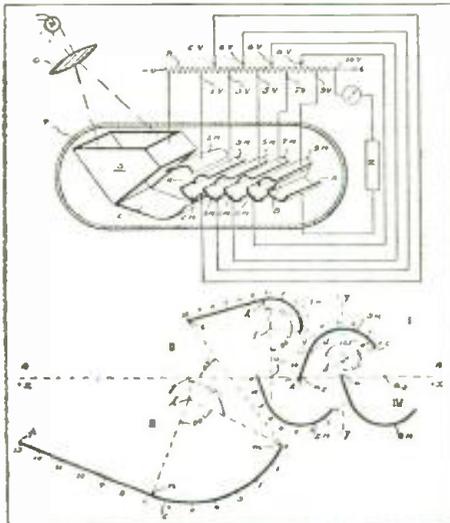
● NAVIGATION is aided by the use of a radio beam, or any bearing of a distant object obtained through determining its direction from the observer. If we have two directional bearings, on points whose position is known, there is no difficulty in indicating our position on a map. However, by an application of geometry which is equally fundamental, if the distances of two objects are known, instead of their direc-

tion, control of aerial navigation. The principle is the change of phase in the modulation of a carrier wave as it travels along; for instance, 90° in 9.3 miles, in the case of a 5,000-cycle note. It is proposed in the patent to synchronize the modulation of waves from the beacon stations, so that difference of distances from them can be determined. A special chart of them will be required, however; since the map of "phase difference curves" will be a pattern of hyperbolas, rather than straight lines.

ELECTRON MULTIPLIER

(Illustrated on Front Cover)

● HAVE you puzzled over the layout shown in the patent drawing reproduced on the cover of this issue? It is the set-up of an "electron multiplier" for which patent No. 2,198,227 was issued to Eugene W. Pike and others, and assigned to R.C.A. The purpose, of course, is to increase the current obtained from a photo-electric device. The first element, the photo-cathode (C in the figure reproduced) is made as large as possible, and light is focused upon it. It gives off from its coated surface electrons, of rather low velocity; these are attracted to the first multiplying electrode, 1M, which has a comparatively low positive voltage impressed on it. The impact strikes out more electrons, and they are attracted to electrode 2M, which has a slightly higher voltage, and is slightly smaller. The dimensions are carefully calculated, after experiment, and form part of the patent claims. The result is to obtain, at the end,



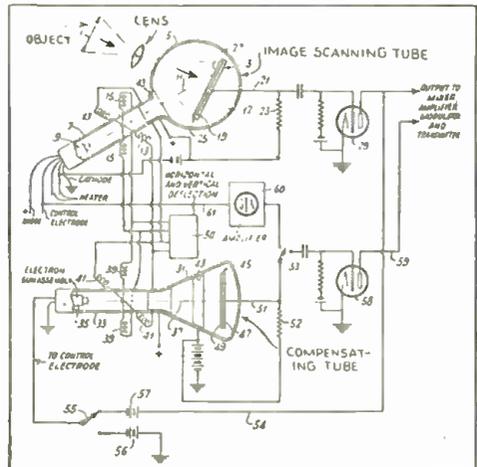
Electron multiplier steps up PE tube output.

a considerable stream of electrons, concentrated with fair uniformity, and moving with the velocity imparted by a considerable voltage. Only part of the nest of electrodes is pictured here.

ICONOSCOPE COMPENSATOR

● THE television device subject

what is known as "black spot distortion" at the receiving end. (It might be compared to playing a searchlight over the screen on which a motion picture is being projected.) Other difficulties include the fact that the scanning speed of the cathode ray is not uniform, though it might be synchronized at both transmitter and receiver, and the angle of the ray on the image is not uni-



Overcomes inherent faults of iconoscope.

form. To overcome these and other conditions, this invention includes in the transmitter a second or compensating tube, which is intended to produce the same conditions as in the actual image scanning tube, except for the image. This is so adjusted as to neutralize, or buck, the elements in the television signal created undesirably, and thus correct the output of the transmitter.



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- CHAPTER V. Powers and Involution—Roots and Evolution.
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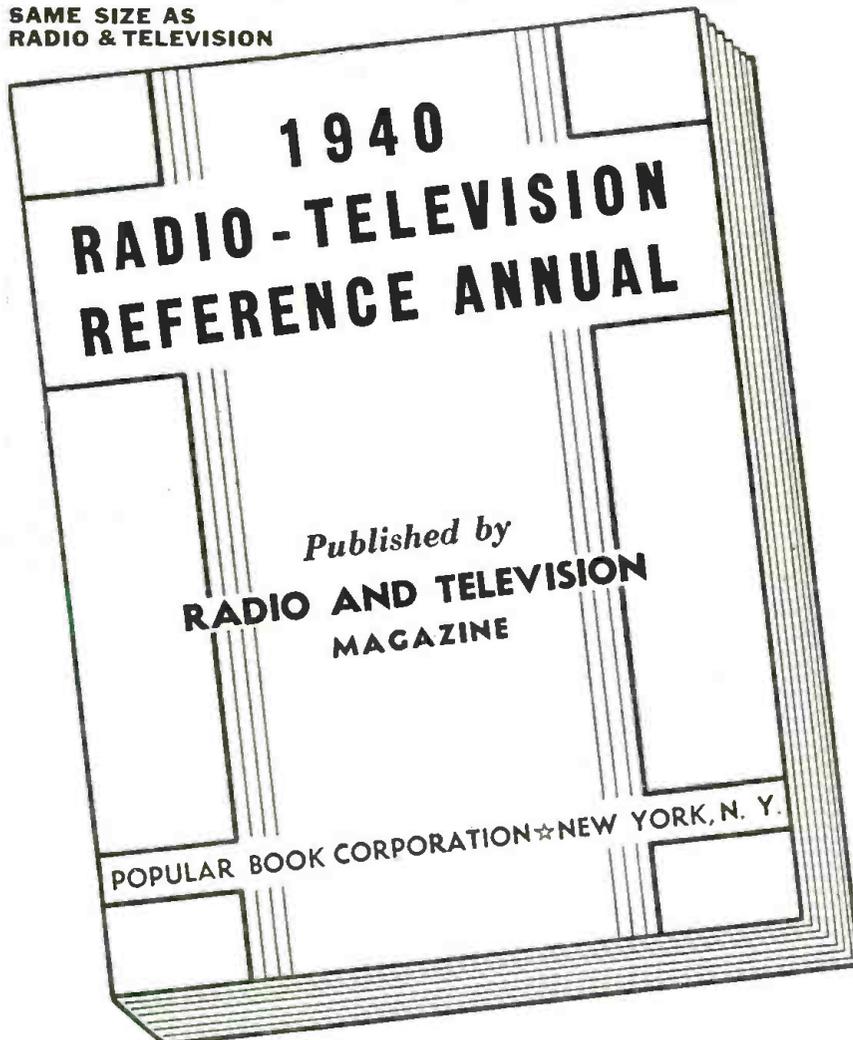
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(approximately)

45 ARTICLES

(approximately)

170 ILLUSTRATIONS

68 BIG PAGES

I Cover the Pacific Coast!

(All times are P.S.T.)

Lyle M. Nelson

● SUMMER short wave reception here on the Pacific Coast is mostly confined to the more powerful daytime European stations and occasional early morning broadcasts from the Far East or "down and under."

Powerful broadcasters in the capitals of Europe still are booming through with daily programs—carrying their propaganda and war news to American listeners. Some English, French or German station can be heard on the 25 or 19 meter band at almost any time during the day.

Transmission 6 from Daventry still is reaching here with good volume over stations GSD on 11.75 and GSC on 9.58 megacycles from 6:37 to 8:30 p.m. daily. Best reception during the summer is usually from GSD.

The German North American program continues to reach here with fair volume daily from 1:50 to 7:50 p.m. over DJD on 11.77 and DJB on 15.20 mcs. Best reception is from DJD near the end of the broadcast.

Once again the very popular Japanese baseball games are on the air. These games are played in the Tokyo ball park on Sunday afternoon and are heard here over JVI on 14.60 mcs. each Saturday night from about 9 to 11:30. The broadcasts are in Japanese, but all balls, strikes, home runs, hits, etc., are called in English since there are no Japanese words for these terms.

A special program for America over the new Budapest station, HAT5 on 9.63 mcs., is heard here with fair volume from 3:55 to 5 p.m. daily, according to Kendall Walker of Yamhill. Best reception, Mr. Walker says, is near the close of the broadcast.

Surprising signals from ZHP of Singapore on 9.71 mcs. have been reported by several Pacific Coast listeners. The station, they report, is on the air from 5 to 6:40 a.m.

HBJ of Berne, Switzerland, now is broadcasting a special program for North America on 14.54 mcs. Mondays and Wednesdays from 5:45 to 7:15 p.m. The station is heard here with fair volume with best reception near 7.

A new Bolivian station announcing as CP43 is reported on 15.16 mcs. by Jack McCliment of Portland. This station is heard near 6 p.m. with fair volume and announces as "Radio Cotagaita," he says.

All Denmark's short wave stations have been taken over by German authorities. Several listeners have reported hearing them on their regular frequencies but with German call letters. DXU, formerly OZH, is heard on 15.32 mcs. from 6:30 to 7:30 a.m. daily, reports T. S. Hite of Los Angeles.

A new Chinese station announcing as XGSE has been reported on 9.80 mcs. in the early morning hours. Location is uncertain, but it is believed that the station is owned by the Japanese government.

John Cavanagh of Oregon City reports that the Finnish station OIE is back on 15.19 mcs. with daily news bulletins in English at 10:20 a.m. The station is weak here, he says.

Saigon's "Radio Boy-Landry" continues to reach here daily near 6 a.m. with fair volume. This station varies in frequency, but is usually heard near 12.01 mcs.

From "down and under" comes the voice of the Australian broadcasting service. VLQ is heard on 9.62 mcs. daily from 7:35 to 8:30 a.m. with a special program for the western part of North America and VLQ5 is heard on 9.68 mcs. with a special program for the East Coast from 4 to 5 a.m. The latter program usually is the best received here.

China's XGOX on 15.19 mcs. has lost considerable signal strength, but still is heard with fair volume each night from 7 to 8:06 p.m. Mr. Walker reports the station from 5:30 to 6:30 p.m.

Over in Japan, JZK on 15.16 is heard broadcasting from 4 to 6:30 a.m. daily with a special Japanese program. No announcements in English.

Another morning broadcaster is 2RO14 of Rome, heard here 6:30 to 8 a.m. 2RO14 is on 15.23 mcs.

COUNT VON ARCO DIES

● GEORG WILHELM ALEXANDER HANS COUNT VON ARCO, Germany's leading radio authority, died on May 7th at the age of 71. Count von Arco originated the idea for the great German radio station at Nauen near Berlin. He formed the Telefunken Gesellschaft, a great German radio corporation in 1903, and subsequently served as its director. Later through his efforts and inventions radio broadcasting was popularized in Germany. Subsequently his work resulted in the establishment of radio telephonic transmission between Germany and the rest of the world.

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| Aerovox Corporation | Parts Mfr. | Catalog | | Free | 189 |
| Allied Engineering Institute | Kit Mfr. | Circulars | | Free | 142 |
| Allied Radio Corp. | Mail Order | 172-Page 1940 Catalog | | Free | 141, 145 |
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| Amplifiers-Distributors Corp. | Intercommuni- cation System | Catalog | | Free | 175 |
| Bliley Electric Co. | Parts Mfr. | Circular | D-2 | Free | 158 |
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| | | Bulletin | E-7 | Free | |
| | | Circular | A-7 | Free | |
| Bud Radio, Inc. | Kit & Parts Mfr. | Catalog | | Free | 159 |
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| Tri-State College | Radio School | Catalog | | Free | 131 |
| Vibroplex Co., Inc. | Code Machine | Illus. Catalog | | Free | 154 |

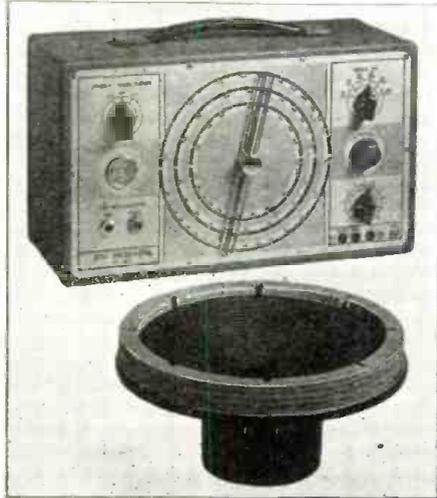
STATIC-FREE TOWN

● STATIC was bad in Richland Center, Wisconsin, according to *Time Magazine*. The good Centerers are avid radio fans and complained of the annoyance they got from vacuum cleaners, electric razors, etc. After making a survey

requested owners of offending apparatus to install filters, but not many agreed. However, the municipally owned power plant sent men around to install filters where necessary, and billed each recipient thereof for the service. Persons who objected were threatened with having their electricity cut.

New RCA Test Oscillator

- RCA's new type 167 test oscillator has all the exclusive features of the former model 153 and several advanced features of its own. This new model has an output cable (see photo below), and a dial and pointer combination which affords a tuning scale of more than 50". The unit has a fundamental frequency range from 100 to 30,000 kc. It is so designed that external frequency modulation may be added for the oscillographic method of servicing. Its other features include a four hundred cycle output of 8 volts for audio circuit testing; 6 bands, minimum signal of two micro-volts and negligible leakage.



Radical Change in Speaker Tone

- THE new accordion-edge loud speaker developed by RCA Manufacturing Co. is said to be one of the most important basic improvements in speaker design in the past few years. It reproduces low frequencies with greater fidelity than possible in speakers of similar size in small cabinets, for it utilizes a folded cone support principle which permits freer movement of the cone. The standard mechanism measures 7" in diameter and 4" deep including the permanent magnet mechanism. It has frequency response from 80 to 7,000 cycles and is also available in a walnut wall housing with sloping baffle. See photo above.

New RCA 16mm Sound Projector

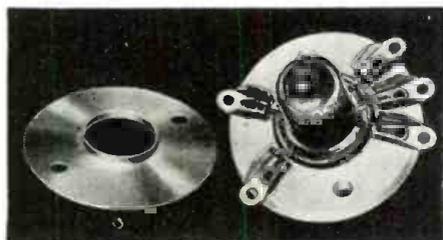
- RCA Photophone engineers have developed a 16mm sound projector for industrial and educational use.

In addition to its exceptional ease of operation, the new projector has many features which are especially interesting to industrial users. These include:

Unusually brilliant projection, f:1.65 optical system, with a standard 750-watt lamp; RCA Photophone sound with push-pull amplification—10 watts rated output; simplified threading with threading line on projector casting; theatrical framing—no change of projector position; efficient cooling of projection lamp. The lamp itself is quickly changed and the lamphouse remains cool after long operation.

Acorn Tube Socket

- A NEW socket for Acorn tubes has just been announced by the Hammarlund Mfg. Co. Known as the type UHS-900 the new socket is provided with silver-plated beryllium contacts, which are



provided with grooves, so that the tube snaps into place; this permits the socket to be mounted in any position as the tube cannot work loose. A metal shield is provided and when used with the pentode type Acorn tube, completes the tubes' internal shielding, thus reducing coupling between input and output circuits and affording higher gain and greater stability. The base is made of "Iso-Q," otherwise known as Super Isolantite, which is said to provide extremely low losses and improved power factor.

Multi-Range Utilitester

- THE latest addition to the Triumph Mfg. Co. line of test instruments is the Model 334 Multi-Range Utilitester. This instrument has 22 ranges, covering A.C. and D.C. voltages on 15, 150, 600, and 3,000 volt scales at 1,000 ohms per volt,



decibels from -6 to +64 in four ranges. Output DB from -6 to +50 in three ranges. A.C. output volts in three ranges, two D.C. milliamperce scales and 2 ohmmeter scales, one to 10,000 ohms and the other to 1 megohm. Weight 2½ pounds.

27-145 Mc. Set for A.M. and F.M.

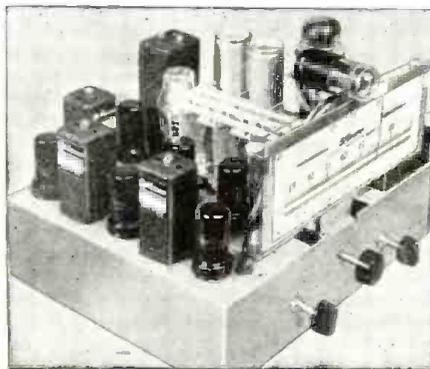
- A RECEIVER which covers 27 to 145 mc. in three ranges has been announced by Hallicrafters, Inc. Fundamentally this receiver, known as the model S27, is a highly refined UHF communications receiver for both amplitude and frequency modulated signals. Among its features are: acorn tubes throughout the R.F. and converter systems; front-panel trimmer to permit maximum antenna gain; voltage regulation for oscillator, converter and metering circuits; extra-wide band-spreading; a new converter system for uniform



gain; double-spaced tuning condensers with silver wiping contacts, cushioned R.F. assembly, automatic noise limiter; oscillator plate-tuned to eliminate hum modulation, separate A.M. and F.M. detectors; 1852 limiter, expanding I.F. including wide band-pass in F.M. position; push-pull audio output with phase inversion and generous inverse feedback for flat and broad response; meter for accurately tuning F.M. signals, etc. Uses 15 tubes.

F-M Receiver

- FREQUENCY modulation is the topic of the hour, and herewith we see one of the newest frequency modulation receivers—designed by the Meissner Mfg. Co. engineers. The range of this receiver is 39 to 44 megacycles. The intermediate frequency is 2.1 megacycles and the set employs 10 tubes. This set has been specially designed to minimize frequency drift. The receiver shown, when used in conjunction with any good audio amplifier and loud-speaker system, will provide excellent reception of the FM signals or speech.



The Telejector

- A NEW electronic device has recently been developed by H. G. Cisin, which makes it possible to pick up telephone conversations and broadcast them through any radio set at loud speaker volume.

A device called an *impulsator* is placed near a telephone instrument. The impulsator is connected to the Telejector which operates from any house lighting circuit. No wires whatsoever are connected either to the telephone circuit or to the radio receiver. When the radio set is tuned to a predetermined point on the dial, it is then possible to listen to both sides of a telephone conversation with full loud-speaker volume.

The impulsator is connected to the Telejector and the first function of this device is to step up the weak induced current and make it possible to use it in the second function. Amplification is attained by means of an electronic audio amplifier.

The second function of the Telejector is to convert the audio frequency signal or the amplified, voice-modulated, audio frequency current, corresponding to the original telephone conversation, to a predetermined radio frequency.

In the Telejector, the constants of the oscillator coil and its tuning condenser have been selected so that the device sends out a wave at about 1590 kilocycles. This portion of the Telejector is actually a miniature broadcasting station sending out messages at 1590 kilocycles. Of course, the power of this transmitter is limited to keep it within the rules of the F.C.C. and the conversations can be picked up only by a radio set placed within 50 feet of the Telejector.

The final step, then, is to tune in a radio set to 1590 kilocycles and listen to both sides of the phone conversation.

The Telejector has many practical applications.

By means of the Telejector, it is possible for a large group of business men to listen in to a telephone conversation with the greatest ease. The device is particularly well-suited for conferences and long conversations. A business man can broadcast a speech to a roomful of people with this device, merely by talking over his home telephone.

By using a powerful radio set, that is, one with a high audio output, it is possible to record any telephone conversation with the Telejector. This is accomplished by connecting a standard recording machine to the output of the radio.

Another use applies to entertainment and experimental purposes. Due to its novelty and startling nature of its performance, the Telejector is certain to be the "life of the party" wherever it is demonstrated.

New 5 Tube Portable

- THE new Knight portable receiver being offered by Allied Radio Corporation makes use of an automatic "switch-over," which affords easy opera-



tion from either batteries, A.C. or D.C. The five tube set, using 1.4 volt tubes, tunes from 540 to 1550 kc. Its features include built-in aerial, 5" dynamic speaker, AVC and slide rule dial. The set weighs 15 pounds, complete with batteries.

Light Around Corners

- EXPRESSLY designed to bring brilliant light at various angles to deeply recessed areas are the A & G—Lites made by the Diagnostic Ultra-Lite Company. The light conducting medium which comes in a wide variety of forms is made of Dupont lucite. The light is provided either from a small pocket flashlight or a miniature transformer which plugs directly into the socket. These lights are useful in illuminating the hard-to-reach spots inside radio sets, etc.

Du Mont Discontinues Small-Image Television Receivers

- CONVINCED, after selling hundreds of its television receivers in the New York metropolitan area, that the public does not care to have "peep-hole" television entertainment, the Allen B. Du Mont Labs. has discontinued all development activities on small picture television receivers. All its resources are now concentrated on the production of "large-screen" direct-vision television receivers, using the 14-inch and the 20-inch Du Mont teletrons.

Adjustable Link Oscillator Coils



• A NEW series of "Airwound" Adjustable Link Oscillator and Buffer Coils has recently been announced by Bud Radio, Inc. These coils are designed for use in circuits where it is desirable to adjust excitation or antenna loading by varying the link coupling.

Each coil is individually linked, and coupling is varied by pushing the link in or out of the main winding. In view of the fact that each coil has its own link, the coupling adjustment for each band can be left permanently set at the proper value.

All coils in this series fit standard 5-prong sockets and are designed for operation in stages where the input power does not exceed 50 watts. Coils are available for all amateur bands.

3 New Dual-Capacity "Atoms"



• THREE new dual capacity midget dry electrolytic condensers with separate positive and separate negative leads have been added to the well-known line of Sprague Atoms. These are especially adapted as duplicate replacements for auto radio receivers and common positive condenser requirements.

The new units include Type TU-220, 20-20 mfd., 150 volts, 1" x 2 3/4", Type TU-216, 16-16 mfd., 250 volts, 1" x 2 3/4", and Type TU-88, 8-8 mfd., 450 volts, 1 1/16" x 3 3/4".

DYNOPTIMUM TUBE TESTERS

• THE new model 308 series D tube tester just announced by Radio City Products Co., incorporates a 9" meter and many other desirable features. It is made for testing all tubes and in addition has spare large and miniature sockets to take care of any new types which may be brought out. It also has provision for testing all types of pilot

lamps, headlight bulbs, ballast tubes, etc. Test for noise anohum are also provided. The line voltage is controllable over a range of 103 to 135 volts and the line is double fused for protection. The tester comes in counter and counter-portable models.

Band Switching Coil Assembly

• WHEN used in conjunction with a 100 mmf. tuning condenser, Browning Labs. new 5PL band switching coil assembly will cover the 10-, 20-, 40-, 80-, and 160-meter amateur bands, the five low loss coils are mounted rigidly on an isolantite band switch and have separate link circuits for output coupling. The unit is designed to be used in the plate circuits of such tubes as the 807 and RK39, in exciters, transmitters, etc., the rating of which is 75 watts or less. The manufacturer claims that careful design and lead symmetry results in these coils being somewhat more efficient than the plug-in type.



Variable Crystal Oscillator

• THE new Bliley Vari-X with VF2 Crystal Unit affords frequency flexibility together with crystal stability. In operation the Vari-X is set beside the receiver and coupled to the set's oscillator stage. It is then necessary only to insert 2 crystal units and to switch on the A.C. Output is obtained on either 40 or 80 meters by means of the tuning knob and either of two crystals may be chosen by means of a switch.



NEW CATALOGS

Kenyon Transformer Catalog

• THE new Kenyon Transformer catalog has 24 pages, showing the manufacturers' line of transformers for various purposes. Also included are five highly interesting graphs for converting loss of gain into decibels, converting ohms, current, and decibels—changing watts to decibels, converting ohms, volts and decibels, and for showing the relation between reactance, capacity, inductance and resonance frequency. The categories of transformers included are—audio, line, auto, interstage, pre-amplifier, plate and filament, output, driver, modulation and many others. In addition there are descriptions of filter and swinging reactors.

New Trade Catalog

• A LIST price catalog for the radio trade with manufacturer's index and order blanks, announced by Momen-Dunnegan-Ryan Co., is a comprehensive listing of hundreds of parts. Dealers will find it very helpful as a reference book.

New Test Apparatus Catalog

• RADIO City Products Company manufacturers of quality test equipment have just issued a new catalog #122 which shows several additions to the RCP line. These include model

Walter H. Candler Dead

• IT is with deep regret that we announce the death on April 23rd of Mr. Walter H. Candler, the originator of the Candler System of Code Teaching. Thousands of Mr. Candler's former students in all parts of the globe will mourn his demise.

Some of the world's fastest telegraph operators owe their success to Mr. Candler's system of mastering speed through the coordination of the mind.

Mr. Candler always conducted his business in

414P Universal De Luxe Multimeter, model 308M Tube Tester with 9" meter, and 14 other pieces of apparatus. The catalog also outlines the company's policy which may be summed up as "maximum protection against obsolescence."

Raytheon Characteristic Data Chart

• THIS 18 page book has been completely revised and much new material added. It now includes information about receiving tubes available in the Raytheon line. Basic connection diagrams have been redrawn and many new ones added. In addition there is a complete set of tube outline drawings, which show dimensions and physical characteristics. The booklet shows characteristic data for 331 receiving tubes, 56 plug-in resistors and 16 pilot lamps. It includes 121 basing diagrams, 52 outline drawings and a table of 194 interchangeable tube types. The book is free on request from any Raytheon sales office.

New Speaker Sheet

• UNITED TELEPHONE CORP. has issued a new speaker sheet listing its linear standard speakers, public address speakers, receiver and portable P.A. speakers and air-column sound projectors.

a systematic manner and wisely made plans for the future by training thoroughly qualified personnel to continue his work.

Supervision of instruction will be by Mrs. Walter H. Candler, who, while a student of telegraphy and as a commercial operator, mastered all Candler Courses. In rapid succession she became Mr. Candler's personal secretary and finally advanced to the position of business secretary of the company. She has been active in the supervision and management of the business since 1924.

We've Got It!



Something really NEW!

We now offer either a SPOTLIGHT or FLOODLAMP with a UNIVERSAL SWIVEL BRACKET mounted on a U. S. Engineer's tripod.



This is the large 10 1/2" U.S. Army Signal Lamp with heavy nickel silver reflector. With the universal swivel bracket the lamp may be directed in any position within a range of 360 degrees horizontally and vertically and by means of thumb nuts, it may be locked in any position desired. The handle on top of the lamp permits its control without danger of injuring your hands from excess heat.

No. 3. SPOTLIGHT WITH TRIPOD, in black crackle finish, fitted with Westinghouse 140 C.P. frosted bulb

and 6 ft. rubber cord attached, ready to plug into any A.C. or D.C. house socket. \$6.25

Weight of lamp and tripod 12 lbs. \$6.25

No. 4. FLOODLAMP WITH TRIPOD, in black crackle finish. Same as described above, fitted with No. 1 G.E. Photoflood bulb. \$6.00

Weight for both 12 lbs. \$6.00

Tripod only (42" high) with bronze fittings (weight 6 lbs.) \$1.65

We can also supply camera tripods in wood and metal from \$5.50 to \$7.75.

Light Stands all brass chrome finish from \$2.25 to \$6.10.

All prices quoted F.O.B. New York.

5% discount allowed on any two items, 10% on four items, 15% on six items.

Send for illustrated price list.

GOLD SHIELD PRODUCTS

350 Greenwich St., RT740, New York City

Making Separation Negatives

(Continued from June Issue)

Luckily the failure of the gray scale to match on all the negatives is not as serious as the failure of the registration marks to line up. There are methods of compensating when making the prints. You should not expect to compensate successfully if the gray scale is hopelessly off.

You will notice that the color identifying patches appear differently on each negative. This furnishes a very easy method for identifying the various negatives. There were 3 color patches in the scene. These were yellow, red, and blue. The negative made through the green filter will show the red patch very light; it will print dark on the print. The blue filter negative will show the yellow box very light, and the red filter negative will show the blue box very light. This furnishes an unmistakable method of identifying the respective negatives.

transparent gray scale regardless of which method you select. This can be done quite easily. Copy your original gray scale, using a full scale cut film. Develop it for softness. With this master negative you may make several transparent gray scales of different sizes, a size being used for each transparency size. The best system consists of placing the master negative in the enlarger and projecting onto the same type cut film. You may vary the size by the usual procedure when working with an enlarger. Make several gray scales: one for 35 mm film, 127 roll film, 120, 116 and so on. The size you will make your homemade gray scale will depend on the size of the color film you are copying. The gray scale should be as long as the longest dimension of the color film to be reproduced. A suggested cut film for both master negative and transparent positive is commercial cut film—either Eastman or Agfa.

But to return to the enlarger method of reproducing transparencies. Place the color film in the enlarger with the required gray scale and project it to the proper size. Make a test strip on your pan film with all lights out in the darkroom, and the enlarger covered. Develop the test strip and, if your negative looks satisfactory, you may proceed. Cap the enlarger with the red filter and project onto the first film, multiplying as usual by the filter factor. Follow up with the other two exposures through the other filters. The usual development technique follows, and then the three negatives are tested as described before.

This brings us to the last point, which is the making of separations of large objects outdoors. First you'll need a large gray scale. Obtain a package of 8 x 10 contact paper, matte surface. Determine what exposure will cause a perceptible gray to form and then make a series of exposures, one on each separate sheet. Each exposure must be double its predecessor. If one second produces a perceptible gray then the first sheet will get 2 seconds, the next 4, the next 8, and so on. Make about 9 exposures out of which you may select say 6. Use a white sheet of paper for the white box in the gray scale and for the deepest black use a sheet of the printing paper fully exposed and developed to a deep black. When these sheets are fixed, washed and dried, you may mount them on cardboard. Tack to a stick of wood and stand your monster gray scale at the edge of the scene you wish to photograph. Later, when you make the print, you may margin it off. Now that you know how to make separations, your next problem will be the making of the print. This is a fascinating process in itself but cannot be discussed here due to space limitations.

Tested by the Editor

REXO PORTRAIT ATTACHMENT. One of these devices was secured and used in conjunction with a Zeiss Ernostar F:1.8 lens of 4" focus. This lens has extremely fine definition, which was in no way impaired by the addition of the portrait attachment, nor was any astigmatic distortion introduced. As a special check on the quality of the attachment a series of photographs of television images was taken. The scanning lines were clearly visible on the negatives. When the attachment was subsequently used for ordinary portrait work, definition was so excellent that the texture of the subject's skin registered clearly even on a 1 1/4 x 2 1/4" negative. The editor hopes

to test this make of copying attachment, filters, and other apparatus in the near future.

DUFAYCOLOR FILM AND DEVELOPING KIT. Dufaycolor roll film was tested with the equipment mentioned in the preceding paragraph and excellent results obtained. No amateur who has had any darkroom experience need hesitate in processing this highly accurate color film. There is but one more step than used in developing ordinary black and white film, and the time and temperature method, if carefully followed, produce exceedingly good results.

The Sensational NEW
SOLAR ENLARGER

- ENLARGES
- REDUCES
- May be used at a CAMERA for COPYING, VIEW or PORTRAIT WORK

USE THE SOLAR
VERTICAL or HORIZONTAL
Brings out the finest detail in your negative. Enlarges! Reduces! Projects vertically or horizontally. High efficiency adjustable condenser light system. Dustless patented negative carriers. All adjustments for perfect prize winning "Salon" prints.

NEW FEATURES
Covers negative sizes from 35mm. to 2 1/4 x 3 1/4 inches. Interchangeable lens boards. May be used as a copy stand for microphotography, lens extension tube work, etc. Complete with baseboard. See the Solar at your dealer.

FREE ENLARGING TREATISE—
Experts collaborated in the preparation of this Solar Book to bring you valuable hints on enlarging, dodging, diffusing, etc. Write for Solar Book RT 640. It's FREE.

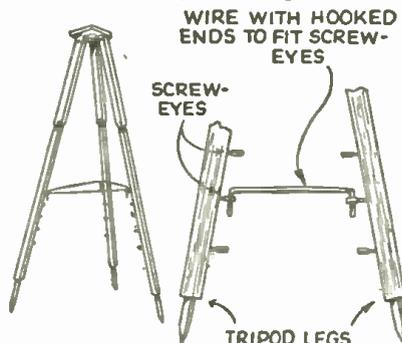
BURKE & JAMES, Inc.
223 W. MADISON ST. • CHICAGO, ILLINOIS

Handy Print Tongs

● TAKE apart a clothes pin of the type that uses a spring and two wooden pieces. Now reverse one side with the back or straight portion towards the coil of the spring. Slide in the tapered end between the two ends of the spring until the spring coil fits into the cut originally made for the ends and the ends fall in the slots made for the coil part of the spring. Do the same thing with the other wooden side



of the pin. The place for the clothes line now offers a good grip and the tapered ends slide easily under the print, which is firmly held by the flat ends.—Zoltan T. Bogar.



Wire hooks brace Tripod legs.

The simplest method of shooting action consists of using transparency color film such as Dufaycolor, Kodachrome or something similar. The transparency is handled in the usual way and separation negatives are then made from it. Pan film must of course be used. It is advisable to use a fast Pan film, as most of the transparencies are quite contrasty and fast pan films have a tendency to soften this. In most cases you will be better off using special filters as (A), (B) and (C-5) do not cut quite sharply enough. They can all be obtained in the gelatin form. For Kodachrome you will need Wratten filters 29, 61, and 49. Of course in a pinch (A), (B) and (C-5) will produce separations—but why not follow the manufacturer's instructions?

There are two methods of going about the job of separating transparencies. Either you may place the transparency in the enlarger and project onto your Pan film, or you may actually photograph the transparency. Of the two methods, I prefer the latter. If you use the enlarger method, you must have a color corrected lens in the enlarger. It will be necessary to make a

Heard 75 Countries!

Editor,

For the past 1 1/2 years I have been SWLing on the 20M. & 160M. phone bands. During that time I have heard 75 countries and 48 of them have sent me their QSL's. The receiver is a Sky Buddy S-19 using a doublet antenna.

I have been reading your magazine for about one year and think it is the best.

I like to exchange my cards with other SWL's and do so 100%.

Wishing your magazine and yourself the best of luck for the years to come.

MYRON E. CHESLEY,
326 High Street,
Newburyport, Mass.

Wants Clearing House

Editor,

I have been a reader of "R.&T." since 1930 and have built over a dozen receivers from your diagrams. I have heard 47 states, 80 countries.

The SWLs in all parts of the world spend hundreds of dollars for postage and in return get nil. A letter from a ham or post card informing the SWL that for some reason or other he does not send out QSLs is appreciated a great deal by the SWL. It shows the ham is on the level with the SWL. After all, is the SWL an out-cast? There is talk going back and forth on the SWL question but nothing is done about it. I believe action is what is needed on the part of the SWL. I would suggest a clearing house for SWLs informing them which hams will not verify. I think a ham would pay postage to instruct this house to put him on the list as a "non"-answerer, or whatever the case calls for.

It would give the ham a breathing spell, and would save the SWL postage. It would put the ham in a "SPOT" but so are the SWLs in a spot. The SWL contributes in all directions; he is entitled to a fair deal. Speaking in behalf of myself and thousands of other SWLs, we would appreciate any word from the ham who writes and tells the "Forgotten man" SWL, the reasons why he won't QSL. All hams are not millionaires; neither are the SWLs!

BERNARD D. KIERSKI,
2011A-South Jefferson Ave.,
St. Louis, Mo.

He'll QSL 100%

Editor,

I have been reading RADIO & TELEVISION for the past year. I am not interested in photography, but I think that having a column about it is a good idea for the people that like it. I think that your magazine is one of the best, if not the best, on the market. A good idea would be to have a column of all the foreign 100% QRA'ers. The "rig" here is a 5-tube Emerson, 7-tube Zenith and a 2-tube home-made. The antenna is a 50 ft. doublet, and a 100 ft. Marconi, covering N-E-S-W. If any of you SWL's want to get a new 100% SWL QRA on your SWL list, send me your card and you'll get mine by return mail. That includes the YL's too, Hi!

Well, I'd better sign off now, so 73 and lots of DX.

THORNTON LYFORD,
260 Woodlawn Ave.,
Hubbard Woods, Ill.

COMMERCIAL NOTICES 10¢ A WORD

Under this heading only advertisements of a commercial nature are accepted. Remittance of 10¢ per word should accompany all orders. Copy should reach us not later than the 10th of the month for the second following month's issue.

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300% PROFIT SELLING GOLDB Leaf Letters for Store Windows; Free samples. Metallie Co., 446 North Clark Chicago.

CORRESPONDENCE COURSES
USED CORRESPONDENCE COURSES and Educational Books Bought, Sold, Rented, Exchanged. Catalog Free. Vernon Exchange, Henagar, Alabama

DIATHERMY MACHINES
DIATHERMY, SHORT-WAVE Therapy, and ultra short-wave therapy machines custom-built by radio engineer at considerable saving over commercial machines; 6 meters, 16 meters or any other frequency specified can be furnished. Machines substantially built with high patient safety factor.

250-300 watts output. Neat professional appearance. Automatic safety limit switcher. All necessary pads and electrodes. For sale only to physicians, hospitals, and sanatoriums. Prices from \$195.00 to \$300.00. Not for sale to the general public. Write for further information giving your own specifications and requirements. Allan Stuart, 1015 Wilson Ave., Teaneck, N. J.

INSTRUCTION
8-INCH VICTROLA RECORD CAN teach you the code Easily—Quickly! \$1.00. Dwight Studios, 13 Dwight St., Jersey City, N. J.

\$15.00 S T E A M ENGINEERING Course—8 vols. \$4.50; Radio and Electrical text-book bargains—Ret list. Life of Napoleon, 3 de luxe volumes \$3.00. \$16.00 New Encyclopedia of Science, 1300 pp. \$4.50; Hopkins "Experimental Science," 2 vols. \$3.50. Harry Ackerson, Box 322, Ram-ss, N. J.

PATENT ATTORNEYS
INVENTORS — PROTECT YOUR rights before disclosing your invention to anyone. Form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and instructions sent free. Lancaster, Allwine & Romel, 436 Bowen Building, Washington, D. C.

SWL—CARDS—QSL
SWL'S—QSL'S, COLLECTIBLE, ECONOMIC, W9KXL, 819 Wyandotte, Kansas City, Mo.

TELEVISION
TELEVISION — MOTORS, DISKS, Tubes, Arthur Pohl, 4829 Merritt, Detroit, Mich.

FOR SALE (NON COMMERCIAL) 3¢ A WORD

Under this heading we accept advertisements only when goods are offered for sale without profit. Remittance of 3¢ per word should accompany all orders. Copy should reach us not later than the 10th of the month for the second following month's issue.

HALLICRAFTER SKY CHAMPION S-20, practically brand new—beautiful condition \$29.50. (cost \$50.00 private. Paul Rudeck, 1718 Jarvis Avenue, Bronx, N. Y. Underhill 3-5483.

FOR SALE: ALL SHIPPED ON TEN day free trial. Reconditioned guaranteed receivers with same guarantee as new receivers. Sky Buddies \$15.00. SW3-\$9.00, F17s \$9.00, Howard 430s \$17.50, Sky Chiefs \$19.00, late model Comet

Pros \$29.00, Sky Chalkners \$34.00, NG-44s \$34.00, Howard 438s \$34.00, National AGS with 18 coils \$34.00, RME9Ds \$39.00, ACR-17s \$49.00, SX-24s \$49.00, PR-15 \$69.00, N100 \$69.00, HME-69s \$79.00. Many other models cheap. Write for free list. W.A.V.R., Butler, Missouri.

HAVE BLACK & DECKER 1/4" ELEC-tric hand drill cost \$19.50 sell for \$19.00. Also Power Kraft hand grinder

with six steel and five emery cutters cost \$15.00. Sell for \$7.00, both in perfect condition. M. G. Lachance, 26 Howard, Lewiston, Me.

DON'T BUY A RECEIVER UNTIL you get my free list of reconditioned, guaranteed Receivers! Practically all models at money saving prices. Trade-ins—Time Payments. Send for list. W2A.VA, 12 West Broadway, New York.

BARBER AND EXCHANGE — 1¢ A WORD

NO ADVERTISEMENT TO EXCEED 35 WORDS, INCLUDING NAME AND ADDRESS

Space in this department is intended solely for the benefit of our readers, who wish to BUY or EXCHANGE anything in the Radio, Television and Photographic fields. Radio, photographic and other merchandise; therefore we charge only 1¢ a word. Each word in a name and address is counted. Remittance should accompany order. Only one advertisement can be accepted from any reader in any one issue. Copy should reach us not later than the 10th of the month for the second following month's issue.

We cannot accept responsibility for any statements made by the readers. All ads must be above board. Remember you are using the U. S. mail in all these transactions and therefore you are bound by the U. S. Postal Laws. Describe any thing you offer accurately and without exaggeration. Treat your fellow men the way you wish to be treated. We welcome suggestions that will help to make this department interesting and helpful to our readers.

WANTED: CIGARETTE PICTURES in sets, odds or albums. Will give you radio, photographic equipment or cash. Write stating quantity you have. Thomas Lawson, 166 11th Avenue, New York City.

WANTED, GOOD ALL WAVE RECEIVER, Holstein, 246 E. 148 St., Bx, N. Y.

WANT PHOTOGRAPHIC EQUIP-ment. Have Sky-Buddy, Tubedeker, Ghirard's tubes, parts. Wirgin plate camera, key. Helen Wax, 156 Taylor St., Brooklyn, N. Y.

WANTED TO BUY A WESTON model 776 test oscillator and a set of Riders Manuals. Also radio tools. James Notaris, 203 W. Oak St., Ambler, Pa.

HAVE ARGUS A CAMERA AND enlarger to match. Photocolor U. S. model exposure meter. Want bread-cruiter in good condition. Browning, etc., or what have you. All letters answered. John Walsh, 2290 Andrews Ave., Bronx, N. Y.

NOTICE BEGINNERS, BUILDERS, experimenters. Have a big lot of good radio parts. Don't like to destroy them. Will give for the cost of packing and shipping them. Inquire, Bert Agnew, 79 West Ave., Alliance, Ohio.

SWAP GOOD UNDERWOOD TAPE-writer for camera or enlarger. Also have new Falcon Electronicama, 5 x 7 printer. Instosep meter, microscope, and telescope to trade for? Jack Cansler, Hickson, Tennessee.

HAVE 18" BASS PIANO ACCOR-dion, nuke, test equipment, parts. Want good Hallicrafters amateur radio, such as Sky Rider, DeLant or like value. Please give complete details. E. Smith, Box 612, Spindale, N. C.

HAVE CABINET MODEL RCA 7 tube—want Radio Amateur's Handbook, 1935 twelfth edition, plus any other editions to 1940. Also radio books or course. Pay cash or trade? Russell Taylor Jr., Stone Harbor, N. J.

WANT USED CORRESPONDENCE courses and books (all kinds). Will pay cash or trade radios, radio parts or books. Send stamped envelope for liberal offer. All letters answered. Clarence P. Ottosen, Crook, Colo.

HALLICRAFTER SK17, (isin Shae-c) Explorer, Instuctograph, all 1939, 410 doublet shotgun. Want Bell & Howell Spolister 8 mm movie camera, Master projector and accessories or? K. H. Glidewell, 119 S. Franklin, Muncie, Ind.

WANT KADETTE 4-WAY PORTA-ble; also books Credits & Collections by Zimmerman, Auto Letterwriter by Shaw, Let Your Mind Alone by Thurber. Have books, rifles, sights, parts. R. Welker, 406 No. Harvey, Oak Park, Ill.

I WANT—3 1/4 x 4 1/2 GRAFLEX CAM-era. Have films, 3 x 7, Cradex, 5 x 7 Cyclo Graph, 3 1/4 x 5 1/2 Speed Graphic and radios for exchange. Fred R. Wolcott, 273 Medford Road, Syracuse, N. Y.

TRADE: ARGUS A AND CASI FOR Browning projector. Hallicrafters SK11 for 1937 NCS9 in fair condition. Francis Baber, Packanack Lake, New Jersey.

HAVE "RADIO TELEVISION ENGI-neering Course" by First National Television. Will swap for 8 MM camera and projector or anything else. A. Sabath, 2222-80 St., Brooklyn, N. Y.

DISMANTLING TEST BENCH HAVE all-wave oscillator, analyzer, tube tester, condenser analyzer and numerous other items. Interested in Super-Pro or similar receiver. T. G. Watt, Chanute, Kans.

HAVE SW-2, 3 SETS COILS, HOME made pack; electric motor; wash-machine motor (gas); speakers; Hammarlund coils; phones; radio mags.; key; tubes; parts; etc. Want motorcycle. Gilbert Hannon, 1000 Main St., Green Bay, Wis.

HAVE KEYSTONE 16-MM. WRIST watch, banjo, oil paintings, printing press, etc. Want 16-mm with backwind, P.A. amplifier or? Frampton, 806 Elmsire Place, N.Y.C.

INSTROGRAPH, 10 TAPES, built in a.c. oscillator and speaker. Meissner noise silencer with tubes. Milten Hetroff, Peak preselector, tubes 14 200 meters. Want Rider manual or test equipment, what have you. Hornick, 8707 Twelfth, Detroit.

HAVE: RIDER MANUAL NO. 1, new NII analyzer, etc. Need: New auxiliary units of proper capacities for fluorescent tubes. Manias, Colorado City, Texas.

HAVE NATIONAL RADIO INSTI-tute course and Drake's Cyclopedia of Radio Electronics. Wanted—0-1 ma. meter, preselector, transmitting parts or what have you? John W. Nye, 23 Pearl St., Middleboro, Mass.

WANTED BACK ISSUES OF SHORT Wave Craft, State condition. Roy Tucker, 2175 N. Star, Columbus, Ohio.

HAVE 3 1/4 x 4 1/2 AUTO GRAFLEX Tessar F.4.5, Elwood 5 x 7 enlarger, Radio, etc. Want Bee camera, smaller enlarger, photographic goods, portable radio, or? Michael Gianfroco, 604 Union Ave., Proc., R. I.

WOULD LIKE TO BUY USED Riders Service Manuals. Write H. H. Pickens, Fort Payne, Ala.

WANTED — KONTAK MIKE FOR musical instruments. Will pay cash or? W8T8I, Mekeesport, Pa.

EXCHANGE 200 TO 400 WATT transmitter kit including key, crystals, antenna and p-wire supply for Ladies solitary diamond of one-half carat or over. Box 513, Port St. Joe, Florida.

SWL EXCHANGE

This department is for the benefit of all short wave listeners who wish to exchange SWL cards and correspondence. Remittance of 1¢ a word for each word in the name and address should accompany order.

- UNITED STATES**
GROSVENOR CALKINS, JR., 49 Fairlaw Rd., Newton, Mass.
EDWIN GUMESON, R.P.D. Rt. 2, Box 110, Logansport, Colorado.
BILLY HENRY, W5SW2, P. O. Box 111, Siloam Springs, Arkansas.
ROBERT KELLEY, 2718 Fifth Avenue, Altoona, Penna.
JIM MASTERTSON, 109 So. Talley, Muncie, Indiana.
MIKE MORRISSEY, Sharpshurk, Ky.
GEORGE PAPPAS, 136 17th Avenue, Paterson, New Jersey.
J. I. VAUGHN, P.O. Box 1424, New Orleans, La.

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(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.)

A Word From That "SWL Punk" Bird

Editor,

I am the fellow who started the "SWL Punk" business, in February's issue of RADIO & TELEVISION. And I was pleased that my letter woke up some of the readers of this magazine.

I have another complaint, and I do hope that you will pass it on to the other boys and girls. It might do some good. I hope so. Hi!

About 50 per cent of the SWL's won't even answer you when you write them. I have taken their QRA's from this magazine, the RSSL, and many others. And just a few of them answer. Why do they have



their names published, if they don't want to answer in the first place?

I rate the SWL's in the same class as the Hams. Being an SWL myself, I answer every piece of mail that comes to me. So why can't they?

I am not the only one who has found this out. I get letters nearly every day, telling me about this subject. So I am writing this letter on their behalf too.

If an SWL or HAM doesn't want to be written to, why don't they say so?

I personally keep a list of those who do not answer. And I pass their names around to the gang!

There is another thing that burns me up, and that is, there are times when death comes into the family, just like the incident that happened to me a few months ago. I sent my card to a fellow who lived in North Dakota. About two months later I found out he was dead. Now just stop and realize a moment. When that card of mine reached his home, naturally his family received it. The harm was done. It brought back memories of his death, and many heartaches. Why didn't some of his friends have his death notice published? And it would have not caused this unhappiness. This kind of incident has happened to me many times.

I would like to hear from you readers of this magazine both from the United States and Foreign countries on this subject. I promise to answer all of your letters. I will also exchange my card 100% with anyone from anywhere.

I wish to thank the editors of RADIO & TELEVISION magazine for the splendid work they have done with this magazine. I would feel completely lost without my monthly issue. It's RADIO & TELEVISION 100% for me. But let's just have good old radio & television material.

AUSTIN WARDMAN,
832 Linden Ave.,
East Pittsburg, Pa.

He Finds "Twinplex" a Hot Receiver

Editor,

I have just finished building the Twinplex which I happened to notice in one of my back issues, using the 1G6G tube. A "top-notch" receiver at a very economical price.

The receiver is the same but my mounting is a little different. I have two bakelite sockets set in an aluminum chassis (there is not very much R.F. loss). This is the first set I ever built and I hope you will publish a 3-tube circuit.

In about the last 8 days I have logged the following: 2RO3, Italy; GSD, England, and T2K, Japan. The above are my distant catches. United States short-wave stations are WBOS, WPIT, WNBI, WRCA. About every state on the amateur bands and every district.

My coils are two Meissner broadcast coils and two "home-made" ones which I wound on tube bases.

On local stations like WMT and WHO, I can't use headphones, because it comes in too loud to be pleasant, so I am using a Utah speaker.

Antenna is a 30 ft. wire with a 25 ft. lead in. I am a SWL exchanger and will swap my card.

I have been buying your "top-notch" magazine since 1936, and have just really become interested in this field of short wave listening.

I have been a member of the Short Wave League now for almost a year. Keep up the good work!

RUSSELL W. OLMSTEAD,
321 Ricker St.,
Waterloo, Iowa.

Can YOU Answer These Questions?

1. How was Miss Television chosen for the RCA exhibit at the New York World's Fair? (See page 172).
2. How did F.M. compare with A.M. for police two-way radio service when tested in Chicago? (See page 136).
3. Name six common household objects, and two other substances which fluoresce under ultra-violet light. (For answer see page 182).
4. How does one calculate grid-leak resistance values for amplifiers in transmitter applications? (For answer see page 178).
5. How may the magnetic field of a loud speaker be prevented from affecting the beam of a C-R tube in a television receiver? (For answer see page 184).
6. "It's all done by mirrors" might be the description of a new large screen television system. Describe it! (For description see page 170).
7. More efficient transmission is secured by some unique antenna arrays used by G.E. in the Helderberg Hills. How do these work? (See page 137).
8. Name three major types of lie detection apparatus and tell what each measures. (For data see page 169).
9. Draw a parallel to compare the working of an electron microscope with the old light microscope. (For answer see page 134).
10. Can loop aerials be used for television reception and if so, how? (For answer see page 171).

Radio Would Have Made The Pony Express A Local!

Back in 1860 the wonder of the day was the picturesque Pony Express. Racing horses in relays, riders carried the mail 1960 miles from St. Joseph, Missouri, to Sacramento, California, in 10 days. Radio messages would cover the same distance in a fraction of a second.



What a difference the Services of RCA would have made in 1860...

Communication is the life-line of civilization. Up to a hundred years ago, civilization spread slowly, because communication could travel no more swiftly than the gallop of a horse.

In contrast, if the West were being opened up today, the Services of RCA would coordinate developments with instantaneous communication. Portable broadcasting equipment would go wherever pioneers went. Over nation-wide broadcasting networks a running history of progress and achievement would be heard by millions. R.C.A. Communications would keep two-way contact between our scattered outposts and forty-three foreign nations.

Young men, following the classic ad-

vice, would "go West" carrying RCA Victor Pick-Me-Up Portable Radios. And through the RCA Photophone, motion picture audiences in the East would hear as well as see the saga of the winning of the West. Lonely settlers would carry into the wilderness their favorite musical selections on Victor and Bluebird Records.

Yes...the Services of RCA in every field of radio and sound could have contributed immensely to building our country in 1860. But...the contribution they could have made is in no sense greater than the actual contributions they are making to our civilization today.



Henry Wells



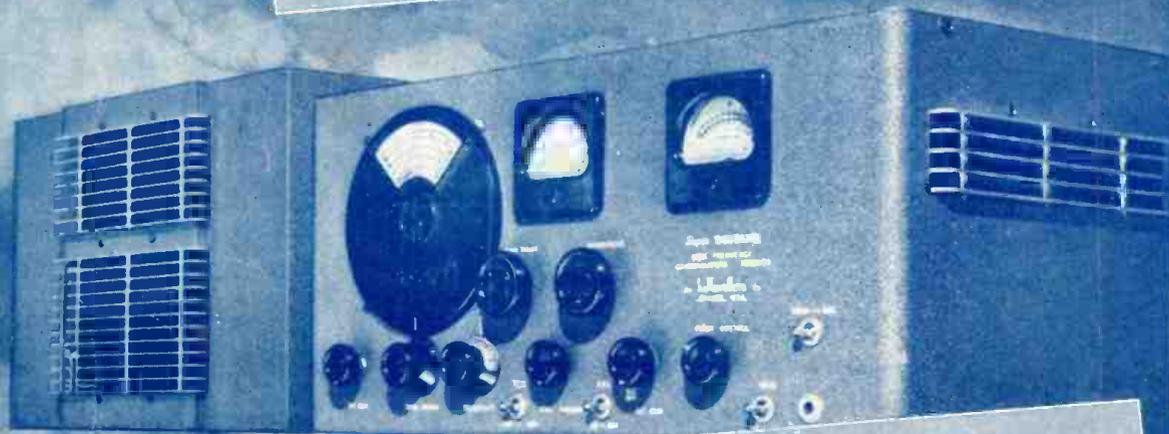
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RADIO CORPORATION OF AMERICA *RADIO CITY, N. Y.*



Skyrider Defiant

One stage of preselection. New, highly efficient noise limiter circuit. Four bands cover from 545 kc to 43.5 mc. Accurately calibrated bandspread dial. Frequency stability throughout a wide range of line voltage, humidity and temperature variations. Six point variable selectivity. Meter calibrated in both S and DB units. Single-signal crystal filter. Complete with 9 tubes and crystal (no speaker) \$69.50.



Super Defiant

Two stages of preselection. Automatic noise limiter. 540 kc to 42 mc coverage in four bands. Better signal-to-noise ratio. Calibrated bandspread dial. Compensation in oscillator circuit for frequency stability. Six-step variable selectivity. Meter calibrated in S and DB units. Push-pull output delivering 8 watts. Ten-inch PM speaker in metal cabinet. Complete with 12 tubes, crystal and speaker, \$99.50.

the hallicrafters inc.
CHICAGO, U. S. A.

WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS EQUIPMENT