10 NEW CIRCUITS

RADIO NEWS

AND

SHORT WAVE RADIO

Special TUBE Number

JULY

What you should know about TUBES

2 out of 3 RADIO VIBRATORS are MALLORY made

MALLORY is recognized as STANDARD

Vibrators made by Mallory are *standard equipment* in America's most popular automobile radio receivers and in 6 volt and 32 volt household receivers.

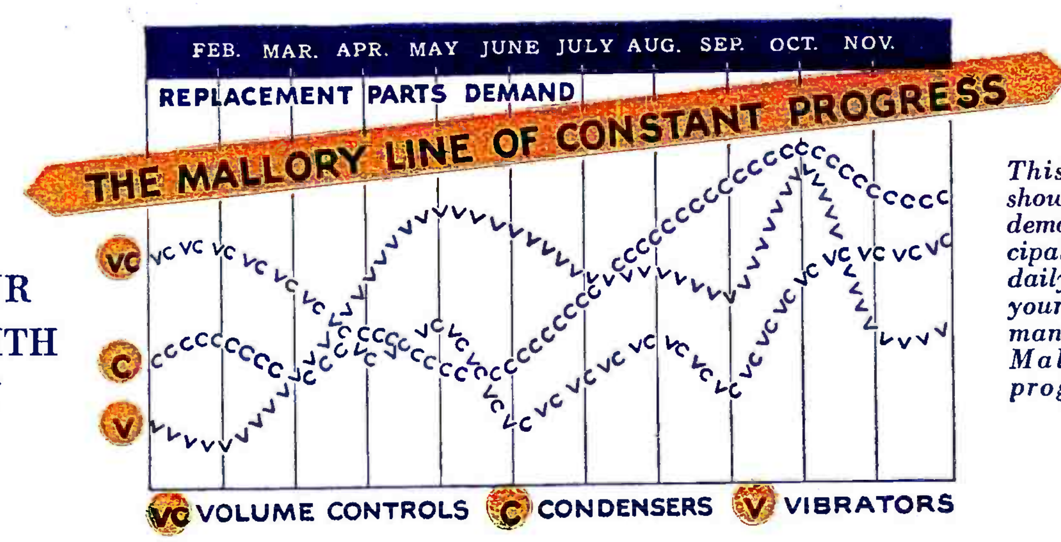
The use of Mallory Replacement Vibrators is *standard practise* on the part of radio service men the country over.

A mere handful of Mallory Replacement Vibrators render universal service to over 3,000,000 automobile radio sets now in use.

Mallory Replacement Vibrators save time — save inventory — reduce stock investments. They are dependable in service. They provide more efficient performance and are easy to install. They build good will and good business!

Be sure your vibrator replacement work is done with Mallory. It pays — in profits, as well as in customer satisfaction — as thousands of service men can tell you.

BUILD YOUR BUSINESS WITH MALLORY



This composite graph shows the trend of service demand for the three principal replacement items in daily service work. Check your needs with the demand — and depend on Mallory for constant progress.

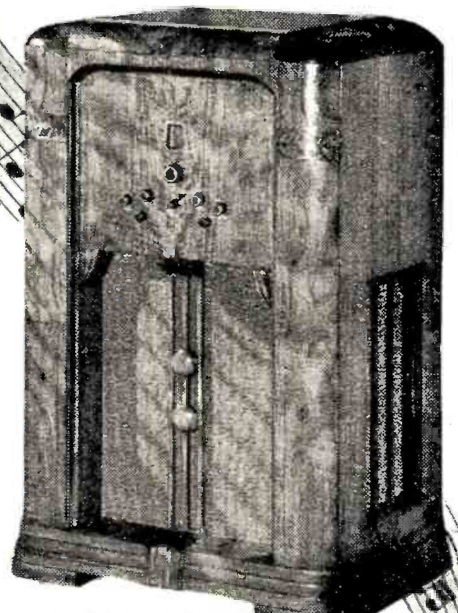
MALLORY

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO

YAXLEY

ALL THE BEAUTY OF THE OVERTONES

ALL THE MAGIC OF DISTANT LANDS



23 Tube SCOTT with Warrington Console

Volume Range Expander—restores expression necessarily cut in broadcasting and recording. Continuously Variable Selectivity—2 to 16 K.C. True Separate Bass and Treble Controls. 19 exclusive cabinets. Highest Useable Sensitivity—for clearest reception at prevailing noise level.

PROOF and MORE PROOF—

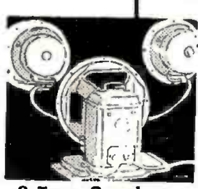
Proof-every day that when you own a SCOTT you have at your command the finest performance in the world—regardless of price! Tested by celebrated musicians and opera stars! Tested in almost every country in the world! And NOW—tested in *one of the country's leading radio stations**—the SCOTT is *again chosen as the peer of all receivers.* WHY? Ask yourself this vital question when considering your new radio receiver! WHY did SCOTT tone have the most magnificent realism of all the one hundred and fifty receivers?

There under the impartial scrutiny of those engineers in the most gruelling comparison test yet devised, the SCOTT alone—of all receivers tested—captured all the marvelous beauty of the overtones which were broadcast—all the overtones audible to the human ear.

HEAR *ALL* THE PROGRAM!

When your receiver misses the overtones you miss half the beauty of the program—all instruments tend to sound alike. Science shows that *fundamental* notes from voice, violin, trombone, oboe, etc., are all identical—it's the *overtones alone*, or secondary tones, which enable you to tell one instrument from another.

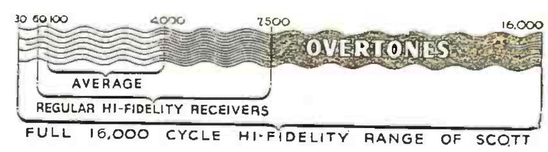
Put your finger up to one ear. Shut off the sound. What you hear doesn't sound complete—you say "there's something missing." Look through a screen. Hold a sieve up to the light. Everything beyond is just the same—but colors are not so pleasing, faces are dimmer. It is the same with your radio. Every day you turn it on for entertainment—for local programs, programs a thousand miles away, programs from Europe, Asia, South America! These programs are for *you!* The stations have been designed for *you!* Get the *full* beauty they have to offer you! More and more stations are raising the fidelity of their broadcasts—and more and more are going "High Fidelity"—*broadcasting the music as it is being played and as it was meant to be heard*—with all the ephemeral and powerful expression that was written into it—with all the enthralling 16,000 cycle overtone range, wherein lies the most sublime beauty of all music.



3 True Speakers

Each amplifying its full portion of the complete tone and overtone range.

The SCOTT 16,000 cycle overtone range now offers you and your family the full enjoyment of popular music with all its original sparkle—offers you the world's really great music with all the inspirational beauty the composer himself meant for you to hear. The SCOTT does not overload *one* speaker with this full tonal range. In addition to the *bass and medium tone speaker* (using the sensational bass reinforcing filter) the SCOTT offers *two special true loudspeakers for the higher tones* (these additional speakers receive direct electrical impulses through the regular circuit). Be sure that any extra "loudspeakers" in the set you are considering are not merely "resonators" screwed to the sounding board and "vibrating" with regular tones received by the single real speaker.



Average speakers with less than 10 watts power "go to pieces", "rattle" or distort the tone when the full volume of concert music is played through them. With SCOTT 35 Watt Power you may listen to the full glory of symphonic or popular music without any distortion to the ear.

With its Highest Signal-to-Noise Ratio, its remarkable Continuously Variable Selectivity, with its exclusive Rotary Coil System and many other exclusive features, the SCOTT has made probably more verified world distance records than any other receiver in the world.

*Name of station upon request.

HEAR *ALL* THE STORY!

This is only a fraction of the magnificent story of the SCOTT. You can own a SCOTT for no more than you would pay for an ordinary good radio. A side by side comparison test is invited. Try it in your own home for 30 days. If you are not then *completely satisfied* that its tone is more beautifully *clear*, that its realism is more strikingly *life-like* than any other receiver, then return it—and there will be no obligation of any kind. Send — TODAY — for complete details of this extraordinary story, every word backed by page upon page of printed PROOF—PROOF of definite, vital superiorities—PROOF of unparalleled tone and distance performance in every quarter of the world—in every state in the Union! Send NOW for full facts!

FREE-SEND TODAY FOR DETAILS

E. H. Scott Radio Laboratories, Inc.
4440 Ravenswood Ave., Dept. 5M6, Chicago

I'd like to know more about the new 23-tube SCOTT. Please send me full proofs, and illustrated booklet above.

Name ....

Street ....

City .... State ....

E. H. SCOTT RADIO LABORATORIES, INC.
4440 Ravenswood Avenue, Dept. 5M6, Chicago, Illinois
630 5th Avenue, New York — 115 N. Robertson, Los Angeles

RADIO NEWS

Edited by LAURENCE MARSHAM COCKADAY

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JOSEPH F. ODENBACH, *Art Editor*

Vol. XVIII July, 1936 No. 1

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Coming Next Month

A new oscillator-frequency meter which will be extremely useful to DX'ers, short-wave listeners and amateurs. It is so stable that, beating against WJZ's carrier *from a cold start*, it maintained frequency constant within 400 cycles in a one-hour test. Servicemen will find a constructional article on another RADIO NEWS development—a simple and inexpensive beat-frequency oscillator having a dependable range from 0 to far above 10,000 cycles which is expected to be ready for the August issue. For beginners there will be a combination power-supply, audio-amplifier unit to be used with any tuner, including those to be described in the Beginners Series in subsequent issues.

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The March of Tubes!

From Set Manufacturers to the Homes of America . . .

AS TIME MARCHES ON — Raytheon's momentum increases and it will be further accelerated by Raytheon's new line of "G" tubes.* Thousands of new sets will be equipped with Raytheon "G" tubes, paving the way for more Raytheon replacement sales.

Leading set manufacturers prefer Raytheon quality and performance, Raytheon's painstaking attention to details, Raytheon's research and production engineers. That's why Raytheon is the fastest growing tube producer today.

Raytheon dealers and servicemen are capitalizing this established, ever growing replacement market.

A COMPLETE LINE—"G" types, standard glass and Genuine All-Metal types. New technical information now available. Write for it.

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415 Peachtree St. N. E. . . . Atlanta, Ga.

RAYTHEON
TRADE-MARK
4-PILLAR RADIO TUBES

** Glass tubes with octal base. 6A8G base illustrated.*

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Pages From A Serviceman's DIARY

THE MIKE REGARDED HIM WITH STOLID INDIFFERENCE

Our serviceman helps a budding young playwright to record his play but some records were spoiled until the speaker who took all parts calmed down and learned the proper microphone technique

SATURDAY—Always our busiest day. Started off with a call up the hill. Note on service slip—"Check home-recording—bring extra blanks." Was ushered in to the sun porch, where a large RCA combination stood. Checked over the tubes, switched to home-recording position and held the microphone near the speaker. Plenty of pep, as shown by the acoustic feed-back. Put a stroboscope disc on the turntable—O.K. for both 78 and 33⅓ r.p.m. except for slight "wow" on 33⅓. Oiled leather pad on spindle under the turntable. Now normal. In stepped a young fellow dressed in a fashion-plate array and holding a thick manuscript. "I hope you have brought plenty of recording discs, I want to record my play", spoken with a smoothly-operating Harvard accent. Went out to the truck and brought him a dozen large-size blanks. Told him we could supply lots more when, as and if required. Showed him how to operate the apparatus, the proper method of talking across the mike and cautioned him to maintain a reasonably constant voice level. Stood by as he proceeded to swing into action, taking all parts. Expected the worst and got it! He gradually worked up steam until the room resounded with his shouting and shrieking. Meanwhile I kept motioning him to calm down, but no go. The mike regarded the whole discourse with stolid indifference, which seemed to arouse his anger. I finally decided to break in, shutting off the set and suggesting that we play back the recording so he could modify his delivery for better results. He simmered down a little when he found his best efforts were too violent and suggested that I stay around while some more recordings were made. Told me "O. K. by me", at the regular service rate of three dollars for the first hour and two dollars per hour thereafter. (Sold him two hours' time—some people are born that way).

Next—Moved on to a Capehart job, arriving a little late and busting in on a hen party. Chassis located on the right side of the phono compartment. Removed the partition and replaced a defective 55. O.K.! Was asked to run upstairs and check a set on the second floor. All doors closed so I knocked before entering. Was told to come in but the inmate let out a yell when I opened the door. She was dressing and apparently expected one of the women. Tried the next door, calling out, "Radio!" as a precautionary measure and walked in on a fortune teller who had been engaged for the party. Recognized her as the wife of the Armenian rug man, who carried on this little racket as a side-line. She offered to read my hand, but I thought it better not to overwork the lady's imagination. Replaced the antenna lead-in strip, removed the chassis, cleaned the volume control and tightened the socket contacts of the Radiola 17 there. Put in a new set of tubes and went out to lunch.

Stopped off to instruct a customer on the operation of his new Stromberg. Started off with WABC, then a whiff of WEAF and a shot of WOR. Switched over to short-wave and brought in London, Paris and a few German stations. All O.K.—well satisfied.

Ran over to the yacht club to complete the p.a. installation. Hooked a couple of crystal mikes in series and connected to the pre-amplifier input terminals. Also brought leads from a Packard record-changer to the main amplifier. With the speakers outside, naturally there was no trouble from acoustic feedback.

Next—An Echophone midget — Complaint, no reception below 700 kc (in frequency). A real problem—this set uses a 24 as dynatron oscillator, which still tested fair but was not functioning at the low frequency end of the range. Tried three different 24A's, but none would operate right as a dynatron. Decided the oscillator circuit would have to be redesigned, since the old 24's are now extinct. A mean job—but they like the set and are willing to pay for the work.

Went over to one of my old customers, who has a couple of General Electric sets. This poor old lady lives all alone in one of the most beautiful homes in town and is always complaining about business conditions which have reduced her to such a poverty-stricken state that she is compelled to worry along with but four servants. Her radio troubles are usually trifling. She is very exacting, but pays spot cash and is a good booster, so we class her as a good customer. Her complaint this time was intermittent noise. As usual, everything functioned normally when I arrived. Looked over the installation. Ground and antenna O.K. Tapped the tubes. O.K. for noise. Checked power connections. Receptacle badly worn but could not prove it to be a cause of trouble. Tightened all connections on plug and receptacle. Switched on all lights. Noise started immediately. Checked all light bulbs and bridge lamps. O. K. Located the fuse box—an elaborate switchboard with cartridge fuses and noticed a tiny arc at one of the fuse clips. Pushed the fuse for better contact. Arc stopped—likewise the noise. Switched off the power and went over the entire layout, finding several carbonized clips and loose screws. Put everything in ship-shape order, pointing out the troubles to the owner, and made arrangements to have our electrician replace some of the old outlets throughout the house.

THESE records from an anonymous serviceman's diary should be of decided interest to veteran servicemen, as well as to those whose experience in the service field is more limited. Written by a man who "knows his stuff," and shot with an occasional outcropping of humor, these items provide many hints not found in text books. More of these pages will appear from time to time.

Servicemen Becoming Business Minded

By Leon L. Adelman

As time goes on it becomes more clearly apparent that the radio servicemen, as a class, are becoming more business-minded. In this important respect, they are realizing the difference between knowing their job and just make-shifting their way through. It is natural therefore, that successful servicemen are well-informed, are thoroughly equipped—mentally and instrumentally—to meet the varied everyday demands made upon them. And it is most gratifying to actually feel the upward trend towards betterment by watching the increased yearly sales of standard parts.

I believe—after seventeen years of association with the radio industry—that service work is still in its embryonic development stages: that the next few years will bring forth most remarkable service equipment, and more important, better trained and more capable men to handle it.

Radio News

July, 1936

RADIO and YOUR VOTE

Radio's quadrennial political circus is now under way. From the start of the June conventions to November's Election Day, broadcast schedules will be as uncertain as a European peace treaty. Aspirants to the White House and their potential star boarders will take to the air to tell their story in whatever way they think most convincing to American voters. Don't miss them.

By Merle Cummings

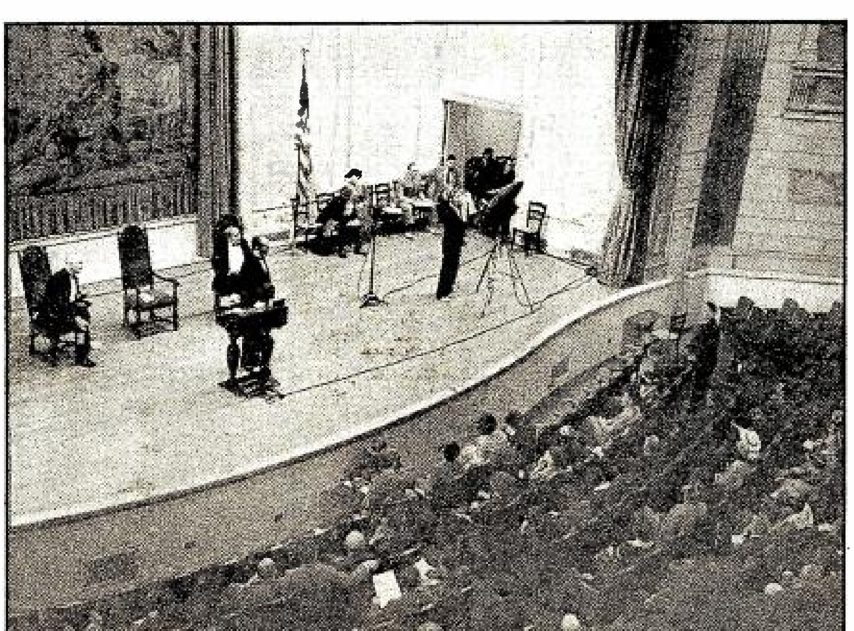
THE experience of previous Presidential campaigns—particularly 1932 and 1928—has convinced the major parties that Radio's microphone is a mighty weapon. It has replaced, in importance, the old junkets through the nation by the respective candidates; soap-box oratory, torch-light processions, hand shaking and yes, even baby kissing! Some of these archaic methods are still used to supplement the radio efforts, but they are perfunctory gestures. When a candidate makes a talk in Dubuque, it is actually aimed at every fireside in the U. S. A., the aspirant's presence in Dubuque merely having a supposed added psychological effect on the local voters who are figurative props and backdrops for the show being placed on the national networks.

Modern Campaigning

Politicians have learned a lot about the importance of radio technique. They know that a candidate with a good voice and "microphone personality" is a vote-getting asset. If some of the party moguls had their way about it, they might even hold auditions to pick their "talent" in the same manner as the Delight Liver Pills Company picks its romantic tenor.

POLITICAL RALLIES IN THE TOWN HALL

Many such meetings will be held throughout the United States during the next four months and many of them will be broadcast to the nation through the various networks



The "auditions" for political candidates get under way in June when on the ninth, the Republicans will gather at the Cleveland Municipal Auditorium to name their Presidential and Vice-Presidential candidates and, on the twenty-third in Philadelphia when the local Convention Hall will resound with the din of the Democrats going through the business of nominee hunting.

Under the head of "public service," the American Radio networks plan to cancel various commercial features at the occasion of the political parties' major campaign addresses by both candidates and supporters. Political talks must be paid for just as any other sponsored periods, but in these solidly-booked radio days, the networks must give a rebate to the manufacturer whose feature is shoved aside for the cheering and jeering of a political broadcaster.

Convention Plans

Major outlets for the convention broadcasts are the National Broadcasting Company, the Columbia Broadcasting System and the Mutual Broadcasting System—the latter now laying full claim to being the nation's "third network."

Plans for the conven-





THESE FAMOUS COMMENTATORS WILL BROADCAST POLITICAL DEVELOPMENTS

Listeners in the United States may expect to hear snappy items of political news through he medium of these commentators and chain broadcasting. Very little of political significance will escape their keen minds and they will keep potential voters advised of the doings and sayings of campaigners for government office. Left to right they are: Boake Carter, William Hard, Edwin C. Hill, Gabriel Heatter and Lowell Thomas

tion broadcasting were made early in the spring. The Republican broadcasting committee laid down rigid rules for the broadcasters to prevent any so-called circus stunts that predominated at the 1932 conventions. This, in a way, is being fussy, seeing that the networks are giving all convention broadcasting time free of all charges, due to the policy of not accepting political periods on a commercial basis until the candidates are chosen.

According to information obtained by the writer at the time of going to press, the convention broadcasting rules call for the use of a single community microphone. This will serve the three chains, the building public-address system and the sound newsreels. Such a device will tend to eliminate the banner bedecked broadcasting booths and giant call letter plates used at previous conventions. The worst fear of such an arrangement, if it does go into effect, is that it will curtail individual scoops on the enterprise of the respective broadcasters. To offset the difficulties, the chains will establish private mikes at points outside the convention auditoriums where announcers, political writers and narrators will be engaged to stage surprise interviews and other stunts.

The Chain Set-ups

Alfred Morton, manager of the NBC program department, is in charge of his network's convention plans while his chief microphone assignments for the Philadelphia and Cleveland events are in the hands of Graham McNamee, veteran announcer, and William Hard, political writer. Lawrence W. Lowman, CBS vice-president in charge of operations and Paul W. White, director of public events, are handling the Columbia arrangements. The chief CBS announcing and commentating will be done by Robert Trout, Washington announcer, and H. V. Kaltenborn and Raymond Gram Swing, veteran newspapermen. Both NBC and CBS plan to call upon long lists of political experts and writers in attendance at the events.

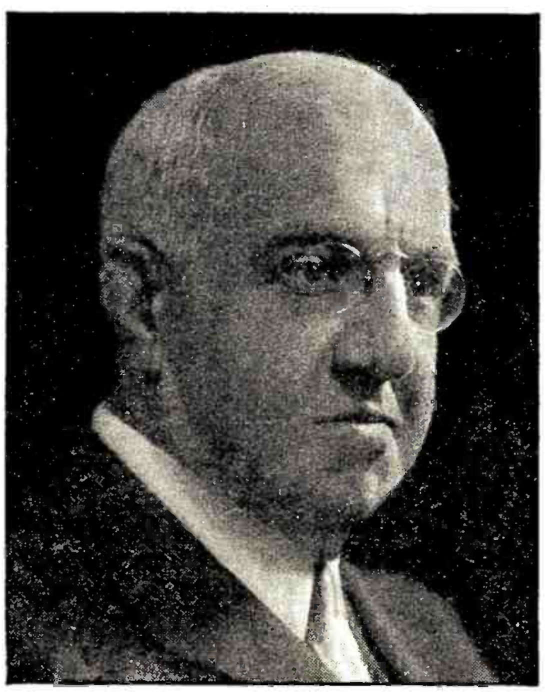
Actually, political broadcasting got under way long before the conventions. Alfred E. Smith's Liberty League dinner address, President Roosevelt's Jackson Day speech and the countless radio talks of Senators, Representatives and certain others were definitely political long before the candidates were chosen. Many of the (*Turn to page* 10)

WHO'S AHEAD?

This will be a familiar scene in broadcasting offices during the conventions and on election night. Commentators and script writers will gather around the commercial radio and teletype services to pick the latest news from the air and fling it back to the listening public through broadcasting

SCANS THE NEWS FROM WASHINGTON

Frederick William Wile, veteran commentator of many campaigns, scans the political situation at Washington for broadcasters

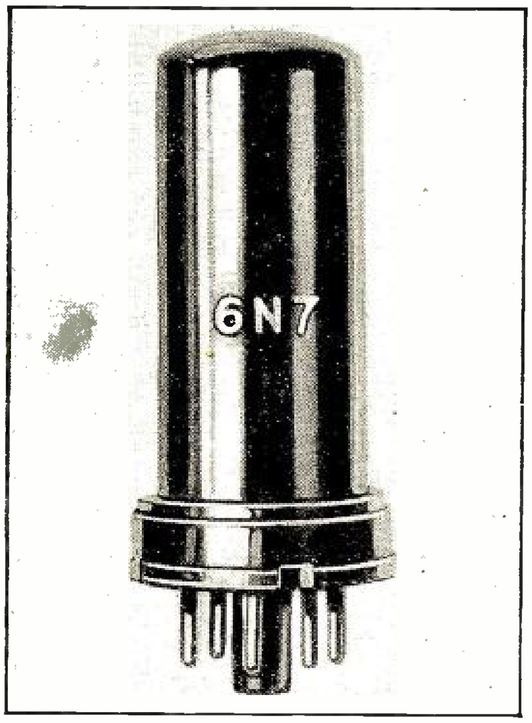


WHAT'S NEW in RADIO

By W. C. Dorf

New Tubes Announced

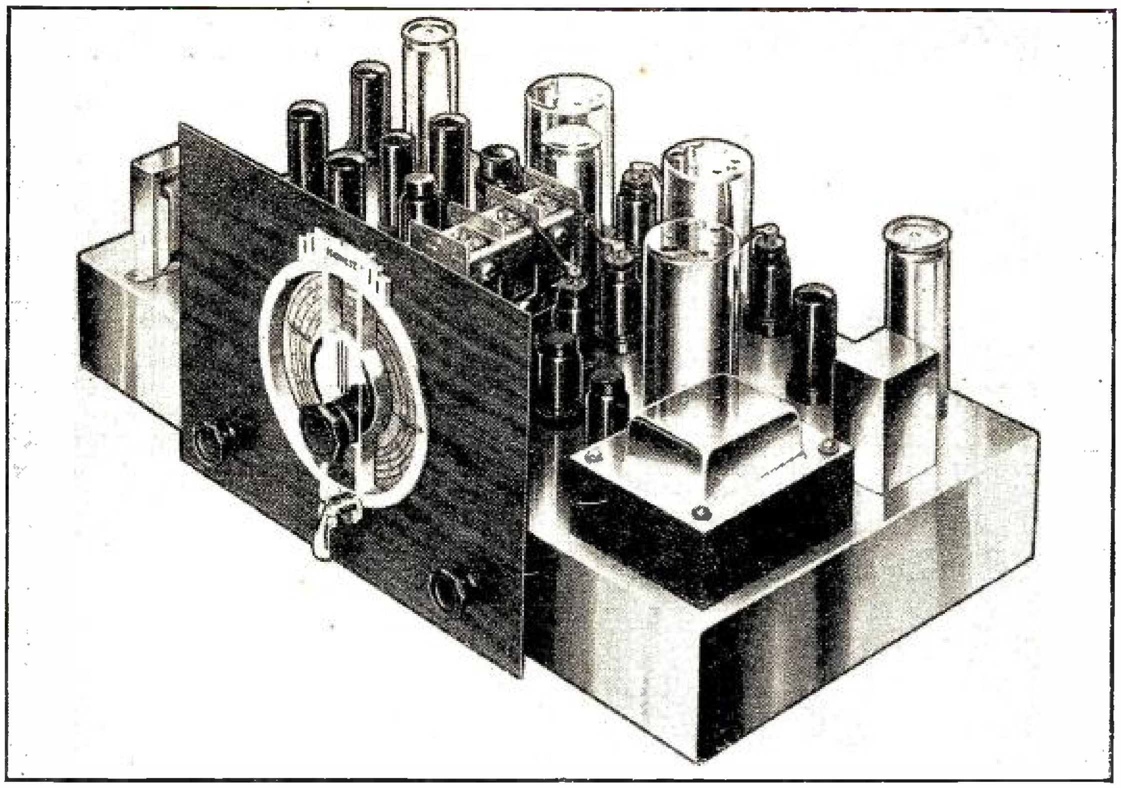
Among the recent new tubes are the 1F6, 5W4, 6N6 and 6N7. The 1F6 is a 2-volt duo-diode pentode; a battery operated tube similar to the 6B7. The 5W4 is a metal full-wave rectifier tube, with a maximum current rating of 110 ma. The 6N6



and the 6N6G are equivalents of the 6B5 and the 6N7 is the metal edition of the 6A6.

Something New in Auto Antennas

The Norwest "streamline" auto antenna is mounted on rubber vacuum-cup standoffs on top of the car roof. Aluminum tubing is used for the aerial and its high polish and style of mounting lends itself to the modern streamline design of automobiles. This type of installation does away with the difficulty of drilling holes and it is said that the natural shielding of the *steel* car top, the added height of the antenna as compared with the under-car style, and others factors afford increased pick-up and a lower ignition noise level.

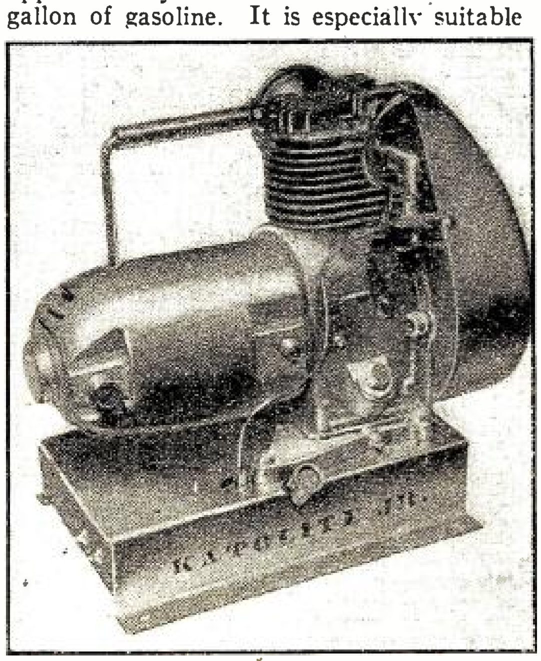


Range of This New Receiver—9 to 2400 Meters

The addition of this new 14-tube all-wave set by the Midwest Radio Corp. to their line of receivers should create wide interest among broadcast and short-wave listeners because of its many new developments and unusually wide tuning range. In addition to providing reception on the regular broadcast band, 200 to 550 meters, and a tuning range up to 2400 meters, it has continuous coverage on the short-wave lengths from 200 down to 9 meters, which takes in all the amateur bands and all the short-wave broadcast tuning ranges above 10 meters and of course the airlanes and police channels. The entire range is covered in 5 bands all completely calibrated in kilocycles and meters. A few of the outstanding features include silent visual tuning, pre-balance coil assembly and automatic aerial adaption. While the set is designed to use the metal type tubes, the new "G" glass tubes with octal base are equally applicable. The circuit employs 6K7's in the r.f. stage, the mixer stage and the two i.f. stages, a 6H6 as a combination detector and a.v.c. tube, a 6C5 in the first audio stage, a 6F6 for the driver stage and four 6F6's connected in a parallel push-pull power output stage. The type 6C5 tube is used for the oscillator and for the tunalite circuit and the 5Z3 is used for rectification. The set delivers 20 watts power output and the chassis measures 20 inches long by 12 inches wide by 8½ inches high. It is offered in several attractive consoles.

Small Gas-Engine Generator Delivers 300 Watts

Weighing only 50 pounds, the new Katolite Jr. portable power plant, made by the Kato Engineering Co., furnishes 300 watts, 110-volt, 60-cycle a.c. power. It is easily installed and it is not necessary to bolt the plant down. The fuel tank is contained in the base and the fuel consumption is approximately 10 hours' service on one gallon of gasoline. It is especially suitable for furnishing power for sound trucks, "ham" transmitters, small summer cottages, camps, trailers and numerous other applications which will suggest themselves.



Model MP-420 Mobile Sound System

The Webster Company announces a combination 6 volt d.c.—110 volt a.c. P.A. system. It is designed to cover out-door gatherings up to 5,000 people. The specifications follow: 20 watts power output, gain 115 db., and universal output connection arrangements. It is equipped with two 12-inch speakers, crystal microphone pick-up and phonograph turntable.

Tiny Bias Cell

The Mallory grid bias cell used for some time by manufacturers is now available to the experimenter and serviceman. Only 5/8 inch in diameter by 11/32 inch deep it is a self-contained device of practically infinite life to furnish a one volt potential—no current—as grid bias for the various

(*Turn to page* 60)

What You Want to Know
ABOUT TUBES

By The Staff

THE time has long since passed when a serviceman, an amateur or an engineer could quote from memory the "basing" and all the "characteristics" of the available vacuum tubes. From a modest beginning, the number of types has increased to a total so great that not even the type designations can be memorized with assurance. The purpose of the consolidated tube chart (which follows) is to group together the essential data on each type so that information can be had in a minimum of time.

IN studying the vacuum tubes available today, two groups can be formed. The first includes tubes of the conventional glass type manufactured prior to the introduction of the metal tube in April, 1935. The second group includes all-metal tubes and several classes of glass tubes designed to be interchangeable with metal tubes.

Glass tubes designed to be interchangeable with the all-metal types can be sub-divided into two general classifications. First of these is the "G" classification (or group in which the tubes are glass but are equipped with the octal base first introduced on metal tubes). These "G" tubes, except for the base, appear to be exactly like certain of the conventional glass tubes and indeed they are. For example, type 6K7G is a 78 with an octal base and type 6A8G is type 6A7 with an octal base. When fitted with a "glove" shield, these tubes are practically interchangeable with the all-metal 6K7 and 6A8 types. The second group includes the "metal-glass" tubes. These M.G. tubes are the conventional glass types which correspond in characteristics to the all-metal tubes but they are equipped with the octal-type base and are covered with a close-fitting sleeve cover of shield metal. In general they are designated with the same number used for the all-metal tubes followed by the suffix MG. In receivers of modern design, the MG tubes like those in the G classification can be substituted for all-metal tubes with small realignment adjustments. The smallest of the metal-glass tubes are the "Coronet" type. These, except for height, correspond to the regular MG tubes, although they are designated with the same type numbers which apply to the all-metal tubes.

The application of type designations to vacuum tubes was a haphazard process until the Radio Manufacturers' Association set up a committee of engineers from the radio tube industry to handle the numbering of tubes and associated problems connected with the new types. From this committee came the present numbering system of: a numeral to indicate approximate filament or heater operating voltage; a letter to show the function of the tube, and a numeral to indicate the number of elements. Thus the 25Z5 tells by its first numeral group that the filament or heater operates at approximately 25 volts, by the letter Z that the tube is a rectifier and by the final numeral that the tube has five connected elements: two plates, two cathodes and one common heater. Reference to the chart will show that more than seventy-five tubes appear under the old numbering system of an arbitrary numeral. No doubt there are many more tubes in this class which for some reason (usually poor adaptability to circuits) were dropped by the manufacturer who introduced them.

Among the special tubes listed in the chart are several of the "spray shield" type introduced by Majestic. The replacement tubes now furnished for them are no longer sprayed with metal in most cases, but are fitted with a "glove shield" soldered at the joints.

The basing views shown with the tube chart are for the bottom of the tube base or the bottom of the socket. This arrangement provides the clearest picture of connections, since construction (or service) involves the bottom of the base in all cases. The pin numbering, looking at the bottom of the base or socket, runs clockwise. In the conventional base glass tubes, with the filament or heater pins toward the observer, the left-hand pin is number one. In the octal base tubes, looking at the bottom of the base, the first pin in a clockwise direction from the key is the No. 1 pin. While this explanation is unnecessary in reference to the base diagrams shown, it is useful in checking the basing of new types where the pin numbers and their corresponding internal connections may be published without a diagram.

The data given in the tube chart covers essential points of interest for each type. It should be noted that the plate *supply* voltage is indicated. In resistance-coupled amplifiers, the *actual* plate voltage will be considerably lower, due to the drop in the plate resistor. In adjusting bias to the proper value, this lower plate voltage should be taken into account.

The values of internal capacitance are useful in the design of radio-frequency circuits and in figuring shunt effect on high audio frequencies in high-gain, resistance-coupled amplifiers.

Filament voltages should be held within a few percent for the older thoriated, tungsten-filament tubes such as the 01A, V99 and X99. Oxide-coated filaments and the heaters for oxide-coated cathode tubes should be maintained within 10 percent of the rated values.

Your Vote

(*Continued from page 8*)

vanguard Presidential programs were labelled as non-partisan, although the correct use of the term was frequently debated.

There were many heated moments in the pre-convention days. Henry P. Fletcher, chairman of the Republican National Committee, minced no words in deploring the refusal of the NBC and CBS to allow his "Liberty at the Crossroads" skit on the air. Freedom of the air immediately loomed as one of the arguments. One of the points that arose was how much time could be allotted to the President in his official capacity as against the time allotted him for strictly political broadcasts. The Fletcher program finally was placed on the Mutual chain, but it was not heard in the New York area, where WOR, Newark, serves as the MBS outlet.

Freedom of the air and free speech loom as vital issues and, if the discussions continue, it is quite likely that the whole American system of radio will become a campaign issue. Many public figures have come forward with opinions on the subject. In scope the subject is a very broad one, politics representing a small part of the issue.

One of the stormy political incidents centered about William S. Paley and the CBS when the president of the network allotted a broadcast period to Earl Browder, secretary of the Communist Party. Various editorial and Congressional objections to the talk were made. The Hearst newspapers launched an editorial tirade against Paley that did not abate even many weeks after the Browder talk. Bernarr Macfadden, of "Liberty," demanded the resignation of Paley.

Other publishers termed Paley's action as fair-minded. CBS also allotted a period to Representative Hamilton Fish, Jr., an outstanding foe of radicals, to answer the Communist Party talk, and he defended the CBS action in permitting the Browder program on the grounds that it proved the existence of free speech in the U. S. A. Certain CBS affiliates, particularly the New England group known as the Yankee Network, declined to carry the Browder talk.

The radio talks of Father Coughlin over his large independently-grouped network also brought about stormy political moments. One congressman, not exactly extolled by the Royal Oak priest, served notice on the stations conveying the Coughlin programs that he holds them responsible for any "further libelous remarks" about him made by Father Coughlin or any other persons.

A few persons of note in public and business circles have come forth with warnings and prescriptions of varied "codes of ethics" for political broadcasters. Such action is risky business in view of stepping on the sensitive toes of the "free speech" advocates. As a result despite the fact that political talks are accepted on the same basis as any other commercial programs, the campaign speakers will be allowed, directly and indirectly, to throw verbal mud at opponents. However, each network forbids ordinary sponsors any mention, favorably or unfavorably, of a competitor. But the rule is apparently just ignored when the Presidential year rolls around.

On the occasion of receiving an honorary degree at Rollins College last February, Owen D. Young, industrialist, criticized spokesmen of both political parties for "abusing" the privilege of free speech. He even included the President in his appeal for the "choice word and measured phrase," although he made no direct reference to his use of the radio. His direct "scoldings" were aimed at former President Hoover, Alfred E. Smith and Senator Robinson. Quoting from their recent broadcasts, Young added this comment: "Without questioning their right to freedom of speech, without inquiring as to the sincerity of their belief, one may well ask whether such statements are a wise exercise of the great powers and responsibilities of trusteeship which these men hold." Concluding, Mr. Young said: "To these great men, and

(*Turn to page 56*)

COMPLETE TUBE CHART

TYPE NO.	DESCRIPTION TYPE	DESCRIPTION CATHODE	BASING SEE SOCKET CONNECTION CHART	FIL CURRENT AMPS.	CAPACITANCES MICRO-MICRO-FARADS GRID-PLATE	INPUT	OUTPUT	OPERATING CONDITIONS AND CHARACTERISTICS WHEN USED AS	PLATE SUPPLY VOLTS	SCR. GRID VOLTS	GRID BIAS VOLTS (NEG.)	PLATE CURRENT M A.	AMPL. FACTOR	PLATE RESIS. OHMS	MUT. COND. µMHOS	MAX. UNDIST. OUT PUT WATTS	RECOMM. LOAD RESIS. OHMS	CUT-OFF BIAS VOLTS
1.1 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
WD-11 / WX-12	TRIODE	FIL.	4 F SPEC.4 PIN / 4 D MED.4 PIN	0.25	3.3	2.5	2.5	GRID LEAK DET.	45		+A							
								AMPLIFIER	90		4.5	2.5	6.6	15500	425	0.007	15000	
									135		10.5	3.0	6.6	15000	440	0.040	15000	
864	TRIODE	FIL.	4E SM.4 PIN	.25				NON MICROPHONIC AMPLIFIER	90		4.5	2.9	8.2	13500	610		15000	
									135		9.0	3.5	8.2	12700	645		15000	
2.0 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
15	PENTODE	HEATER	5F SM 5 PIN	.22				DET-OSC	135	67.5	1 S	1.85	500	800000	750			
30	TRIODE	FIL.	4D SM.4 PIN	0.060	6.0	3.7	2.1	BIAS DETECT.	180		18							
								AMPLIFIER	135		9	3	9.3	10300	900	0.07	20000	
									180		13.5	3.1	9.3	10300	900	0.13	20000	
31	TRIODE	FIL.	4D SM.4 PIN	0.130				AMPLIFIER	135		22.5	8	3.8	4100	925	0.185	7000	
									180		30	12.3	3.8	3600	1050	0.375	5700	
32	TETRODE	FIL.	4K MED.4 PIN	0.060	0.015 MAX.	6.0	11.7	DETECTOR	180	67.5	6						150000	
								AMPLIFIER	135	67.5	3	1.7	610	.95MΩ	640			9
									180	67.5	3	1.7	780	1.2MΩ	650			9
33	PENTODE	FIL	5K MED.5 PIN	0.260				AMPLIFIER	100	100	8	10.5	60	50000	1200	0.30	7000	
									135	135	13.5	14.5	70	50000	1450	0.70	7000	
34	REMOTE CUT-OFF PENTODE	FIL	4M MED.4 PIN	0.060	0.015 MAX.	6.0	12.6	1st DETECTOR	67.5 TO 180	67.5	5							
								AMPLIFIER	135	67.5	3	2.8	360	0.6MΩ	600			27
									180	67.5	3	2.8	620	1.0MΩ	620			27
49	DOUBLE GRID TRIODE	FIL	5C MED.5 PIN	0.120				CLASS A	135		20	5.7	4.5	4000	1125	0.17	11000	
								CL.B (AVG. 2 TUBES)	180		0	4 TO 30				3.0	9000 MIN.	
19	TWIN TRIODE	FIL.	6C SM.6 PIN	0.260				COMPLETE CL. A (BOTH SECTIONS)	135		0	10 TO 35				2.1	10000	
									135		3	4 TO 35				1.9	10000	
1A4	TETRODE	FIL.	4K SM.4 PIN	0.060	0.007 MAX.	4.6	11	AMPLIFIER	180	67.5	3	2.3	720	0.90MΩ	750			20
1A6	HEPTODE	FIL.	6L SM.6 PIN	0.060	0.8	5	6	OSCILLATOR SECT.	135		a 50000Ω b 20000Ω	2.3						
					0.25	10.5	9	MIXER SECTION	(a)180	67.5	3	1.3		0.5MΩ	300	CONVERSION CONDUCTANCE	R_{c2} 0.02MΩ	22.5
									(b)180	45	−F	1.2		0.6MΩ	250			11
1B4 / 951	TETRODE	FIL	4K SM.4 PIN	0.060	0.007 MAX.	4.6	11	1st DETECTOR	180	67.5	6							
								AMPLIFIER	180	67.5	3	1.7	780	1.0MΩ	650			9
1B5 / 25S	DUPLEX DIODE TRIODE	FIL	6M SM.6 PIN	0.060	3.6	2	3	DIODE DETECT. TRIODE AMPLI.	135		3	0.8	20.0	35000	575			
1C6	HEPTODE	FIL	6L SM.6 PIN	0.120	1.5	6	6	OSCILLATOR SECT	180		0.05MΩ	3.3				CONVERSION CONDUCTANCE	R_{c2} 0.02MΩ	
					0.3	10	10	MIXER SECTION	180	67.5	3	1.5		0.75MΩ	325			14
1F4	PENTODE	FIL.	5K MED.5 PIN	0.120				AMPLIFIER	135	135	4.5	8.0	340	0.2MΩ	1700	0 34	16000	
1F6	DUODIODE PENTODE	FIL.	6T SM.6 PIN	.060	.007	4	9	R.F. DET.-AMPLI	180	67.5	1.5	2.0	650	1 MEG.	650			12.0
								A.F. DET.-AMPLI.	135	135 SUPPLY	2.0	PLATE RESISTOR .25 MEG. SCREEN RESISTOR .8 MEG.						
2.5 VOLT A.C. DETECTOR AND AMPLIFIER TUBES																		
24A	TETRODE	HEATER	5E MED.5 PIN	1.75	0.007 MAX.	5.0	10.5	DETECTOR	250	45	5						0.25MΩ	
								A.F. AMPLIFIER	250	25	1	0.5	1000	2.0MΩ	500		0.1MΩ	
								R.F. AMPLIFIER	180	90	3	4.0	600	0.4MΩ	1000			15
									250	90	3	4.0	630	0.6MΩ	1050			15
26	TRIODE	1.5V.AC FIL.	4D MED.4 PIN	1.5 V 1.05 a	8.1	3.5	2.2	AMPLIFIER	135		10	5.5	8.3	7600	1100	0.08	8800	
									180		14.5	6.2	8.3	7300	1150	0.18	10500	
27	TRIODE	HEATER	5A SM.5 PIN	1.75	3.3	3.5	3.0	BIAS DETECTOR	250		30							
								AMPLIFIER	135		9	4.5	9	9000	1000	0.08	13000	
									180		13.5	5.0	9	9000	1000	0.165	19000	
									250		21	5.2	9	9250	975	0.30	34000	
35 / 51	REMOTE CUT-OFF TETRODE	HEATER	5E MED.5 PIN	1.75	0.007 MAX.	5.0	10.5	1st DETECTOR	250	90	7 APP.							
								AMPLIFIER	180	90	3	6.3	305	0.3MΩ	1020			50
									250	90	3	6.5	420	0.4MΩ	1050			50
45	TRIODE	FIL.	4D MED.4 PIN	1.50				SINGLE AMPLI.	180		31.5	31	3.5	1650	2125	0.82	2700	
									275		56	36	3.5	1700	2050	2.0	4600	
								PUSH-PULL (AVG. 2 TUBES)	300		70	44 TO 70				10	9000	
46	DOUBLE GRID TRIODE	FIL.	5C MED.5 PIN	1.75				CLASS A	250		33	22	5.6	2400	2350	1.25	6400	
								CL.B (AVG. 2 TUBES)	300		0	8 TO 70				16	5000 MIN.	
									400		0	12 TO 75				20	5500 MIN.	
47	PENTODE	FIL.	5B MED.5 PIN	1.75				AMPLIFIER	250	250	16.5	31	150	60000	2500	2.7	7000	
53	TWIN TRIODE	HEATER	7B MED.7 PIN LG. PIN CIRCLE	2.0				CL A (PARALLEL CONN.)	294		6	7	35	11000	3200	0.37	35000	
								COMPLETE CL. B (BOTH SECTIONS)	250		0	28 TO 50				8	8000	
									300		0	35 TO 50				10	10000	
55	DUPLEX DIODE TRIODE	HEATER	6G SM.6 PIN	1.0	2.0	2.0	4.0	DIODE DETECT.	180		13.5	6	8.3	8500	975	0.16	20000	
								TRIODE AMPLI.	250		20	8	8.3	7500	1100	0.35	20000	
56	TRIODE	HEATER	5A SM.5 PIN	1.0	3.2	3.2	2.2	BIAS DETECT.	250		20							
								AMPLIFIER	250		13.5	5.0	13.8	9500	1450	0.26	47000	
57	PENTODE	HEATER	6F SM.6 PIN	1.0	0.007 MAX.	5 0	6.5	DETECTOR	250	100	3.8						0.25MΩ	
								AMPLIFIER	250	100	3	2.0	2000	2.0MΩ	1225			7
58	REMOTE CUT-OFF PENTODE	HEATER	6F SM.6 PIN	1.0	0.007 MAX.	5.0	6 5	1st DETECT.	250	100	10							
								AMPLIFIER	250	100	3	8.2	1280	0.8MΩ	1600			50
59	TRIPLE GRID	HEATER	7A MED.7 PIN LG. PIN CIRCLE	2.0				CLASS A TRIODE	250		28	26	6	2400	2600	1.25	5000	
								CLASS A PENTODE	250	250	18	35	100	40000	2500	3	6000	
								CL. B TRIODE (AVG. 2 TUBES)	400		0	25 TO 75				20	6000 MIN.	
2A3 / 2A3H	TRIODE	FIL. / HEATER	4D MED.4 PIN / 4Q	2.5 / 2 8				SINGLE AMPLI.	250		45	60	4.2	800	5250	3.5	2500	
								CLASS AB (2 TUBES)	300	SELF BIAS	62	80 TO 100				10	5000	
									300	SELF BIAS	62	80 TO 150				15	3000	
2A5	PENTODE	HEATER	6B MED.6 PIN	1.75				PENTODE	250	250	16.5	34	220	0.1MΩ	2300	3	7000	
					#2 GR. TO PL. CLASS AB TRIODE 2 TUBES				350		38	42 TO 90				18	8000	
2A6	DUPLEX DIODE TRIODE	HEATER	6G SM.6 PIN	0.8	2.0	2.0	4.0	DIODE DETECT.	250		2	0.8	100	91000	1100			
								TRIODE AMPLI	250		2	0.1					0.25MΩ	
2A7	HEPTODE	HEATER	7C SM.7 PIN	0.8	1.0	7	5.5	OSC SECTION	250		50000Ω	4					R_{c2} 0.02MΩ	
					0.3	8.5	9	MIXER SECTION	250	100	3	4		0.36MΩ	520	CONVERSION CONDUCTANCE		45
2B7	DUPLEX DIODE PENTODE	HEATER	7D SM.7 PIN	0.8	0.010 MAX	3.3	10	DIODE DETECT.	100	100	3	5.8	285	0.3MΩ	950			17
								R.F. AMPLIFIER	250	100	3	6.0	800	0.8MΩ	1000			17
								DIO. DET. & A.F. AMP.	250	50	4.5	0.65					0.20MΩ	

TYPE NO.	DESCRIPTION: TYPE	DESCRIPTION: CATHODE	BASING SEE SOCKET CONNECTION CHART	FIL. CURRENT AMPS	CAPACITANCES MICRO-MICRO FARADS: GRID PLATE	CAPACITANCES: INPUT	CAPACITANCES: OUT-PUT	OPERATING CONDITIONS AND CHARACTERISTICS: WHEN USED AS	PLATE SUPPLY VOLTS	SCR. GRID VOLTS	GRID BIAS VOLTS (NEG.)	PLATE CURRENT M.A.	AMP. FACTOR	PLATE RESIS. OHMS	MUT. COND. µMHOS	MAX. UNDIST. OUTPUT WATTS	RECOMM. LOAD RESIS. OHMS	CUT-OFF BIAS VOLTS
3.3 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
20	TRIODE	FIL.	4D SM.4 PIN	0.132				AMPLIFIER	135		22.5	6.5	3.3	6300	525	0.110	6500	
V-99 X-99	TRIODE	FIL	4E SPEC. 4 PIN 4D SM. 4 PIN	0.063	3.3	2 5	2.5	GR. LEAK DET.	45		+A	1.5	6.6	17000	370			
								AMPLIFIER	90		4.5	2.5	6.6	15500	425	0.007	15500	
22	SCREEN GRID	FIL.	4K MED.4 PIN	0.132	0.020 MAX.	3.3	12	R.F. AMPLI.	135	67.5	1.5	3.7	160	0.32MΩ	500			7.5
								AUDIO AMPLI.	180	22.5	0.75	0.3	350	2.0MΩ	175		0.25MΩ	
5.0 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
12A	TRIODE	FIL	4D MED.4 PIN	0.25	8.0	4.0	2.0	AMPLIFIER	135		DC 9.0 AC	6.2	8.5	5100	1650	0.13	9000	
									180		13.5	7.7	8.5	4700	1800	0.85	10700	
71A	TRIODE	FIL.	4D MED.4 PIN	0.25				AMPLIFIER	135		27.0 29.5	17.3	3.0	1820	1650	0.40	3000	
									180		40.5 43.0	20	3.0	1750	1700	0.79	4800	
200A	CsVAPOR TRIODE	FIL	4D MED.4 PIN	0.25	8.5	3.2	2.0	GR.LEAK DET.	45		−A	1.5	20	30000	670			
01A	TRIODE	FIL	4D MED.4 PIN	0.25	8 1	3.1	2.2	GR.LEAK DET.	45		+A	1.8	80	12000	670			
								AMPLIFIER	90		4.5	2.5	8.0	11.000	725	0.015	25000	
									135		9	3.0	8.0	10000	800	0.055	20000	
40	TRIODE	FIL.	4D MED.4 PIN	0 25	8.8	3.4	1.5	BIAS DETECT.	180		4.5	0.1					0.25MΩ	
								AUDIO AMPLI.	180		3	0.2	30	0.15MΩ	200		0.25MΩ	
6.3 VOLT A.C. OR D.C. DETECTOR AND AMPLIFIER TUBES																		
36	TETRODE	HEATER	5E SM.5 PIN	0.30	0.007 MAX.	3.7	9.2	DETECTOR	180	67.5	6						0.25MΩ	
								AMPLIFIER	100	55	1.5	1.8	470	0.55MΩ	850			7
									250	90	3	3.2	595	0.55MΩ	1080			7
37	TRIODE	HEATER	5A SM.5 PIN	0.30	2.0	3.5	2.2	BIAS DETECTOR	180		20							
								AMPLIFIER	90		6	2.5	9.2	11500	800	0.03	17500	
									250		18	7.5	9.2	8400	1100	0.34	20000	
38	PENTODE	HEATER	5F SM.5 PIN	0.30				AMPLIFIER	100	100	9	7	80	85000	950	0.27	13500	
									135	135	13.5	9	100	0.1MΩ	1000	0.525	13500	
									250	250	25	22	120	0.1MΩ	1200	2.5	10000	
39 44	REMOTE CUT-OFF PENTODE	HEATER	5F SM.5 PIN	0.30	0.007 MAX.	3.5	10	1st DETECTOR	90 TO 250	90	7 APP.							
								AMPLIFIER	90	90	3	5.6	360	0.375MΩ	960			42
									250	90	3	5.8	1050	1.0MΩ	1050			42
41	PENTODE	HEATER	6B SM.6 PIN	0.40				AMPLIFIER	180	180	13.5	18.5	150	81000	1850	1.5	9000	
									250	250	18	32	150	68000	2200	3.4	7600	
42	PENTODE	HEATER	6B MED.6 PIN	0.70				PENTODE AMPLIFIER	250	250	16.5	34	185	79000	2350	3	7000	
									315	315	22	42	230	0.1MΩ	2300	5	7000	
					#2 GR. TO PL. CL. A.B. TRIODE (2 TUBES)				350		38	42 TO 90				18	8000	
52	DOUBLE GRID TRIODE	FIL.	5C MED.5 PIN	0.30				CLASS A	110		0	43	5.2	1750	3000	1.5	2000	
								CL.B (AVG. 2 TUBES)	180		0	6 TO 40				6	9000 MIN.	
75	DUPLEX DIODE TRIODE	HEATER	6G SM.5 PIN	0.30	2.0	2.0	4.0	DIODE DETECT	250		2	0.8	100	91000	1100			
								TRIODE AMPLI.	250		2	0.1					0.25MΩ	
76	TRIODE	HEATER	5G SM.6 PIN	0.30	2.8	3.5	2.5	OSCILLATOR	90		0							
								AMPLIFIER	250		13.5	5.0	13.8	9500	1450	0.25	50000	
77	PENTODE	HEATER	6F SM.6 PIN	0.30	0.007 MAX.	4.0	11	DETECTOR	250	100	4.3							
								AMPLIFIER	250	100	3	2.3	1500	1.5MΩ	1250			7.5
78	REMOTE CUT-OFF PENTODE	HEATER	6F SM.6 PIN	0.30	0.007 MAX.	4.0	11	1st DETECTOR	250	100	10							
								AMPLIFIER	250	100	3	7.0	1160	0.8MΩ	1450			42
79	TWIN TRIODE	HEATER	6H SM.6 PIN	0.60				COMPLETE CL.B BOTH SECTIONS	250		0	20 TO 60				8	14000	
85	DUPLEX DIODE TRIODE	HEATER	6G SM.6 PIN	0.30	2.0	2.0	4.0	DIODE DETECT.	180		13.5	6	8.3	8500	975	0.16	20000	
								TRIODE AMPLI	250		20	8	8.3	7500	1100	0.35	20000	
89	TRIPLE GRID	HEATER	6F SM 6 PIN	0.40				CL. A TRIODE	250		31	32	4.7	2600	1800	0.9	5500	
								CL.A PENTODE	250	250	25	32	125	70000	1800	3.4	6750	
								CL. B TRIODE (AVG. 2 TUBES)	250		0	6 TO 50				5	10000 MIN.	
6A3	TRIODE	FIL	4D MED. 4 PIN	1.0				SINGLE AMPLI.	250		45	60	4.2	.800	5250	3.3	2500	
								CLASS AB (2 TUBES)	325	SELF BIAS	63	130 TO 150				10	5000	
									325	FIXED BIAS	63	140 TO 200				15	3000	
6A4 LA	PENTODE	FIL.	5B MED. 5 PIN	0.30				AMPLIFIER	180	180	12	22	100	4500	2200	1.4	8000	
								CL. AB (2 TUBES)	230	230	22	32	SELF-BIAS R_{c1}=700Ω			4.2	16000	
12A5	PENTODE	HEATER	7F SM. 7 PIN	6.3V. 0.6A 12.6V. 0.3A	8.5	4	2	AMPLIFIER	100	100	15	17			1700	0.65	4500	
									180	180	27	38			2300	2.6	3800	
6A6	TWIN TRIODE	HEATER	7B MED. 7 PIN LG. PIN CIRCLE	0.8				CL. A PARALLEL CONN.	294		6	7	35	11000	3200	0.37	35000	
								COMPLETE CL.B BOTH SECTIONS	250		0	28 TO 50				8	8000	
									300		0	35 TO 50				10	10000	
6A7	HEPTODE	HEATER	7C SM.7 PIN	0.30	1.0	7	5.5	OSC. SECTION	250		50000Ω	4					R_{c2} 0.02MΩ	
					0.3	8.5	9	MIXER SECTION	250	100	3	4		0.36MΩ	520	CONVERSION CONDUCTANCE		45
6B5	DUAL TRIODE	HEATER	6D MED.6 PIN	0.80				SINGLE TUBE	EACH 300		0	OUT-PUT 45 IN-PUT 8	58	24000	2400	4	7000	VOLTS RMS 15
									" 325		0	51 9				5.2	7000	17
								TWO TUBES	" 250		0	33 6.5				8.5	10000	38
									" 325		0	51 9				13.5	10000	42
6B7	DUPLEX DIODE PENTODE	HEATER	7D SM.7 PIN	0.30	0.010 MAX.	3.3	10	DIODE DETECT.	100	100	3	5.8	285	0.3MΩ	950			17
								R.F. AMPLIFIER	250	100	3	6.0	800	0.8MΩ	1000			17
								DIO. DET. & A.F. AMPLI.	250	50	4.5	0.65					0.2MΩ	
6C6	PENTODE	HEATER	6F SM.6 PIN	0.30	0.007 MAX.	5.2	6.8	DETECTOR	250	100	3.8						0.25MΩ	
								AMPLIFIER	250	100	3	2.0	2500	2.0MΩ	1225			7
6D6	REMOTE CUT-OFF PENTODE	HEATER	6F SM.6 PIN	0.30	0.007 MAX.	5.2	6.8	1st DETECT	250	100	10							
								AMPLIFIER	250	100	3	8.2	1280	0.8MΩ	1600			50
6E5	CATHODE RAY	HEATER	6R SM.6 PIN	0.30				TUNING INDICATOR	WITH PLATE 250V. (THRU 1MΩ) TARGET 250V. I_b=0.25m.a. AND SHADOW ANGLE IS 90° AT E_c=0V, ANGLE IS ZERO AT E_c=−8V. APPROX.									
6E6	TWIN TRIODE	HEATER	7B MED.7 PIN	0.60				COMPLETE CL. A BOTH SECTIONS	180		20	23	6.0	2150	2800	0.75	15000	
									250		27.5	36	6.0	1750	3400	0.6	14000	
6F7	TRIODE PENTODE	HEATER	7E SM.7 PIN	0.30	2.0	2.5	3.0	TRIODE AMPLI.	100		3	3.5	8	18000	500			
					0.008 MAX.	3.2	12	PENTODE 1st DET.	250	100	10							
								PENTODE AMP.	250	100	3	6.5	900	0.85MΩ	1100			50
6G5	CATHODE RAY	HEATER	6R SM.6 PIN	0.30				TUNING INDICATOR	WITH PLATE 250V. (THRU 1MΩ) TARGET 250V. I_b=0.25m.a. AND SHADOW ANGLE IS 90° AT E_c=0V; ANGLE IS ZERO AT E_c=−22V. APPROX.									
6N7G	TWIN TRIODE	HEATER	8B OCTAL MED. SHELL 8 PIN	0.80								SAME	AS	6A6				

TYPE NO.	DESCRIPTION: TYPE	DESCRIPTION: CATHODE	BASING (SEE SOCKET CONNECTION CHART)	FIL. CURRENT AMPS.	CAPACITANCES MICRO-MICRO FARADS: GRID PLATE	CAPACITANCES: INPUT	CAPACITANCES: OUTPUT	OPERATING CONDITIONS AND CHARACTERISTICS: WHEN USED AS	PLATE SUPPLY VOLTS	SCR. GRID VOLTS	GRID BIAS VOLTS (NEG.)	PLATE CURRENT M.A.	AMPL. FACTOR	PLATE RESIST. OHMS	MUT. COND. μMHOS.	MAX. UNDIST. OUTPUT WATTS	RECOMM. LOAD RESIST. OHMS	CUT-OFF BIAS VOLTS
7.5 VOLT AC POWER AMPLIFIER TUBES																		
10	TRIODE	FIL.	4D MED. 4 PIN	1.25				AMPLIFIER	350		31	16	8.0	5150	1550	0.9	11000	
									425		39	18	8.0	5000	1600	1.6	10000	
50	TRIODE	FIL.	4D MED. 4 PIN	1.25				AMPLIFIER	350		63	45	3.8	1900	2000	2.4	4100	
									450		84	55	3.8	1800	2100	4.6	4350	
SERIES FILAMENT POWER AMPLIFIER TUBES																		
43	PENTODE	HEATER	6B MED. 6 PIN	0.3a 25V.				AMPLIFIER	95	95	15	20	90	45000	2000	0.9	4500	
									180	135	20	38	100	40000	2500	2.75	5000	
48	PENTODE	HEATER	6B MED. 6 PIN	0.4a 30V.				AMPLIFIER	96	96	1.9	52			3800	2.0	1500	
									125	100	22.5	56			3900	2.5	1500	
12A7	PENTODE & DIODE	HEATER	7K SM. 7 PIN	0.3a 12.6V.				AMPLIFIER	135	135	13.5	9	100	0.1MΩ	975	0.55	13500	
								RECTIFIER	125RMS			30MAX.						
METAL DETECTOR AND AMPLIFIER TUBES																		
6A8	HEPTODE	HEATER	8A OCTAL 8P.	0.3	1	7	4.5	OSC. SECTION	250		50000Ω	4						
					0.05	13	13.0	MIXER SECTION	250	100	3	4		0.36MΩ	520 CONVERSION CONDUCTANCE			
6C5	TRIODE	HEATER	6Q OCTAL 6P.	0.30	2.0	4.5	14	OSCILLATOR	90		0							
								AMPLIFIER	250		8	8	20	10000	2000			
6F5	TRIODE	HEATER	5M OCTAL 5P.	0.30				AMPLIFIER	250		2	0.9	100	66000	1500			
									250		2	0.1					0.25MΩ	
6F6	PENTODE	HEATER	7S OCTAL 7 PIN	0.70				PENTODE AMP.	250	250	16.5	34	185	79000	2350	3	7000	
								TRIODE (G_2 TO P)	250		20	31	6.2	2700	2300	0.85	4000	
								CL. AB PENTODE	375	250	340Ω SELF	54				19	10000	
								AMPLI. (2 TUBES)	375	250	26 FIXED	34				19	10000	
6H6	TWIN DIODE	HEATER	7Q O.7 P.	0.30				DIODE DET.	100 MAX. AC			2 MAX EA. DIODE						
6J7	PENTODE	HEATER	7R OCTAL 7 PIN	0.30	0.002	8	12	DETECTOR	250	100	3.8						0.25MΩ	
								AMPLIFIER	250	125	3	4			1550			9
									250	100	3	2	2500	2.0MΩ	1225			7
6K7	PENTODE	HEATER	7R OCTAL 7 PIN	0.30	0.002	8	12	1ST DETECTOR	250	100	10							
								AMPLIFIER	250	125	3	10.5	990	0.6MΩ	1650			52
									250	100	3	7	1160	0.8MΩ	1450			42
6L6	TETRODE	HEATER	7Y SMALL OCTAL 7 PIN	0.9				PWR. AMPLI.	250	250	14V	72	135	22500	6000	SCR.G. CURRENT 5MA		
								PWR. AMP. FIXED BIAS	375	125	9	24				4.2	14000	
								PWR. AMP. SELF BIAS	375	125	9	24				4.0	14000	
								FIXED BIAS	375	250	17.5	57				11.5	4000	
								2 TUBES CLASS AB FIX. BIAS	400	250	20.0	88 TO 168				40	6000	
								2 TUBES CLASS AB FIX. BIAS	400	300	25.0	102 TO 230				60	3800	
6L7	HEPTODE	HEATER	7T OCT. 7 PIN	0.30	G_1 0.001	G_1 8.5 G_3 11.5	13	MIXER	250	150	G_1 6 G_3 15	3.3	I_{c2-4}=8.3	2.0MΩ	350 CONVERSION CONDUCTANCE			G_1=45
								AMPLIFIER	250	100	G_1 G_3 3	5.3	880	0.8MΩ	1100			G_1 23 G_3 12
6Q7	DUPLEX DIODE TRIODE	HEATER	7V OCT. 7 PIN	0.30	1.2	6	4.5	DIODE DETECT.	100		1.5	0.35	70	0.87MΩ	800			
								TRIODE AMP.	250		3	1.1	70	0.58MΩ	1200		0.25MΩ	
6R7	DUPLEX DIODE TRIODE	HEATER	7V O.7 P.	0.30	2.0	6	4.5	DIODE DETECTOR TRIODE AMPLIFIER	250		90	9.5	16	8500	1900	0.28	15000	
25A6	PENTODE	HEATER	7S O.7 P.	0.3a 25.0V.				AMPLIFIER	95	95	15	20	90	45000	2000	0.9	4500	
									180	135	20	38	100	40000	2500	2.75	5000	

RECTIFIER TUBES

					FIL. AMPS	FIL. VOLTS	MAX. AC VOLTS PER ANODE	MAX. DC OUT. CURR (AMPS)	MAX. PEAK INVERSE VOLTS	MAX. PEAK PLATE CURR.	MIN. CHOKE BEFORE FILTER CONDENSER	MAX. HEATER CATHODE BIAS	MAX. D.C. VOLTS DEL. TO FILTER (NOM.): CONDENSER INPUT	MAX. D.C. VOLTS DEL. TO FILTER (NOM.): CHOKE INPUT
BA	FULL WAVE	GAS	COLD	4J M.4 P.	—	—	350	0.350	1000	1.00				300
BH	FULL WAVE	GAS	COLD	4J M.4 P.	—	—	350	0.125	1000	0.40				300
BR	HALF WAVE	GAS	COLD	4H M.4 P.	—	—	300	0.050	850	0.20			300	
1-V	HALF WAVE	HIGH VAC.	HEATER	4G SM. 4 PIN	0.3	6.3	350	0.050	1000	0.20		500	400	
80	FULL WAVE	HIGH VAC.	FIL.	4C MED. 4 PIN	2.0	5.0	350	0.125	1000	0.40			300	225
							400	0.110	1100	0.35			370	275
							550	0.135	1500	0.30	20 HENRIES			425
81	HALF WAVE	HIGH VACUUM	FIL.	4B MED. 4 PIN	1.25	7.5	700	0.085	2000	0.60 FULL WAVE			750	550
82	FULL WAVE	MERCURY VAPOR	FIL.	4C MED. 4 PIN	3.0	2.5	500	0.125	1400	0.40			590	425
83	FULL WAVE	MERCURY VAPOR	FIL.	4C MED. 4 PIN	3.0	5.0	500	0.250	1400	0.80			530	400
83V	FULL WAVE	HIGH VACUUM	HEATER	4L MED. 4 PIN	2.0	5.0	500	0.250	1400	0.80			510	385
0Z3	FULL WAVE	GAS	COLD	5N SM. 5 PIN	—	—	350	0.075 MAX. 0.030 MIN.	1250	0.20			425	300
0Z4	FULL WAVE	GAS	COLD	4R OCT. 4 PIN	—	—	350	0.075 MAX. 0.030 MIN.	1250	0.20			425	300
5Y3	FULL WAVE	HIGH VAC.	FIL.	5L OCTAL MED. SHELL 5 PIN	2.0	5.0		SAME	AS	TYPE	80			
5Z3	FULL WAVE	HIGH VAC.	FIL.	4C MED. 4 PIN	3.0	5.0	500	0.250	1400	0.70			480	360
6Z4 / 84	FULL WAVE	HIGH VAC.	HEATER	5D SM. 5 PIN	0.5	6.3	350	0.060	1000	0.20		500	425	300
12Z3	HALF WAVE	HIGH VAC.	HEATER	4G SM. 4 PIN	0.3	12.6	250	0.060	700	0.30		350	310	
25Z5	RECTIFIER DOUBLER	HIGH VAC.	HEATER	6E SM. 6 PIN	0.3	25.0	125	0.200	700	0.40	RECTIFIER	350	200	
								0.100	700	0.20	DOUBLER	350	120	
METAL RECTIFIER TUBES														
5W4	FULL WAVE	HIGH VACUUM	FIL.	5H SM. OCT. 5 PIN	1.5	5.0	350	0.110					370	
5Z4	FULL WAVE	HIGH VACUUM	HEATER	5L OCT. 5 PIN	2.0	5.0	400	0.125	1100	0.50			425	275
6X5	FULL WAVE	HIGH VACUUM	HEATER	6S OCT. 6 PIN	0.6	6.3	350	0.075	1250	0.25		500	400	
25Z6	RECTIFIER DOUBLER	HIGH VACUUM	HEATER	7Q OCT. 7 PIN	0.3	25.0	125	0.170	700	0.35	RECTIFIER	350	225	
								0.085	700	0.17	DOUBLER		115	

SPECIAL TUBES

TYPE NO.	FILAMENT VOLTS	FILAMENT AMPS	BASING VIEW	BASING SHIELD CONN. TO	CHARACTERISTICS USE & DIMENSIONS
2S/4S	2.5	1.35	5D	CATHODE PIN	APPROXIMATELY 40 MA ON EA. DIODE PLATE AT 50 VOLTS DC. DUPLEX DIODE DETECTOR
24S	2.5	1.75	5E	CATHODE PIN	SAME AS 24A
27S	2.5	1.75	5E	CATHODE PIN	SAME AS 27
35/51S	2.5	1.75	5E	CATHODE PIN	SAME AS 35
55S	2.5	1.0	6G	CATHODE PIN	SAME AS 55
56S	2.5	1.0	5A	CATHODE PIN	SAME AS 56
57S	2.5	1.0	6F	CATHODE PIN	SAME AS 57
57AS	6.3	0.4	6F	CATHODE PIN	SAME AS 6C6 EXCEPT HEATER AMPS.
58S	2.5	1.0	6F	CATHODE PIN	SAME AS 58
58AS	6.3	0.4	6F	CATHODE PIN	SAME AS 6D6 EXCEPT HEATER AMPS.
75S	6.3	0.3	6G	CATHODE PIN	SAME AS 75
85AS	6.3	0.3	6G	HEATER PIN ADJACENT TO CATHODE PIN	SIMILAR TO 85 EXCEPT AMP. FACTOR = 20 MUTUAL COND. = 1250; PLATE CURR. = 5.5 MA. PLATE VOLTS = 250V; GRID BIAS = −9V.
182B	5.0	1.25	4D	NO SHIELD	SIM. TO 45 EXCEPT FIL. VOLTS. AMP. FACT. = 5.0 MUTUAL COND. = 1800, PLATE CURR. = 18 MA. PL. VOLTS = 250 V. GR. BIAS = −35V.
183	5.0	1.25	4D	NO SHIELD	SIM. TO 45 EXCEPT FIL. VOLTS: AMP. FACT. = 3.0, MUT. COND. = 1500, PL. CURR. = 20 MA., PL. VOLTS = 250V; GR. BIAS = −6.8V.
485	3.0	1.25	5A	NO SHIELD	SIM. TO 27 EXCEPT HEATER VOLTS; AMP. FACT. = 12.8 MUT COND. = 1300; PL. CURR. = 5.2 M.A.; PL. VOLTS = 180V.; GR. BIAS = −10V.
950	2.0	0.12	5K	NO SHIELD	SIM. TO 33 EXCEPT FIL. AMPS; PL. CURR. = 7 MA. POWER OUTPUT = 0.45 WATTS, PL. & SCR. VOLTS = 135 V. MAX. CONT. GR. BIAS = −16.5
2A7S	2.5	1.0	7C	CATHODE PIN	SAME AS 2A7
2Z2/G84	2.5	1.5	4B	NO SHIELD	SIMILAR TO 1-V
6A7S	6.3	0.3	7C	CATHODE PIN	SAME AS 6A7
6B7S	6.3	0.3	7D	CATHODE PIN	SAME AS 6B7
6C7	6.3	0.3	7G	SEPARATE PIN	SAME AS 85A-S
6D7	6.3	0.3	7H	SEPARATE PIN	SAME AS 6C6
6E7	6.3	0.3	7H	SEPARATE PIN	SAME AS 6D6
6F7S	6.3	0.3	7E	CATHODE PIN	SAME AS 6F7
6Y5	6.3	0.8	6J	SEPARATE PIN	SIMILAR TO 6Z4/84
6Z5	12.6 / 6.3	0.4 / 0.8	6K	NO SHIELD	SIMILAR TO 6Z4/84

COMPARISON CHART
SIMILAR CHARACTERISTICS

OCTAL BASE GLASS	METAL GLASS	METAL	GLASS
5Y3	5Z4MG		80
6A8G	6A8MG		6A7
6C5G	6C5MG	6C5	
6F5G	6F5MG	6F5	75 TRIODE
6F6G	6F6MG	6F6	42
6H6G	6H6MG	6H6	
6J7G	6J7MG	6J7	77
6K7G	6K7MG	6K7	78
6L7G	6L7MG	6L7	
6N7G	6N7MG		6A6
	6N6MG		6B5
6Q7G	6Q7MG	6Q7	
6R7G	6R7MG	6R7	
6X5G	6X5MG	6X5	
6B6	6B6		75
6P7	6P7		6F7
25A6G	25A6MG	25A6	43
25Z6G	25Z6MG	25Z6	25Z5

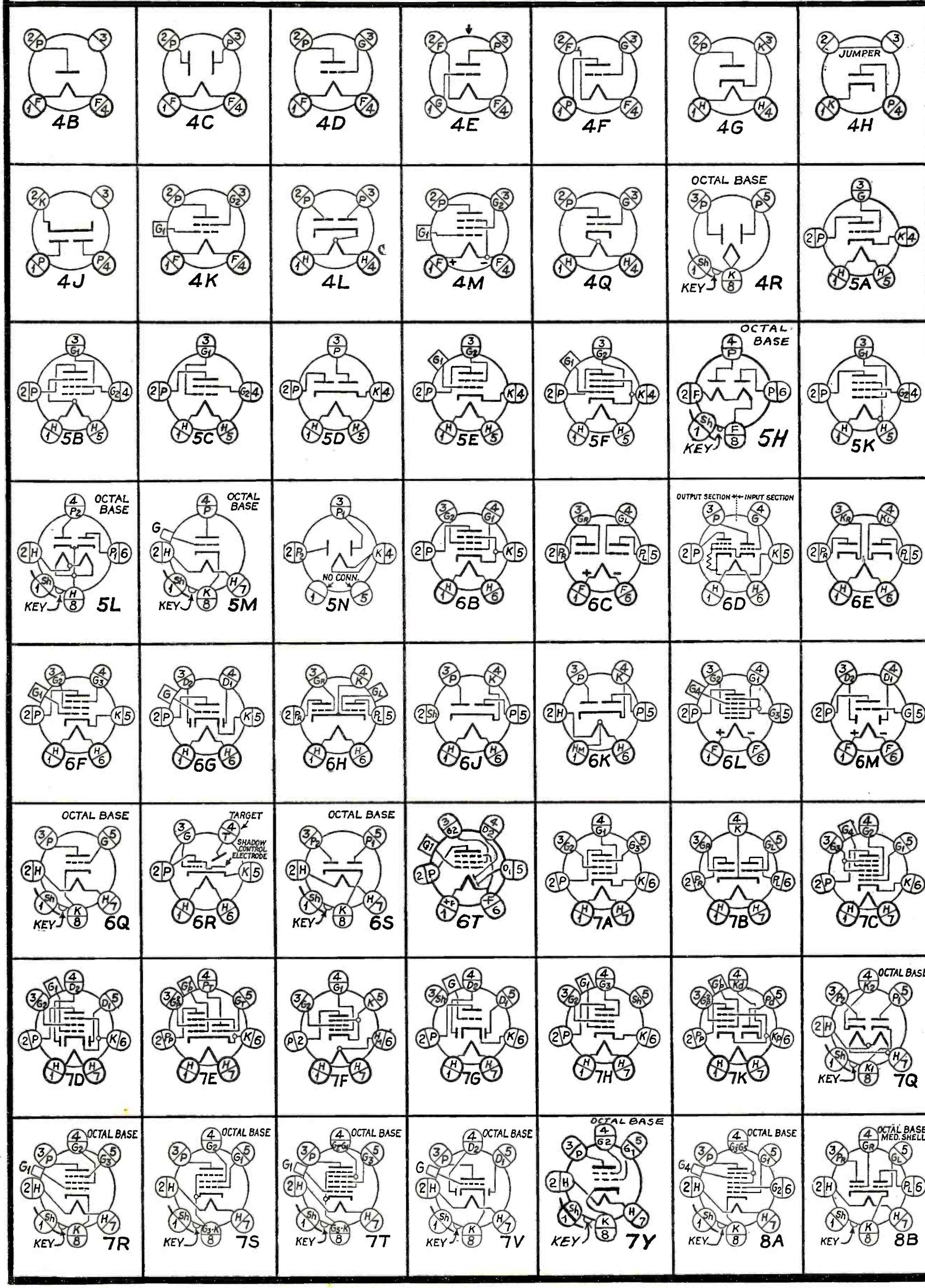
BASE CONNECTIONS
OCTAL BASE TWO VOLT GLASS TUBES

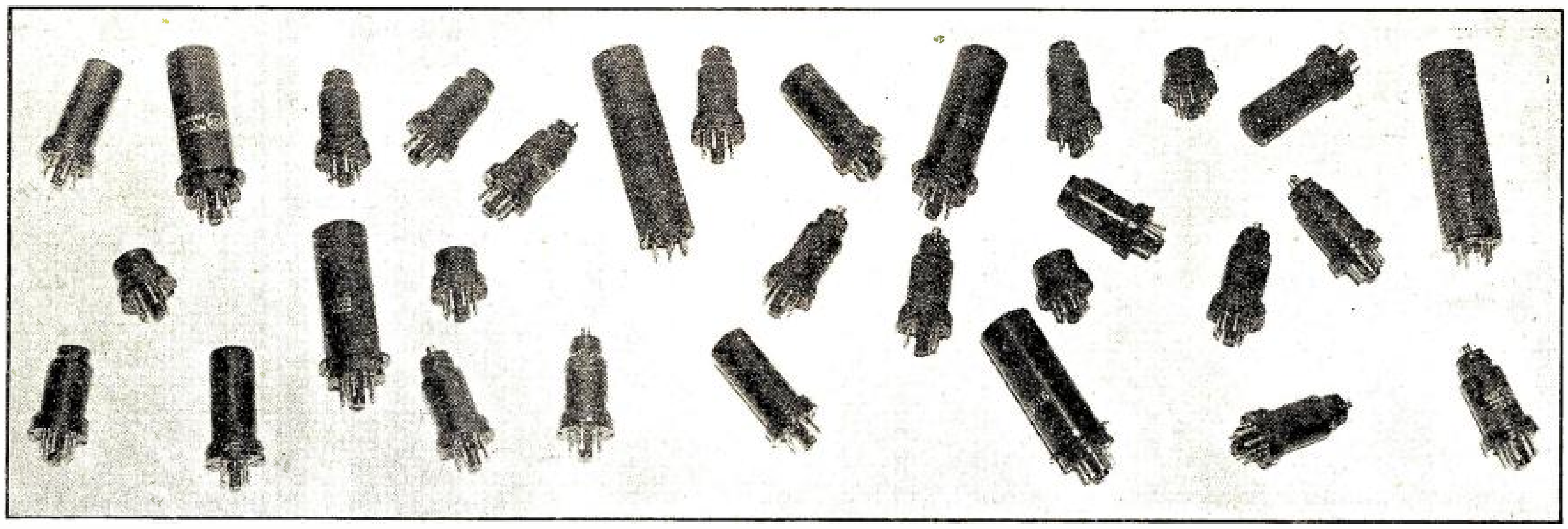
OCTAL BASE "G" TYPES	EQUIV. TYPES	1	2	3	4	5	6	7	8	TOP CAP
1C7G	1C6	NC	+F	P	G_3G_5	G_1	G_2	−F	NC	G_4
1D5G	1A4	NC	+F	P	G_2	NC	—	−F	NC	G_1
1D7G	1A6	NC	+F	P	G_3G_5	G_1	G_2	−F	NC	G_4
1E5G	1B4	NC	+F	P	G_2	NC	—	−F	NC	G_1
1F5G	1F4	NC	+F	P	G_2	G_1	—	−F	NC	—
1H4G	30	NC	+F	P	NC	G_1	—	−F	NC	—
1H6G	1B5/25S	NC	+F	P	D(+)	D(−)	G	−F	NC	—
1J6G	19	NC	+F	P_1	G_1	G_2	P_2	−F	NC	—

TABLE OF COMPARATIVE TYPES

OCTAL BASE GLASS	METAL GLASS	METAL	GLASS
5V4			83V
6L6G		6L6	
1C7G			1C6
1D5G			1A4
1D7G			1A6
1E5G			1B4
1F5G			1F4
1H4G			30
1H6G			1B5/25S
1J6G			19

SOCKET CONNECTIONS—BOTTOM VIEW





A YEAR OF METAL TUBES

Are metal tubes worth while? This review of the first season of metal tubes, based on interviews of tube and set manufacturers, engineers and dealers, indicates an affirmative answer.

By The Staff

JUST one year ago the idea of metal tubes was introduced to the public and shortly thereafter receivers using metal tubes were offered for sale. For some months the question as to whether metal tubes were worthwhile was beclouded by propaganda for and against. Between the enthusiasts and the pessimists among the manufacturers and dealers, the public was left pretty much to make up its own mind as to whether it believed in the new development—or whether it would insist on glass tubes. The answer of Mr. and Mrs. Public was unanimous and spectacular.

TODAY there can be no question about the status of metal tubes in the mind of the average radio-set purchaser, but it is nevertheless interesting to review the phenomenal rise of the metal tube. Its development and acceptance have not been entirely a path of roses. In the first few months of production there were many complaints, concerning mainly the short life of certain types of metal tubes. The principal reason for this condition was that the tremendous demand resulted in a premature rush of production in the tube factories which kept them going at high speed twenty-four hours a day. The second reason was that several different types of tubes were introduced simultaneously and all of them put into immediate heavy production.

It is a safe guess that had an equal number of new glass tubes been brought out simultaneously, and suddenly rushed into high-speed production, just about the same amount of trouble would have been encountered.

Previously the glass tubes had been introduced one at a time and in each case their acceptance by set manufacturers was slow enough to permit the "bugs" of production to be ironed out before a sizable demand developed. This is a logical course of procedure, as no new vacuum tube type can be fully perfected until it has gone through its "baptism of fire" in actual receiver circuits under conditions of normal use.

Under the circumstances, the tube manufacturers really did a remarkable job. They faced an unprecedented situation. They could not introduce metal tubes one type at a time because it would be a little bit ridiculous for set manufacturers to develop receivers which would use one or two metal tubes and glass tubes for the balance. Moreover, set manufacturers would have been hampered in going into full production because they would have to revamp their designs from week to week as additional types of metal tubes were introduced. Also, the inclusion of one or two metal tubes in a radio receiver would offer little buying appeal to the public, whereas the introduction of all-metal-tube receivers undoubtedly contributed very largely to the tremendous radio sales experienced during the past ten months.

Early Criticisms

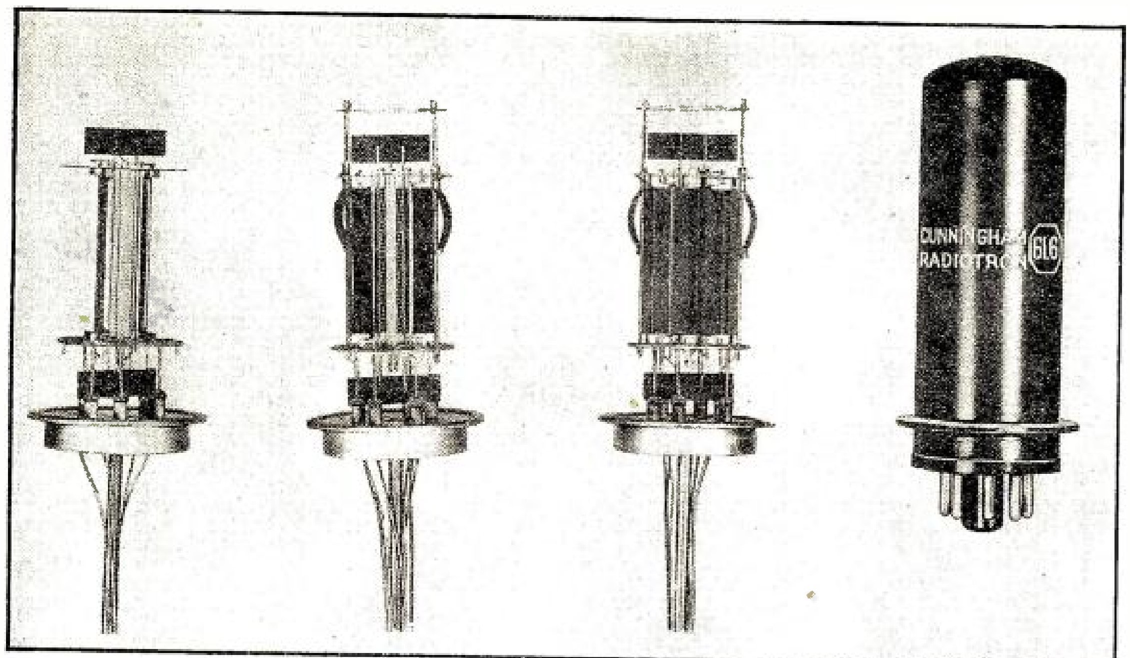
Much of the early criticism of metal tubes was unquestionably justified. From the standpoint of metal tube proponents, however, it is only fair to state that metal tubes received the blame for all sorts of failures for which they were not responsible.

During the season just closed there were of course some manufacturers who were unwilling to use the metal tubes. Some of the more conservative preferred to wait until the metal tubes had proven themselves. They produced some mighty fine glass-tube sets. Others had completed their production plans before metal tubes were available and decided to carry on with glass tubes rather than undertake the expense involved in altering these plans. Most of this latter group of set manufacturers did subsequently change over to metal tubes and others are planning to do so next season.

Favor Metal Tubes

The general acceptance of the metal tube has definitely put the production plans for the coming year on an even more extensive scale than last year. A check was made on this point among engineers who have been and are now engaged in designing receivers for the 1936-7 season. The engineers consulted favor the metal tubes to the last man. The editors believe without any question whatsoever that metal tubes have arrived but that glass tubes will be used on some special jobs and as replacements in old receivers. This opinion is based on rather extensive inquiries and investigation among set manufacturers, dealers and tube manufacturers.

The investigation made by RADIO NEWS included a visit to the RCA Radiotron plant at Harrison, New Jersey, with the object of looking into the whole question of metal tubes versus glass from a technical and a tube production standpoint and to review the metal tube development now that the heat of controversy has subsided. Following are some of the conclusions reached. The metal tube is not radically revolutionary in its effectiveness as compared with similar glass types. It has several advantages, each in (Turn to page 45)



	E_f	I_f	E_p	E_{sg}	E_g	I_p	I_{sg}	mu	R_p	G_m	PLATE AND SCREEN DISSIPATION (TOTAL)
STATIC AND DYNAMIC CHARACTERISTICS	6.3	0.9	250	250	-14	72	5	135	22500	6000	
MAXIMUM RATINGS:											
SINGLE TUBE CLASS A_1 AMP.			375	250							24 WATTS
PUSH-PULL CLASS A_1 AMP.			375	250							24 WATTS
PUSH-PULL CLASS AB_1 AMP.			400	300							24 WATTS
PUSH-PULL CLASS AB_1 AMP.			400	300							24 WATTS

TYPICAL OPERATION

TYPE OF BIAS	E_p	E_{sg}	E_g	PEAK A.F. GRID-VOLTS	I_p ZERO SIG.	I_p MAX. SIG.	I_{sg} ZERO SIG.	I_{sg} MAX. SIG.	LOAD OHMS	% HARMONIC DISTORTION TOT.	2ND	3RD	OUTPUT WATTS	PEAK INPUT MILLIWATTS
SINGLE TUBE CLASS A_1 AMPLIFIER														
FIXED	375	125	-9	8	24	26	0.7	1.8	14,000	9	8	4	4.2	
SELF	375	125	-9	8.5	24	24.3	0.6	2	14,000	9	8	4	4	
FIXED	250	250	-14	14	72	79	5	7.3	2.500	10	9.7	2.5	6.5	
SELF	250	250	-13.5	14	75	78	5.4	7.2	2,500	10	9.7	2.5	6.5	
FIXED	300	200	-12.5	12.5	48	55	2.5	4.7	4,500	11	10.7	2.5	6.5	
SELF	300	200	-11.8	12.5	51	54.5	3	4.6	4,500	11	10.7	2.5	6.5	
FIXED	375	250	-17.5	17.5	57	67	2.5	6	4.000	14.5	11.5	4.2	11.5	
PUSH-PULL CLASS A_1 AMPLIFIER														
FIXED	250	250	-16	32	**120**	**140**	**10**	**16**	5.000	2	—	2	**14.5**	
SELF	250	250	-16	35.6	**120**	**130**	**10**	**15**	5,000	2	—	2	**13.8**	
PUSH-PULL CLASS AB_1 AMPLIFIER														
FIXED	400	250	-20	40	**88**	**126**	**4**	**9**	6,000	1	—	1	**20**	
FIXED	400	250	-20	40	**88**	**124**	**4**	**12**	8,500	2	—	2	**26.5**	
SELF	400	250	-19	43.8	**96**	**110**	**4.6**	**10.8**	8,500	2	—	2	**24**	
FIXED	400	300	-25	50	**100**	**152**	**5**	**17**	6,600	2	—	2	**34**	
SELF	400	300	-23.5	57	**112**	**128**	**6**	**16**	6,600	2	—	2	**30**	
FIXED	400	300	-25	50	**102**	**156**	**5**	**12**	3,800	0.6	—	0.6	**23**	
PUSH-PULL CLASS AB_2 AMPLIFIER														
FIXED	400	250	-20	57	**88**	**168**	**4**	**13**	6.000	*			**40**	180
FIXED	400	300	-25	80	**102**	**230**	**6**	**20**	3,800	*			**60**	350

BOLD FACED NUMBERS REFER TO VALUES FOR TWO TUBES. * WITH ZERO IMPEDANCE DRIVER, NOT OVER 2 PER CENT. SUBSCRIPT 1 IN A_1 AND AB_1 INDICATES NO GRID CURRENT IS DRAWN. SUBSCRIPT 2 IN AB_2 INDICATES GRID CURRENT IS DRAWN DURING A PART OF THE CYCLE.

Data on the 6L6 TUBE

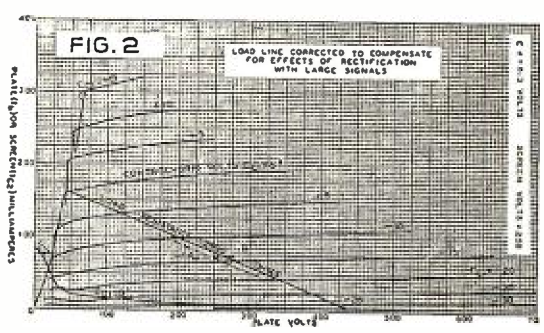
By J. van Lienden

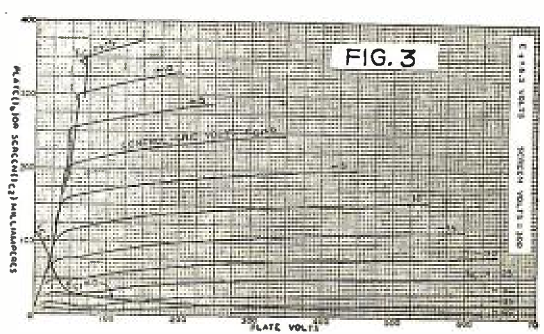
A NEW type of metal power amplifier tube, recently released, is expected to become the most frequently used audio tube for large receivers. It is constructed on an entirely new principle. The electrodes are arranged in such a way as to concentrate the electron current into a beam of high intensity.

This results in an excellent power tube which has a high power output at high efficiency and low distortion. Even in circuits which do not require any grid current a maximum power of 34 watts is obtainable with but 2 percent. harmonic distortion. A maximum of 60 watts can be had from a pair of 6L6 tubes when they are operated "AB_2," that is, when the grids go positive during a part of the cycle.

The tube is a tetrode, and contains a screen-grid (but no suppressor grid). Due to the nature of the internal construction the screen does not absorb any appreciable power and the space charge itself provides the suppressor action. Like other multi-element power tubes, the power sensitivity is high and a large power output can be obtained without driving the grids positive.

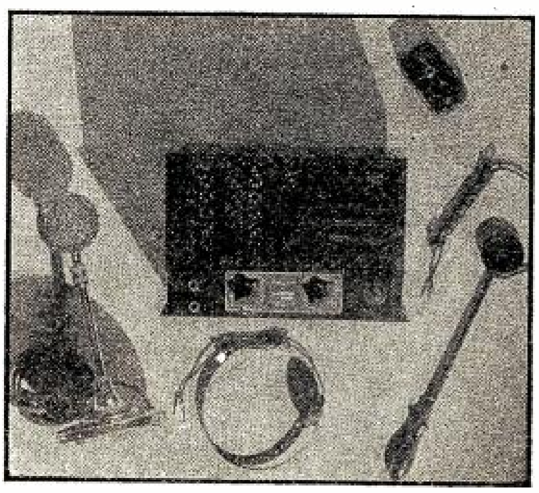
The Table shows the characteristics of the 6L6 tubes under different conditions. It will be seen that the second harmonic distortion of a single tube is high. This was done intentionally since it permitted the third and higher harmonics to be very low. The second harmonic can be cancelled in push-pull circuits, this results (*Turn to page* 59)





Profits in GROUP Hearing AIDS

By Richard Feeney



SERVICEMEN and dealers are realizing that they must have one or more profitable side-lines, allied to the radio or electric field, if they are to watch the black figures mount on the balance sheet at the end of their business year. A field comparatively unexplored and as yet not subject to the intense competition present in servicing and public-address work is the installation of group hearing-aid systems in churches, theaters and auditoriums. This field offers profitable opportunities if gone after with earnest and serious intent (*Turn to page* 57)

An Effective AUDIO Oscillator

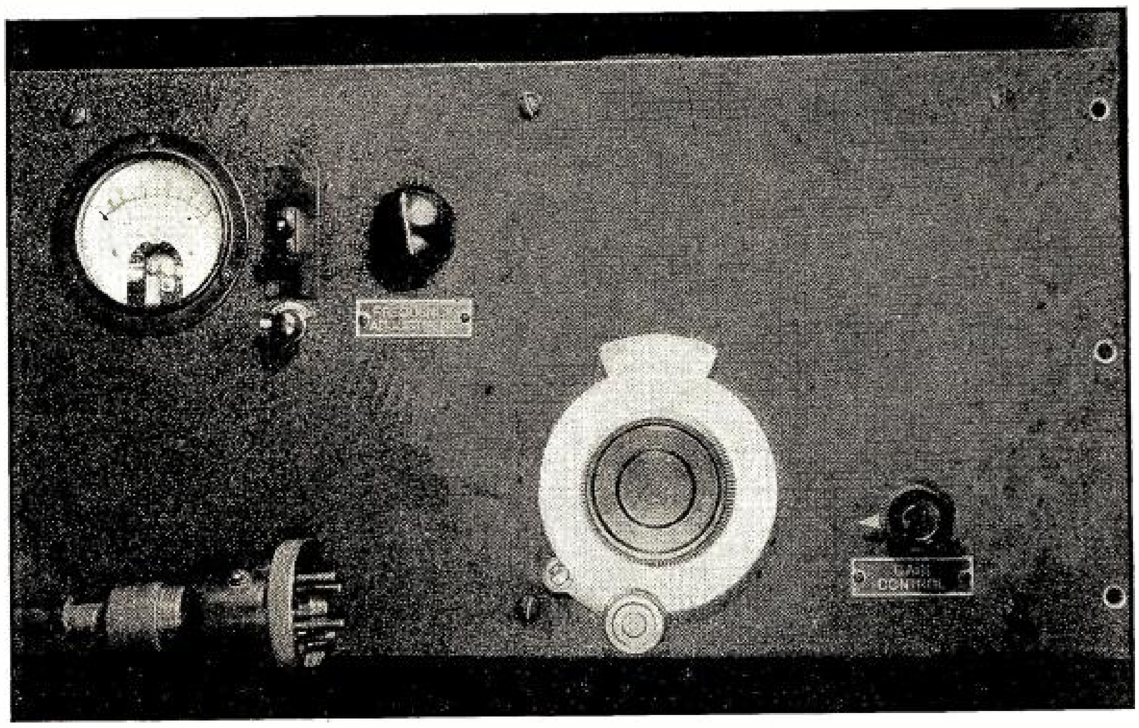
By Frank J. Burris
W6KGG

IT is believed that the beat-frequency oscillator described herewith is one of the simplest that has ever been offered, yet the results procurable with it are equal to some instruments which cost over two hundred dollars. Aside from only two tubes, a variable condenser and an audio output transformer, the remainder of this hook-up should not cost over three dollars.

A beat-frequency oscillator is an instrument for supplying a continuous band of audio signal energy and, to be most useful, should have a range of about 50 to 10,000 cycles per second. The most practical method of obtaining this range is that of heterodyning two radio frequencies, then rectifying and amplifying the result in an audio amplifier, since the nature of the plate impedance in the detector circuit determines what envelope frequency will be amplified. But all is not quite so simple as it sounds. In the first place, we will concern ourselves with only good wave shapes of audio frequency, a fairly uniform output response over the band, and no lock-in effect at the low-frequency end.

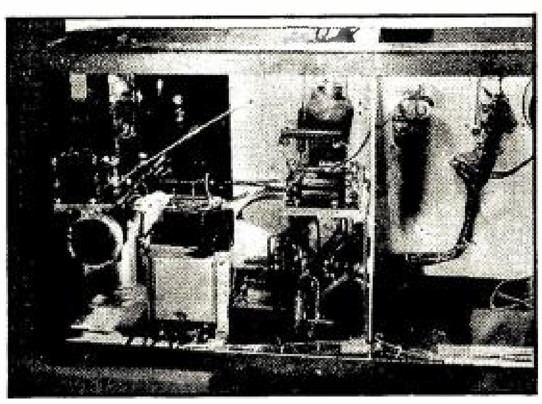
In the unit described here these requirements have been adequately met as follows: If one plots out on graph paper two sine waves (Figures 2A and 2B) of same amplitude but varying in frequency, say, 6 to 10 cycles, then plots the sum of their upper halves as rectified and then constructs an average wave as fed into the audio amplifier, he will find that the audio wave is like that of Figure 2A. Hence we strive for a balanced wave and find that a closer approach is had by reducing the amplitude of one of the waves as shown in Figure 2B. Too great a reduction results in loss of audio signal energy, so it is found that the best results are obtained with a radio-frequency mixing ratio of about ten to one. Though it is theoretically impossible to obtain a sine audio wave from any combination of two sine radio waves, nevertheless our results are most satisfactory.

Secondly, a good level response may be expected over the band, due to simplicity in the amplifier and its inherent characteristics. If the output characteristic is measured (*Turn to page* 56)



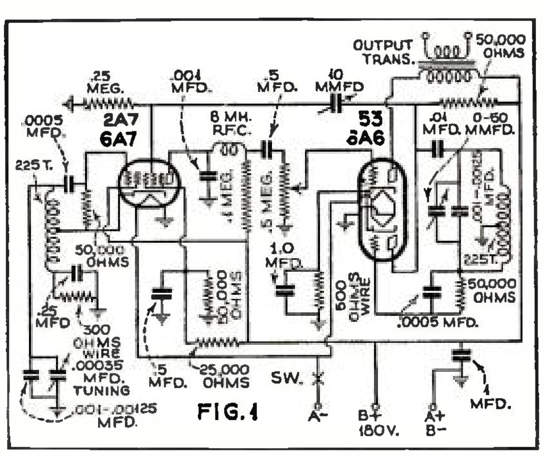
THE AUTHOR'S MODEL OF THE OSCILLATOR

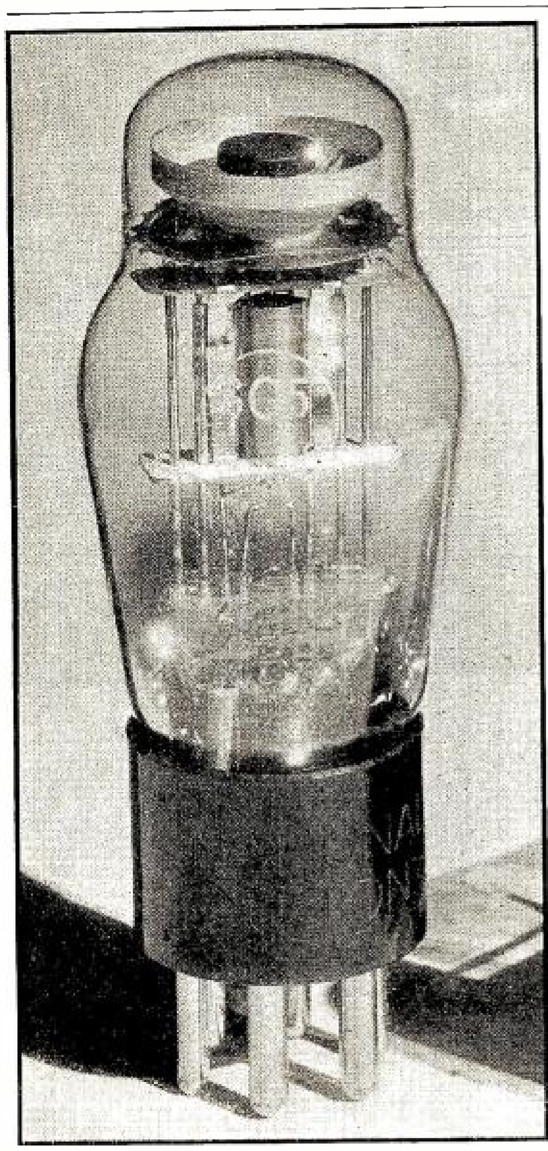
Constructed in an old cabinet, the model shown here includes a meter and switch which are employed for special microphone tests and are not shown in the circuit

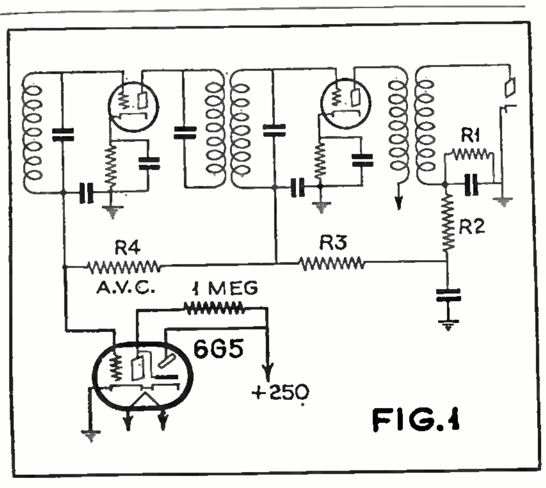


THE "INNARDS"

The assembly is in the left-hand compartment except for the zero-adjusting condenser shown at right of the partition







New TUNING *Indicator*

By Fred. Siemens

GREATER ease in tuning and simpler circuit design are assured through the use of the new 6G5 cathode-ray tuning indicator just introduced by the National Union Radio Corporation. The triode amplifier section of this new tube has a remote cut-off characteristic which spreads out the operating range over a 22-volt variation in a.v.c. potential. The earlier type 6E5 tubes were designed for (*Turn to page* 45)

Seeing's Believing!

(A Report on a Television Demonstration)

By The Television Reporter

SEEING'S believing! As far as television is concerned, that old adage has enhanced significance. And now that RADIO NEWS has *seen* the fruits of America's foremost television engineers' research labors, we are more assured than ever that sight-and-sound programs can be made available to the public whenever the radio moguls give the order to shoot the works. The television predictions made by the RADIO NEWS Television Reporter in the May, 1936, issue, seem to be as correct as Emily Post's calling card.

David Sarnoff, president of the Radio Corporation of America, formally announced that the New York transmissions (on an experimental basis) would begin on June 29, 1936. One of the preliminaries to the launching of the metropolitan visual broadcasts was a special demonstration for the editors of the RCA television transmitter and latest model home-type receiver. The impressive test at Camden, New Jersey, was attended by two members of the RADIO NEWS staff—Laurence M. Cockaday, Editor, and Samuel Kaufman, Broadcast Editor.

The Experimental Receivers

THE visiting editors were conveyed by bus through a maze of Camden streets to a low, garage-like structure one mile airline from the main plant where the transmitter was located. The only external evidence of the secretive receiving work that had been going on at the spot was the 10-foot vertical doublet antenna atop the building.

An average-size radio console contains all of the sight-and-sound receiver equipment. The kinescope apparatus has been cleverly arranged in the cabinet to conserve space. By keeping the long cathode-ray tube vertical, the depth of the cabinet is considerably less than in other types of television receivers using the valve in a horizontal position. A chrome mirror lining on a raised phonograph-type lid reflects the 5 by 7-inch picture to the viewers.

What We Saw

THE image and voice of Frank E. Mullen, manager of the RCA department of information, were the first program items of the demonstration. The image was fluorescent green in color, but the figure was easily recognized. Mullen was smoking and the puffs were easily discernible at the receiving end a mile distant. Some of the visiting editors and writers, including our own Mr. Cockaday, stepped before the iconoscope at the transmitter and were heard and viewed by a portion of the press delegation at the other end.

Then came the highlight of the day! The sensitive eye of the iconoscope was turned to an open window to pick up in minute detail a fire-fighting exhibition especially staged for the occasion by the Camden Fire Department. The fire apparatus was clearly seen as it clanged up to the smoking structure. And the synchronized sound made the reproduction as complete as any talking newsreel. Ladders were quickly raised, fireman after fireman mounted, hose was hoisted up and the streams of water were clearly seen as they were played over the smoking roof. The entire building and considerable background was clearly reproduced. Automobiles crossing the Philadelphia-Camden Bridge were even visible on the receiver screen. A billboard that conveniently extolled the merits of the RCA radio receiver was easily read by the television audience.

The outdoor fire-fighting scene was quite spectacular and demonstrated what we might expect in the way of news event pick-ups. The engineers had the benefit of bright sunshine over most of the area of the television scene.

And "Movies" Too

THE transmission of a talkie short completed the program. This too was impressive and enjoyable.

So much for the performance! Now, back to the equipment. The receiver has a single tuning knob for both sight and sound. It tunes from 48 megacycles with sound on 46 megacycles. The television sidebands are 1½ megacycles wide. The sound frequency is 2¼ megacycles lower. Synchronization of sight and sound is simple, it merely being necessary to tune in the image and the accompanying sound is automatically set.

A single antenna (10-foot vertical doublet, as previously indicated) is used as well as a single oscillator in the receiver. There is, however, separate i.f. for image and sound. The picture i.f. frequency is 10 to 11½ megacycles and the sound i.f., 8¾ to 9 megacycles.

How Tuning Is Done

IN all there are 33 tubes in the receiver, most of them being standard types. The 9-inch cathode tube is the most expensive component, its nearest equivalent on the present market listed at $105. The tube is especially sheathed and its face protected by a pane of shatterproof glass. This precaution was deemed essential to protect the consumers, as well as the equipment, from any harm in the event of the tube's breaking.

At a first glance, it seems that there are so many manual controls on the set that it might require the services of an engineer to operate them. But the operation is really quite simple; once the controls are set, they'll need very little further attention.

In addition to the central sight-and-sound tuning knob on the face of the set, there are six picture-and-phone controls for contrast, brightness, selectivity, high frequency tuning, density and modulation. Seven controls on the top of the unit regulate speed, focus, synchronization, size and vertical and horizontal framing. These on the top rarely need any attention. The set has a 350-watt drain from the a.c. mains.

The iconoscope at the transmitter, the brain child of Dr. Vladimir K. Zworykin, RCA director of electronic research, is said to be capable of doing anything a motion-picture camera can do. Two 802 tubes are used in the Camden transmitter. A 30-watt carrier was used at the press demonstration.

Ralph R. Beal, RCA chief engineer; E. W. Engstrom, in charge of RCA television and facsimile engineering; Dr. Zworykin and Mr. Mullen (*Turn to page 55*)

The "HAM" Shack

Conducted by
Everett M. Walker
Editor for Amateur Activities

IN ITALY
Amateur and Listening Post of A. Passini, whose contacts include North and South America, Asia and Africa. Mr. Passini is also an Official RADIO NEWS *Observer*

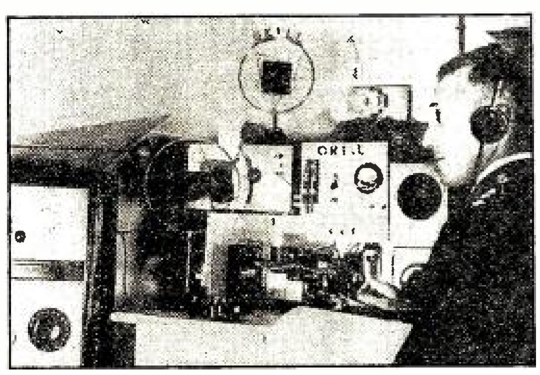
AMATEUR *RECEIVING* ANTENNAS

THE amateur too often devotes endless effort and time to the perfection of his transmitting antenna and completely disregards his receiving aerial. He uses any piece of wire strung off the ground that happens to be available. True, the transmitting aerial is important and an approach to perfection is necessary in order to put out a good signal, particularly on the high frequencies, but so, too, is the receiving antenna. It is a safe wager that more than 50 per cent of the licensed stations in the country disregard its importance!

IMPORTANCE of the receiving antenna cannot be stressed too much. If a station has a good transmitting antenna and a poor one for receiving, the net result is the signals are heard at distant points, but successful contacts are few, and the man with the poor receiving antenna is the one who is most troubled with the interference problem. In the case of strong signals, the haphazardly strung piece of wire will suffice, but in the reception of weak ones it is another story. In many cases a good antenna, when compared with a poor one, on a receiver will raise a R4 to R5 signal to R8 or R9.

Testing various types of antennas with a receiver which includes a dependable meter for checking signal strength tells the story. The human ear is known to be a very poor audiometer. Large differences in signal input, without observing the calibrated input, *are not aurally detectable!* However, when *measuring* carrier strengths of the same signals with different antenna, the results are surprising.

A CZECH AMATEUR STATION
Captain B. Seidl of Prague, Czechoslovakia, operator of station OK1LL, is known throughout the world through this transmission to other amateurs



For the purpose of tests conducted by the writer, three different antennas were tried: a vertical 33 feet high, an L type 132 feet long and a 20-meter doublet. The tests were made, of course, on 20 meters with all three, and with the first two on the lower frequency bands. The doublet and L antennas were strung from northwest to southeast, which happens to be the most desirable for reception in the Middle Atlantic States.

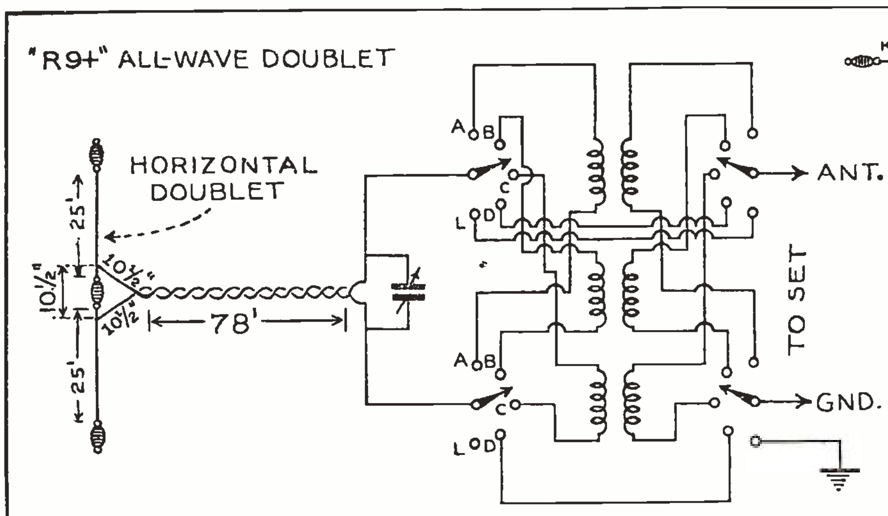
Noise Level

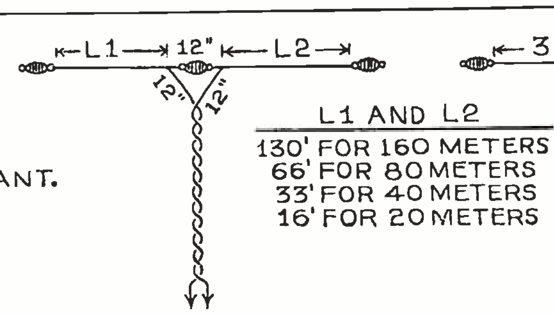
A factor which enters into the picture is noise level—disturbances that may range from negligible inputs to as high as several microvolts. As a matter of fact it is this noise level combined with the tube noise level of a receiver that limits sensitivity. If both could be eliminated, the sensitivity of receivers could be increased almost indefinitely. However, this idea is entirely utopian and cannot possibly be achieved as long as vacuum tubes are used for amplification and detection.

At the location where the tests were made, the man-made noise level was negligible (there being only a small amount from occasional automobiles), so all we had to contend with was the tube "rush." And here are some of the results obtained:

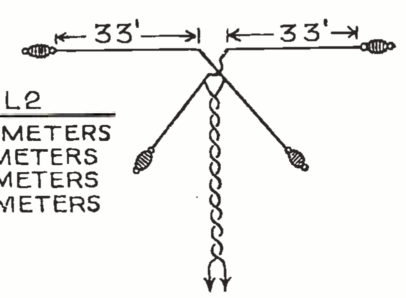
NY2AE in the Canal Zone was tuned in on the vertical antenna. His carrier strength we will assume to be one. On the L, his carrier level increased to slightly more than twice the previous input level, and with the doublet it increased to ten times the original voltage level. This sounds almost unbelievable, but it's true. At the same time it might be pointed out that the signals received on all three antennas were what the average amateur would call R9 without the use of some visible signal-strength recording device.

NY2AE was working G5NI, so we tuned to him and made the same series of tests. It will be noted the change in direction was about 90 degrees. G5NI was 15 degrees off the axis of the doublet and L and NY2AE more than 70 degrees. G5NI was putting in a very strong signal at the time. With the vertical, his carrier strength was twice as strong as NY2AE's; with the L,





STANDARD HALF-WAVE FOR THE VARIOUS AMATEUR BANDS



DOUBLE DOUBLET THAT WILL GIVE GOOD EFFICIENCY ON TWO BANDS—40 AND 20 METERS

¶ A Department for the amateur operator to help him keep up-to-date

DX ON 5 METERS

On May 9th, a Saturday night, from 11:30 p.m. E.S.T. to 1:05 a.m. Sunday morning a peculiar condition of the upper atmosphere made possible the first two-way phone contacts between the Middle West and the East Coast on five meters. At least twenty stations in the West were reported heard on the East Coast and your editor, through his station W2JCY, heard at least 18 stations situated around the Chicago area and some in Wisconsin, Michigan and western Pennsylvania. Mr. Cockaday also has confirmations of three two-way five-meter contacts between Chicago and his station in New York, the best of which was a fifteen-minute talk with W9AUQ in Oak Park, Illinois, operated by Al L. Cox. A comprehensive report on this five-meter DX will be given in an article next month. Sounds encouraging!

five times, and with the doublet, 50 times.

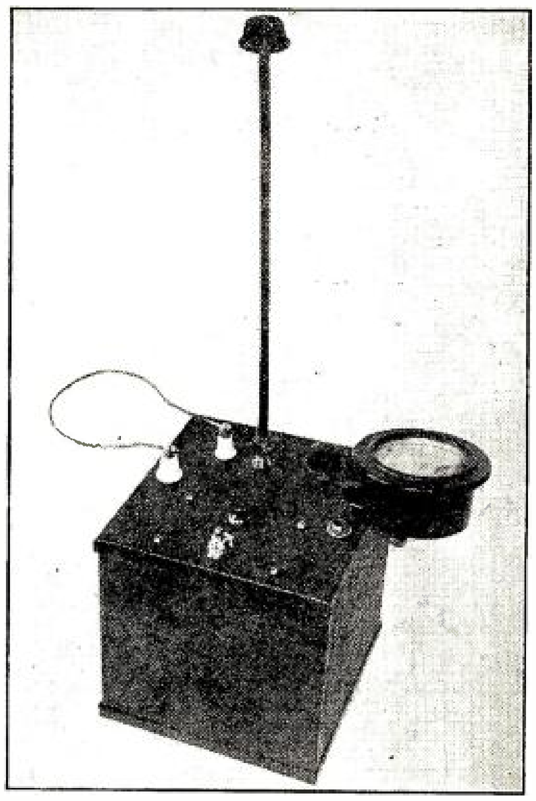
Another test was made on ZL2FA in New Zealand. He was using c.w. and had remarkable signal strength. The signal increase was 9 to 1 when changing from the vertical antenna to the doublet.

Similar comparative tests were made on 40 other stations operating in the 20-meter 'phone and c.w. bands. The results were about in the same proportion on all signals recorded. Obviously, it pays to do some experimenting with the receiving antenna as well as the transmitting aerial. At the same time the tests showed up the high degree of inaccuracy in the R system of giving reports on amateur signals. As we pointed out before, signals over a wide range of input could be classified as R9. This would seem to explain why in so many instances, when two stations establish contact, one reporting the other R9 on the first transmission and then, on the second, coming back with a "sorry O.M., on your first transmission your signal was just roaring in here, but now the QRM has you down. I could hear your heterodyne and that's about all!" It is all because the ear is so misleading. The "R9" signal

(*Turn to page* 53)

You Need This HAM Gadget

by John H. Potts



THIS new and simple *Radio News* test instrument employs one type 1B5 duo-diode triode and one type 30 tube. The pick-up coil, for 5 meters, consists of a 3-inch loop of heavy wire tuned by a 50-mmfd. Hammarlund midget condenser. For lower frequencies suitable coils are substituted for the 3-inch loop. For use at some distance from the transmitter a pick-up wire may be connected to one of the coil terminals for added sensitivity. The incoming signal is applied to one diode section of the 1B5 and the rectified voltage drop across R1 furnishes the grid bias for the triode section of this tube. The plate circuit is direct-coupled to the grid of the 30 tube, with the plate current return passing through R2. Variations in this current make corresponding changes in the voltage drop across R2 and likewise the grid potential of the 30.

A 0-1-ma. meter is connected in the plate return circuit of the 30 and will give more than half-scale deflection with a moderate carrier signal input, either modulated or un-modulated. For use as a monitor, phones may be plugged in the jack provided. Since the connection is made in the return circuit, any accidental short occurring in the output circuit will not injure the plate battery or tubes.

The entire unit is assembled on the cover of a 6 inch by 6 inch by 6 inch Insuline metal cabinet, with the batteries inside. All parts are insulated from the cabinet.

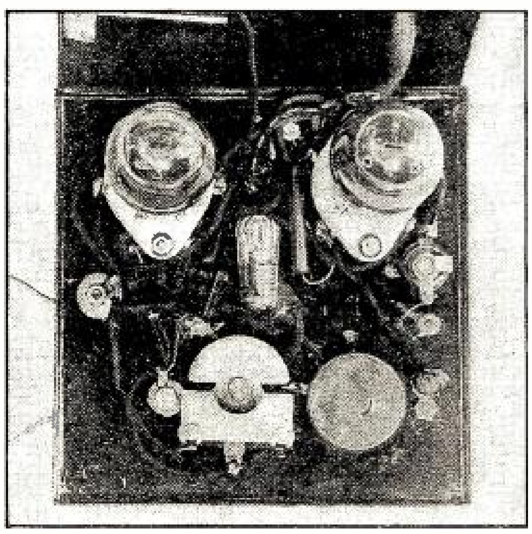
The instrument as it stands is highly sensitive. For high power rigs, the sensitivity may be reduced by varying R1. If, for any reason, increased sensitivity is desired, it may be obtained by using an extra 22½ volt battery in the output circuit.

The apparatus may be readily adapted to a wide variety of applications. As a tube voltmeter, the terminals designated "link" may be opened and the external circuit Figure 1B connected. The grid voltage without battery "C" in the circuit may be adjusted to give a reading near maximum deflection on the output milliammeter. Note the voltmeter reading at this adjustment. Next, with the terminals "A" and "B" connected to the unknown voltage, the output meter will now deflect downward. Additional biasing battery "C" is added until the output meter reading returns to the original setting. The voltmeter will then indicate directly the unknown voltage plus the initial voltage, if d.c., and will give indications proportional to the positive peak if a.c. is being measured. A calibration for a.c. may be conveniently made at 60 cycles, checking against a regular a.c. meter. If the circuit under test is open, a high-resistance leak may be connected

(*Turn to page* 53)

CIRCUIT-CONSTRUCTION

This illustration shows the inside view of the various parts and tubes. Below: the circuit employed is given



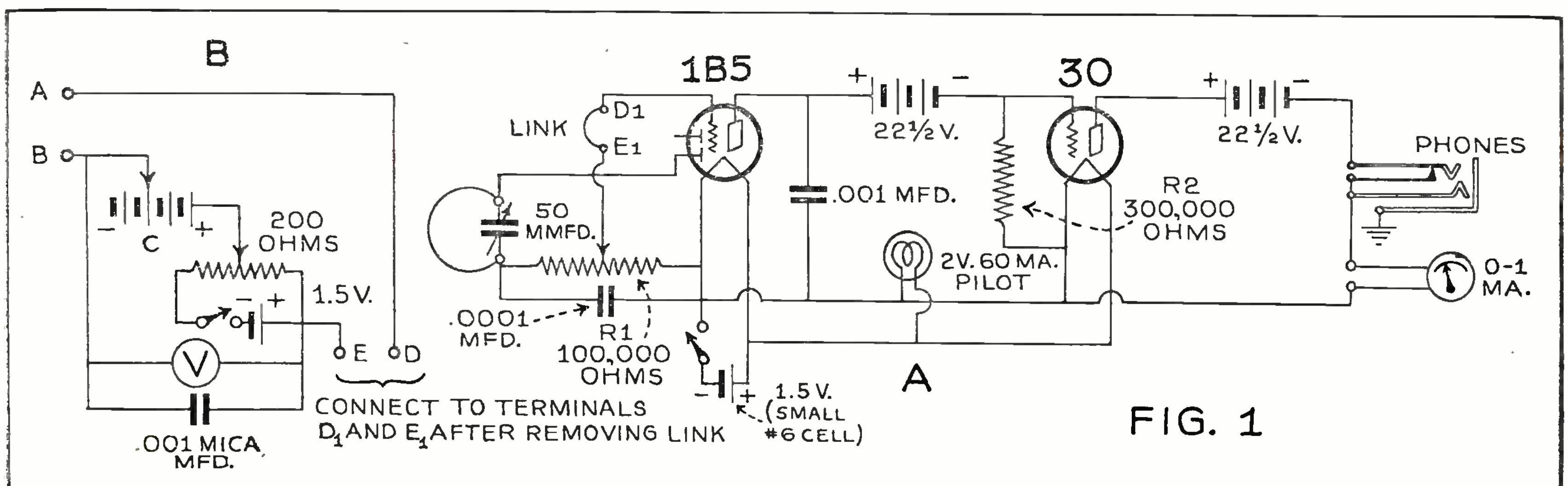


FIG. 1

Technical Data and Description of a New

16-TUBE SUPERHET

(Hammarlund Super-Pro)

By S. G. Taylor

LISTENING POST TESTS

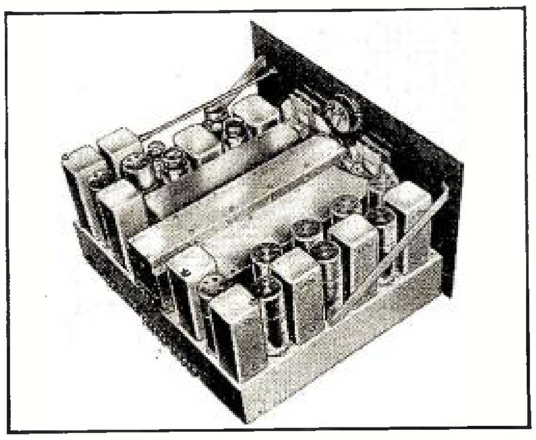
In the author's listening post, in an apartment house where the noise level is high, this receiver has daily been bringing in "Ham" phone stations from all points of the world—and s.w. broadcasters and commercials pound in at all hours of the day and night

IN the winter of 1934 the writer had an opportunity to conduct some "on the air" tests of an early laboratory model of the Hammarlund "Super-Pro." The intervening sixteen months have been spent by the engineers in refining each part and function to the highest possible degree with the result that the final receiver as recently placed on the market is an unusually complete job suitable for dependable use in every type of radio reception service above 540 kc., whether amateur, commercial, regular broadcast or short-wave broadcast.

Excellent Fidelity

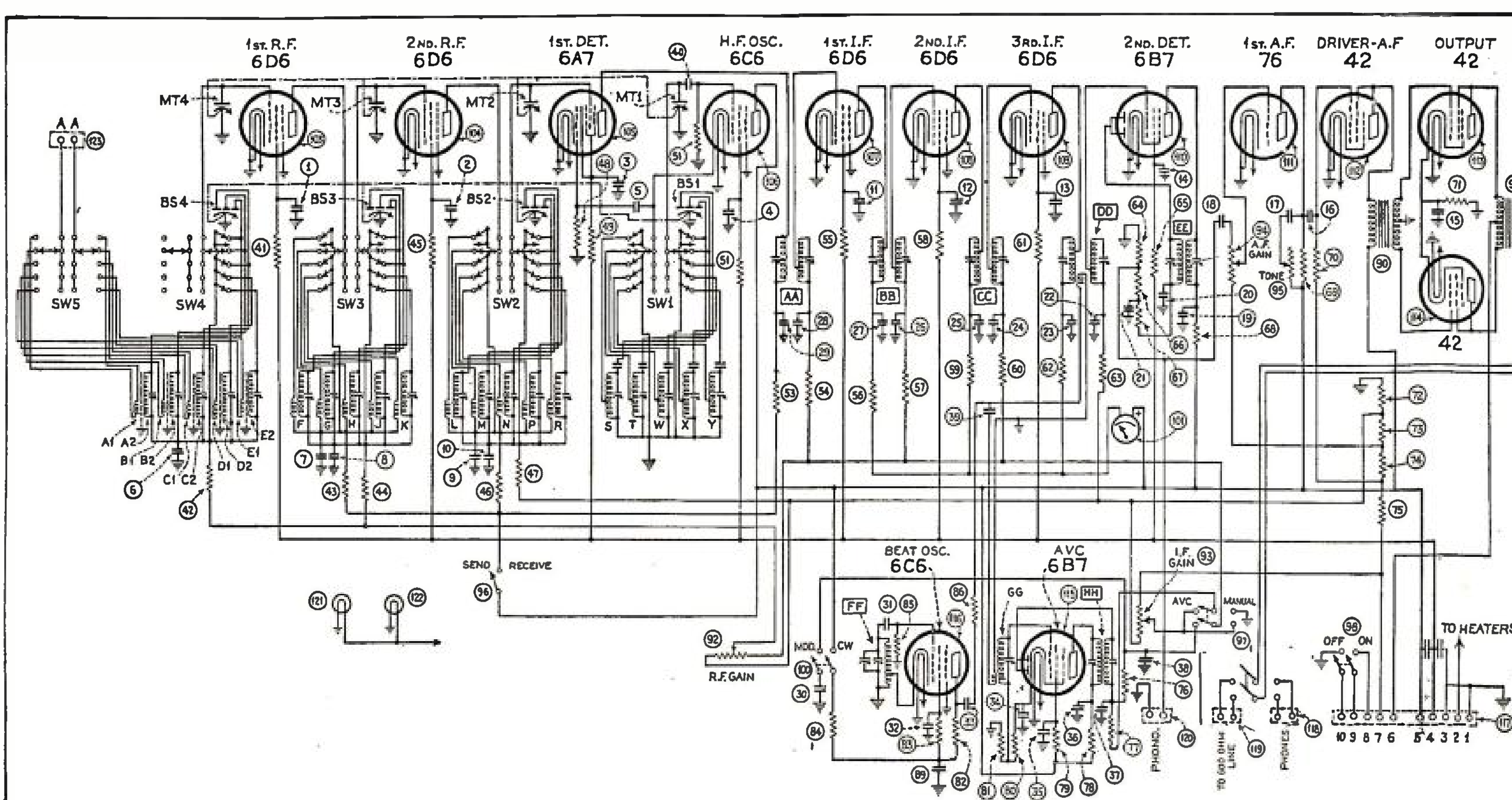
As a broadcast receiver it provides excellent fidelity together with a degree of sensitivity which represents the maximum that can be used even in good locations. Selectivity is variable ranging from a degree adequately broad to permit excellent fidelity of tone at one extreme, to a sharpness which results in decided side-band cutting at the other extreme. A very effective system of a.v.c. is included but in addition, by flipping a switch, the sensitivity may be controlled manually, and individual controls are provided for r.f. and i.f. sensitivity. This permits any desired balance of i.f. and r.f. gain with the result that the best combination for maximum signal-to-noise ratio is readily attained in any location. With the a.v.c. system in operation, these two types of gain are still subject to manual control to limit sensitivity to a degree permitted by the local noise level.

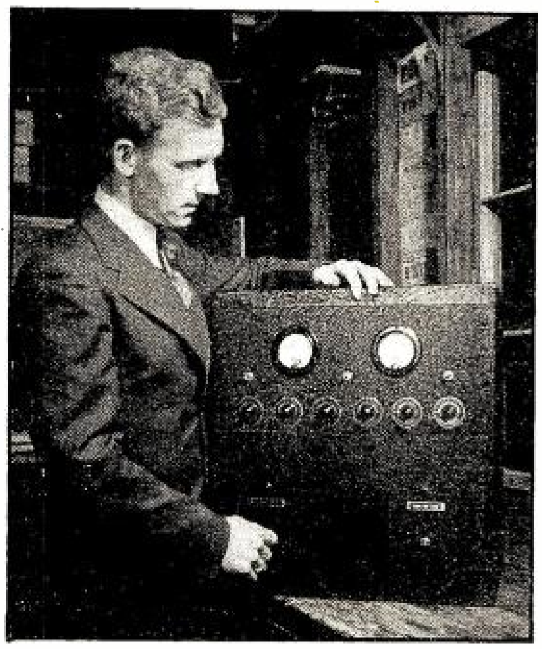
Primarily the "Super-Pro" is a communications type receiver. All of the features mentioned in connection with the broadcast range likewise apply to all the short-wave ranges. In all there are five bands providing complete coverage from 540 to 20,000 kc. In the three highest ranges, which combined cover

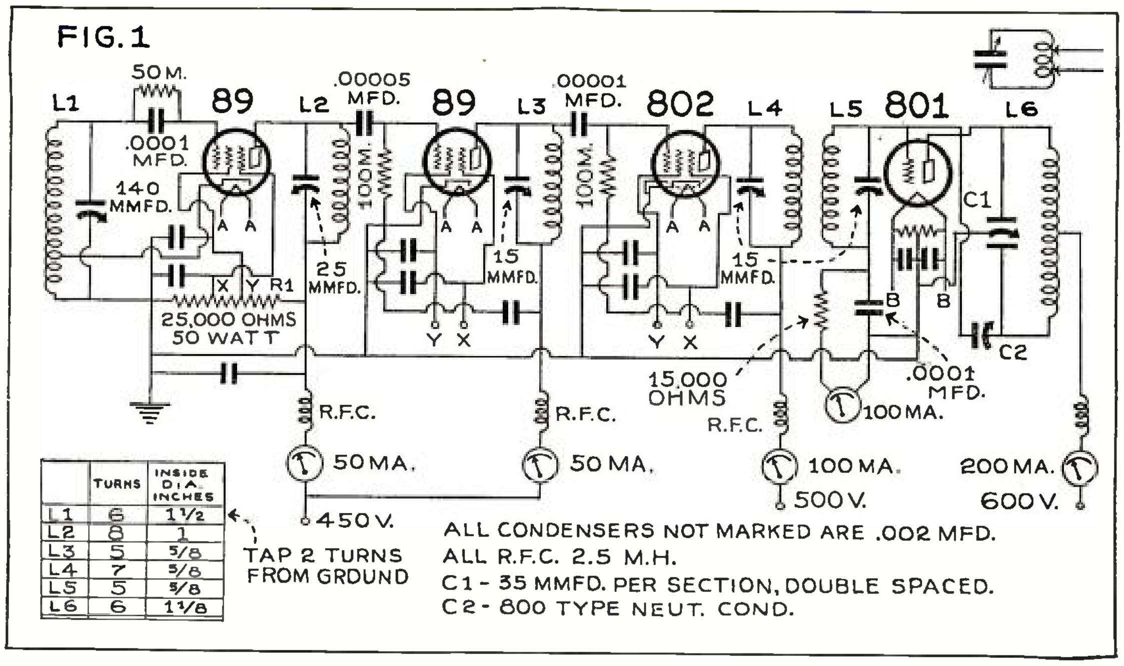


from 2500 to 20,000 kc., electrical band-spread tuning is employed. The main tuning dial is used to adjust the receiver to the particular range to be covered then the fine tuning within that range is accomplished by the duplicate tuning control and dial just at the right of the center of the front panel. The bandspread is approximately the same on all frequencies and is equal to about 1 degree per 4½ kilocycles, or 70 kc. per inch of dial scale.

Sixteen tubes are employed, 14 of which are shown on the schematic diagram below. There are two stages of tuned r.f. amplication on all bands, four i.f. stages and three a.f. stages. The a.v.c. system employs a dual-purpose 6B7 tube as a.v.c. amplifier and rectifier. The first detector or mixer is a 6A7 and the r.f. oscillator is a separate 6C6. Another 6C6 is used as a beat-frequency oscillator. The power supply is a separate unit not shown here. It includes a 5Z3 rectifier and a (Turn to page 59)







	TURNS	INSIDE DIA. INCHES
L1	6	1 1/2
L2	8	1
L3	5	5/8
L4	7	5/8
L5	5	5/8
L6	6	1 1/8

STABILITY equal to that obtainable on lower amateur frequencies may be obtained at 5 meters by following standard M.O.P.A. design practice, provided certain precautions are taken with respect to mechanical layout and choice of tubes.

5-METER M.O.P.A.

By C. A. Nuebling

SIGNALS from the transmitter described, operated at Hewlett, Long Island, have been received on a standard all-wave superheterodyne using two sharply-tuned, transformer-coupled i.f. stages. Absence of frequency modulation has been further demonstrated by satisfactory reception of 'phone signals on this same receiver operated with its beat oscillator in the "ON" position. Attempts to receive typical modulated oscillators of the long-line type have, by way of comparison, proven completely fruitless on this type of receiver.

C.W. reception of the emitted signal is completely practical, comparing favorably with present-day 40- or 80-meter transmission.

The circuit shown in Fig. 1 is fundamentally sound in every respect; all "tricks" have been avoided. There are no twin tubes, push-pull stages which are hard to excite, or pentodes in the final stages which are difficult to keep from going "up in smoke" when under modulation. By avoiding all so-called short cuts and concentrating on high-frequency facts, a stable, high-efficiency transmitter can be constructed.

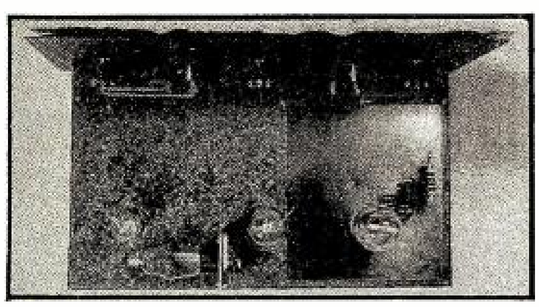
The 89 oscillator of this M.O.P.A. transmitter is operated on 20 meters, electron coupled. The plate circuit is tuned to 10 meters and feeds into the second tube, an 89 doubling from 10 to 5. An 802 buffer provides ample excitation to an 801 in the final stage running 60 watts input. The omission of an r.f.c. in the grid circuits of the 89 doubler and 802 stages is rather unusual. However, by so doing, stray capacities are avoided and a high leak resistance provides a minimum of grid losses.

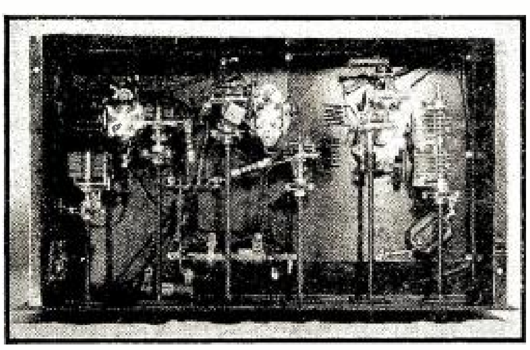
Inductive coupling is desirable from the 802 buffer to the final stage to furnish maximum energy transfer and to further isolate the modulated stage from the rest of the transmitter. The use of a triode in this stage was thought desirable when one studies the inter-electrode capacities of pentode and screen-grid tubes. The tank circuit of the 801 is of the split-stator variety, supplying high efficiency by virtue of the high l.c. radio. This is accomplished by reducing the circulating tank current and consequently the heating of this circuit and of the tube itself.

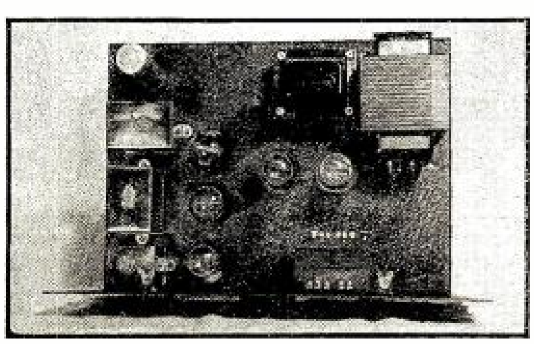
The power supplies are mounted on the lower shelf along with the modulator, and supply 600 volts for the 801 final, 500 volts for the 802 buffer and 450 volts for the oscillator and doubler. This transformer is a special U. T. C. job delivering 600 volts at 350 ma. which feeds all the r.f. stages. The modulator consists of a pair of 59's in Class B, driven by a single 59 Class A; all of which is run from the second supply of 450 volts at 200 ma. The speech amplifier (not shown) consists of a 6F5 high-mu triode, resistance-coupled to a 6C5 (*Turn to page* 56)

THE CHASSIS LAYOUTS

The two views below show the top and bottom of the r.f. unit. At bottom is the combination modulator and power supply.







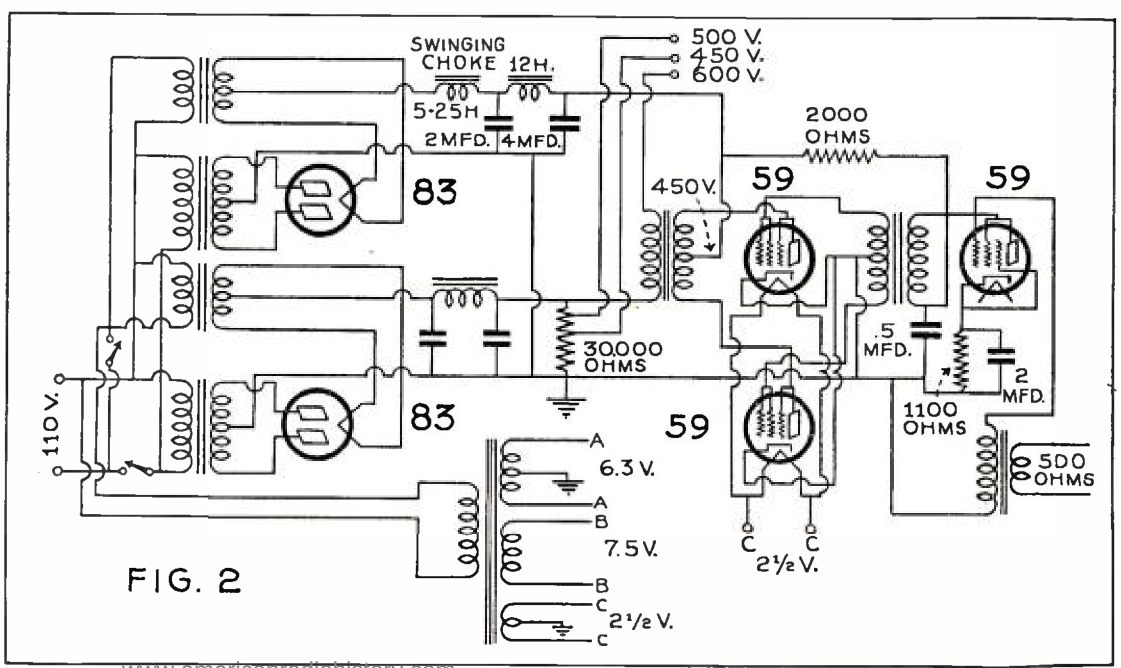
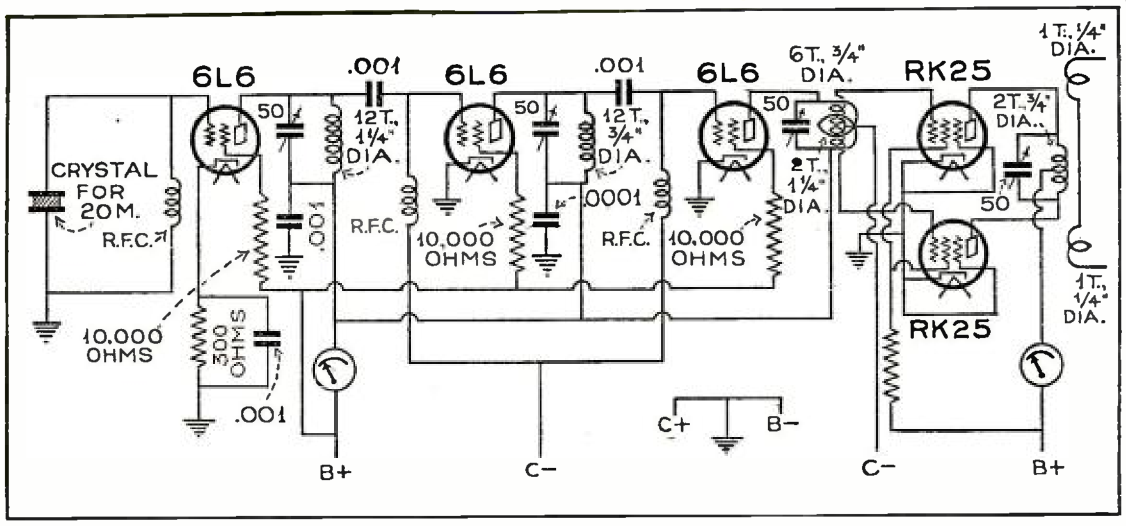


FIG. 2

TESTING THE RIG ON DX

Lieutenant Clark at the transmitter during tests at the Westchester Listening Post (W2JCY), other operators taking care of logging reports of stations in the First District



Experimenting with

CRYSTAL Control on "FIVE"

By Ralph Clark

WITH the development of sharp tuning superheterodyne receivers for 5 meters it is becoming imperative that transmitters utilizing crystal control be designed for use on this band. The writer, who has been experimenting with crystal control transmitters for the last year, placed on the air during December 1935 such a transmitter and has been conducting experiments in cooperation with the editors of RADIO NEWS since that time. The results have been so gratifying that it was considered advisable to place before other experimenters the circuit arrangement for a crystal-control exciter of 30 watts power. The diagram accompanying this article gives all the details of this job which is part of a transmitter being constructed for installation at W2JCY. Mr. Cockaday's transmitter will, however, contain an additional linear amplifier using two 304A tubes in the final stage. Such a transmitter, with suitable audio channels, will be suitable for wide-band television transmission as well as for voice-frequency work.

The present model utilizes three of the new 6L6 tubes in the crystal oscillator (which at present is 20 meters) and the first and second doubler stages, with two RK25 tubes in the output. The inter-stage coupling employed is very simple, using impedance circuits. The present audio channel is a completely metal-tube job (using 6L6 tubes class A-B) which drives the exciter unit with 100 percent modulation out of any type of high-quality microphone.

The results on reception at various distant points in the First, Second and Third Districts have been very gratifying, it being easy to put R8 and R9 signals East as far as Stratford, Connecticut and Southwest well in to the Third District. Reports on quality have indicated "broadcast quality" type of signals with this rig. It is interesting to note that tests at various points with sharply tuned receivers of the superheterodyne variety such as the ACR 175 and the Midwest job pulled in these signals remarkably well with high fidelity reception without any swinging of the carrier or frequency modulation being noticed. On such receivers the signals from this transmitter cut through interference from frequency-modulated transmitters when it completely covered up the band upon which transmission was being made. From these indications the utilization of such transmitter circuits as shown above should do much to eliminate the QRM now found on the (*Turn to page* 59)

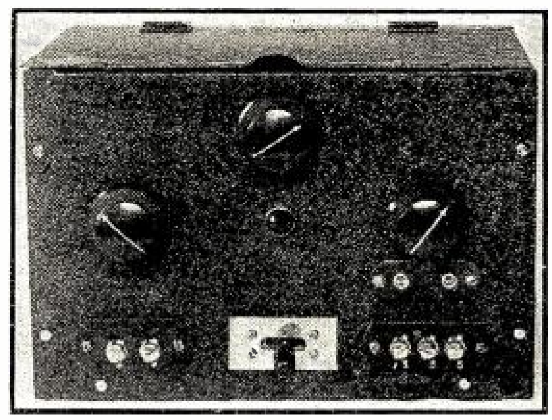
The CQ'er

By W2JCR

A UNIQUE and practical gadget which has been in use with the 5-meter transmitter at W2JCR is described here because of the interest displayed in it by other 5-meter stations. The "CQ'er" as shown in the accompanying photograph is a combination i.c.w. oscillator and microphone input unit which is connected to the input of the speech amplifier of the transmitter. The switch on the front panel is a 3-position affair. When thrown to the left it connects in the i.c.w. oscillator, automatically turning on the tube filaments. When thrown to the right the i.c.w. feature is cut out, the microphone is cut in and the microphone battery automatically connected. In the middle position of the switch all batteries are disconnected. The pilot light shows when the switch is in either of the two operating positions.

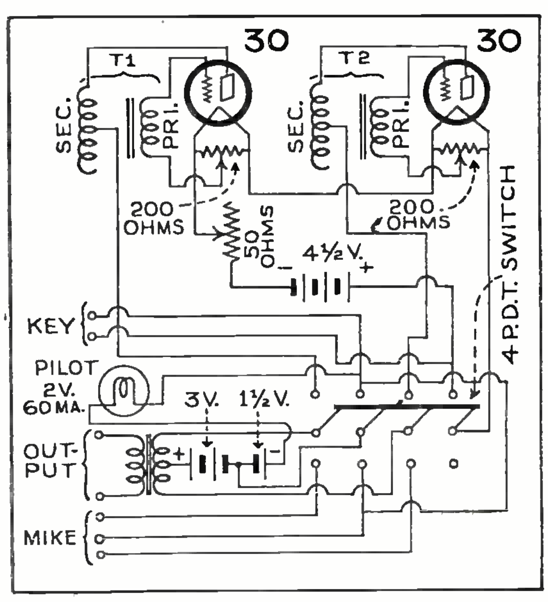
The i.c.w. circuit provides dual tone. Two type 30, two-volt tubes are used, each with small audio transformer connected in its circuit as a conventional audio oscillator. The output of the two tubes is mixed in the winding of the microphone transformer. The tone of either oscillator can be varied over a wide range by means of the filament potentiometers and the overall pitch of the two oscillators can be changed simultaneously by varying the filament rheostat. This combination of three controls provides the utmost in flexibility and any combination of tones desired may be obtained. This unusual arrangement provides a distinctive "trademark of the air" for any station using it.

Practice at W2JCR is to adjust one oscillator at a high frequency that will cut through the QRM and the other one for a rather low frequency. The microphone battery (*Turn to page* 58)



THE CONTROL PANEL

At the lower right is the microphone terminal strip and just above it the key jacks. At the left are the output terminals with the 3-position switch in the lower center and just above it the pilot light. The knobs at the right and left regulate the two audio tones individually and the center knob varies the two tones simultaneously



Test Results On A
5-600 METER SUPER
(RCA Model ACR-175)

UNDER TEST AT R. N. LISTENING POST
The ACR-175 receiver is shown here during "on the air" tests at the listening post in a city apartment house. The results of these tests and those conducted at the author's amateur station are described in this article

By Everett M. Walker
W2MW

OPERATING tests recently completed on the new RCA model ACR-175 receiver at the author's amateur station and at RADIO NEWS short-wave listening posts show that it offers many features of interest to both the amateur and short-wave listener. The receiver is designed primarily for use in amateur stations and therefore contains all of the features that make for simplified operation, elimination of interference on crowded bands and copying of telegraph and telephone signals—features which are, of course, equally advantageous in all classes of short-wave reception.

The set is an eleven-tube superheterodyne employing ten metal tubes and one electron-ray tube as a tuning indicator and signal strength indicator. Its wide range of frequency coverage is unusual in that it covers continuously from 500 to 60,000 kilocycles or 600 meters to 5 meters in four bands.

Technical specifications on the receiver were published last month in "The Ham Shack." In review, however it might be pointed out that the set is mounted in a black crinkle-finish metal cabinet. The ten tubes used in the set proper are: three 6K7's as radio-frequency and intermediate-frequency amplifiers; two 6J7's as oscillators; one 6L7 as first detector; one 6H6 as second detector and automatic volume control; one 6F5 first audio amplifier; one 6F6 as audiooutput tube; and one 5Z4 rectifier. The tuning indicator, a glass tube, is a 6E5.

Band-Spread Tuning

The tuning is controlled by a master dial mounted in the center of the set, which is calibrated in megacycles. The amateur bands are clearly identified, and a 100-to-1 ratio vernier control spreads these bands out sufficiently to make tuning of stations a simple matter, even on the higher frequencies. For instance, on the 20-meter amateur 'phone band more than twenty divisions are available and on the 75-meter 'phone band stations are spread out over nearly forty divisions on the high-ratio pointer which travels over a 360-degee scale marked off in 100 divisions.

Nine controls are mounted on the front panel, the tuning dial of course being in the middle. They are, from left to right: 1, combined power, tone control and stand-by switch; 2, calibrated signal-input (sensitivity) control; 3, crystal phasing control; 4, a.v.c. "on-off" switch; 5, dual-ratio vernier tuning control; 6, range switch; 7, audio gain control; 8, beat oscillator "on-off" switch; and 9, calibrated heterodyne control. A headphone jack which cuts out the speaker is mounted on one end of the cabinet.

Signal Strength Meter

One of the interesting features, particularly to the amateur, is the calibrated signal input control. This unit facilitates an accurate check and comparison of the strength of incoming signals. These values, of course, vary with different types of antenna, but once the most ideally suited aerial is found, it is possible to gauge the intensity of signals far more accurately than can be done by the human ear. The meter makes use of the electron-ray tuning tube and a calibrated sensitivity control. Much interest was found in observing the strengths of signals over a period of time in the test made at the amateur station post.

Six amateur bands are covered by the receiver, including the 5-meter band. On tests made on the 40-meter amateur band, the receiver proved to be extremely sensitive and selective. Amateurs in both the United States and Canada are licensed to use c.w. only on this band, and it is estimated that more than 40 percent of the licensed stations operate on this channel. It is so extremely crowded and interference is a real problem. The ACR-175 handled exceptionally well here. The beat-oscillator seemed to have ample power to provide a good beat frequency and at the same time showed no tendency to cause blocking. The crystal filter circuit was found exceptionally valuable in picking out signals that otherwise were smothered by interference. Extreme selectivity is afforded, and in several instances comparatively weak signals that were practically unreadable without the filter in the circuit were completely isolated after careful adjustment of the phasing control and the beat-frequency pitch control.

On the 75-meter 'phone band stations from all sections of the country were heard. The crystal also functioned well on 'phone signals, it being possible to adjust the phasing control to a high degree of selectivity before extreme distortion was noticeable. At the same time it helped to eliminate a large proportion of the heterodyne interference encountered. The tuning indicator also helped in adjusting the crystal filter circuit. It facilitated holding the peak carrier adjustment while phasing for the elimination of interference.

Stations Logged

On 20 meters stations from all parts of the world were copied over a short period of time. Hundreds of stations were logged. In one evening some of the outstanding were: G5NL, HI5X, W9HCV, XEIQ, XE1AJ, SU8NA, W9KFL, CO6OM, W4BGO, W5SF, CO2WZ, YV4AC, W9EMU, W6ANQ, W6CFJ, W5EEH, XE2N, W5BDB, NY2AE, HH5TA, CO8YB, W6ISH, W6FJ, CO2HY, W5ELC, W6CZ, W6AM, VK2XQ, W6DTE, W6BYO, G6LK, W5JO, W6JH, W6QD, EA7AV, EA5BE, EA5AO, ZL2FA, W6DNN, W6CQG, TI2AV, CO7CX, G5NI, W6LLQ, ZL2NQ, W7FP, VE4OF, VE4CW, K6CNC, XE3W, CO2KC, HP1A, OA4AK and W6LR.

A few of the stations heard on 75-meter phone and 80-meter c.w. were: W4CVQ, W8LWD, W9MM, W4BYA, W8BWH, W3ZY, W8ABS, W3BIN, W8BRC, W8CS, W8CEI, W9NGZ, VE3GO, W1ADM, VE2GP, W9LOK, W9JPK, W4KN, W4AWZ, W4AUP, W3SL, W4BYY, CO8YB, W9IZT, W4ACZ, W8NSL, *(Turn to page 55)*

The DX *for the*

Conducted by

Laurence

CUBAN SHORT-WAVE STATION

Observer Lopez took this beautiful photograph of the Cuban station COCD 6130 kc. which is surrounded by a grove of stately palm trees.

THE fortieth installment of the DX Corner for Short Waves contains the World Short-Wave Time-Table for 24-hour use all over the world. Consult it regularly and make your all-wave set pay big dividends!

Recommendations for Station Reports

To make the work of compiling station reports as efficient as possible it is recommended that our Observers send in reports on post cards at any time during the month that the stations are logged. This allows the work of the editor to be spread out during the month instead of working on an enormous amount of mail around the 30th. Please remember to *keep your information on stations logged specific!* To further classify our recommendations of last month it is thought best that reports be arranged in three ways:

No. 1—New Stations
No. 2—Station Changes
No. 3—Exceptionally Fine 'Catches'

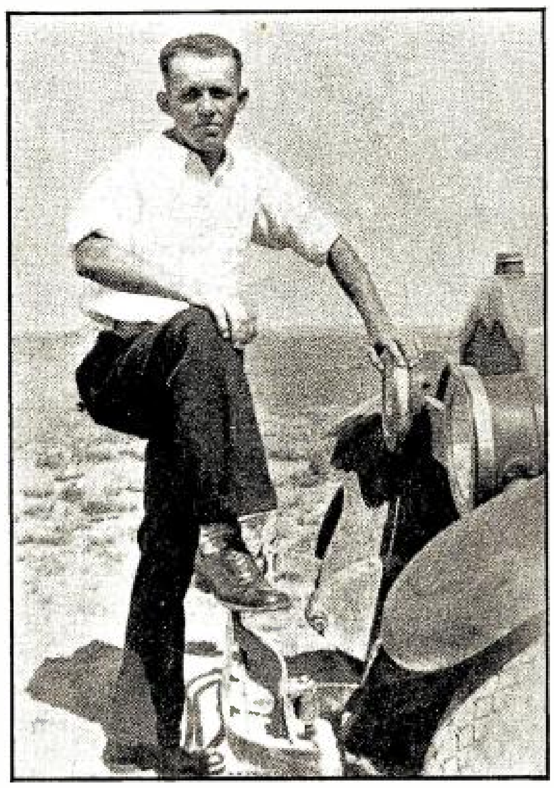
No other information than this should be included on the card except the Observer's or listener's name and address and the fact that he is either a Listener or an Observer for his territory. A standard form for this would be the following:

NEW STATIONS

W2XAF, Schenectady, New York, 9530 kc., 31.4 meters, daily 4 p.m. to midnight, E.S.T. (from verifications).

STATION CHANGES

HCJB, Quito, Equador, changed frequency from 8900 kc. to 8590 kc., daily 1:30 to 4:30 a.m., E.S.T. (from announcement).



LIKES HIS RADIO AND CAR

This is Frank Sakely, Sr., ardent short-wave listener of Roseburg, Oregon, who is proud of his hobbies that help him to see and hear so much of distant places.

THE WORLD'S ORIGINAL ORGANIZATION OF

S.W. PIONEERS
Official RADIO NEWS Listening Post Observers

LISTED below by states are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

United States of America

Alabama, J. E. Brooks, L. T. Lee, Jr., William D. Owens; Arizona, Harry Wolf; Arkansas, James G. Moore, Caleb A. Wilkinson, Claude H. Dalrymple, Charles Holt, John Hartshorn, Chester A. Joerger; California, Eugene S. Allen, A. E. Berger, C. H. Canning, Earl G. DeHaven, G. C. Gallagher, Werner Howald, Robert J. McMahon, Oriente I. Noda, George C. Sholin, James E. Moore Jr., Phil E. Lockwood, Hank G. Wedel, H. H. Parker, Fred A. Pilgrim, Frank Andrews, Fred M. Craft, Radio Fellowship, George C. Akins, Gabriel M. Costes, Bernard L. Wood; Colorado, Wm. J. Vette, T. B. Mechling; Connecticut, H. Kemp, George A. Smith, Harold R. Smith, Philip Swanson, Herbert J. Hyde; District of Columbia, Phillip R. Belt; Florida, James F. Dechart, George H. Fletcher, E. M. Law; Georgia, C. H. Armstrong, Guy R. Bigbee, James L. Davis, John McCarley, R. W. Winfree, Owen Reeve, Ed McKay; Idaho, Bernard Starr, Lawrence Swenson, Melton and Gilpin Amos; Illinois, E. Bergemen, Larry Eisler, Robert Irving, R. O. Lamb, Charles A. Morrison, Phillip Simmons, Ray A. Walters, Floyd Waters, Robert L. Weber, J. Ira Young, Evert Anderson, Eddie Zarn, Louis Horwath Jr., Heinie Johnson, Gus Bartsch, Arthur Evans, Leo Herz, Bruce Holmgren; Indiana, Freeman C. Balph, Arthur B. Coover, Earl R. Roberts, Henry Spearing, Ted Stark; Iowa, Clarence Morman, E. P. Webb; Kansas, William Schumacher, C. W. Bourne; Kentucky, W. W. Gaunt, Jr., George Krebs, Charles Miller, William A. McAlister, James T. Spalding, J. E. Wilson; Louisiana, Roy W. Peyton, Irving G. Couvillion; Maine, Danford L. Adams, M. Keith Libby, Vincent M. Wood, R. C. Messer, Clayton D. Sands, H. Francis Shea; Maryland, Howard Adams, Jr., J. F. Fritsch, Forrest W. Dodge, Lyman F. Barry, Oliver Hersowitz, Wm. J. Thomas III, August J. Walker; Massachusetts, Armand A. Boussey, Walter L. Chambers, Arthur Hamilton, Sydney G. Millen, Harold K. Miller, Roy Sanders, Donald Smith, Robert Loring Young, James B. Robbins, George James Ellsworth, Albert Pickering, Jr., W. C. Reichardt, Francis T. Reilly, G. L. Harris, Edward J. Dailey, Jr., James A. McGregor, Jr; Michigan, Ralph B.Baldwin, Stewart R. Rupple, Jerry M. Hynek, Lewis W. Jones; Minnesota, M. Michaelson, E. M. Norris, Dr. G. W. Twomey, Walter F. Johnson, Preston C. Richardson; Mississippi, Mrs. L. R. Ledbetter; Missouri, C. H. Long, Walter A. Greiner, R. C. Ludewig, Merton T. Meade, Lewis F. Miller, Raymond W. Sahlbach; Montana, Henry Dobrovolny, Charlie E. Hansen; Nebraska, Hans Andersen, P. H. Clute, Harold Hansen, Louis T. Haws, John Havranek; Nevada, Don H. Townsend, Jr.; New Hampshire, Paul C. Atwood, Alfred J. Mannix; New Jersey, William Dixon, Morgan Foshay. George Munz, R. H. Schiller, Paul B. Silver, Earle R. Wickham, George W. Osbahr, A. Kosynsky, Robert F. Gaiser, Morton Dennis Meehan, Fletcher W. Hartman, Peter J. Tortoriello; New Mexico, G. K. Harrison; New York, Donald E. Bame, John M. Borst, H. S. Bradley, William C. Dorf, Capt. Horace L. Hall, Robert F. Kaiser, I. H. Kattell, W. B. Kinzel, William Koehnlein, T. J. Knapp, A. J. Leonhardt, Joseph M. Malast, S. Gordon Taylor, Edmore Melanson, Joseph H. Miller, R. Wright, Harry E. Kentzel, Howard T. Neupert, A. C. Doty, Jr., Thaddeus Grabek, Kenneth L. Sargent, Robert J. Flynn, George Pasquale, Frank J. Flora, James E. Lynch, Pierre A. Portmann, A. J. Umlauf, Alvin H. Behr, E. Scala, Jr., Daniel H. Carey, Kenneth Dressler, Gerald Liccione, Harry J. Potthoff; North Carolina, W. C. Couch, E. Payson Mallard, H. O. Murdoch, Jr.; North Dakota, Billie Bundlie, Ray N. Putnam; Ohio, Paul Byrns, Charles Dooley, Virgil Scott, Stan Elcheshen, Albert E. Emerson, Samuel J. Emerson, R. W. Evans, Clarence D. Hall, Donald W. Shields, C. H. Skatzes, Orval Dickes, Edward DeLaet, M. L. Gavin; Oklahoma, H. L. Pribble, Robert Woods, W. H. Boatman, Wade Chambers; Oregon, Harold H. Flick, George R. Johnson, James Haley, Ernest R. Remster, Ned Smith, Virgil C. Tramp, Jack Frost; Pennsylvania, Harold W. Bower, Roy L. Christoph, John Leininger, George Lilley, Edward C. Lips, Charles Nick, Hen F. Polm, C. T. Sheaks, K. A. Staats, F. L. Stitzinger, Walter W. Winand, J. B. Canfield, Charles B. Marshall, Jr., S. G. DeMarco, R. H. Graham, Thomas R. Jordan, John G. McConomy, Steve Scibal, Jr., Leon Stabler, Joseph Stokes, R. B. Oxrieder; Puerto Rico, Manuel E. Betances, A. N. Lightbourn, Jose D. Caro Costas, Jr.; Rhode Island, Carl Schradieck, Joseph V. Trzuskowski,

Corner SHORT WAVES

M. Cockaday

AMATEURS AND SWL'S TO THE RESCUE

Scene in amateur station W1BPZ where short-wave listeners helped the owner handle hundreds of relief messages during the recent floods in their home city of Springfield. Top row: From left to right, George Ellsworth, L.P.O., and his two pals, Red and Gordey. Below: Left to right, Fred Pinney holding the microphone, and Lyman Brown. The station is Mr. Pinney's.

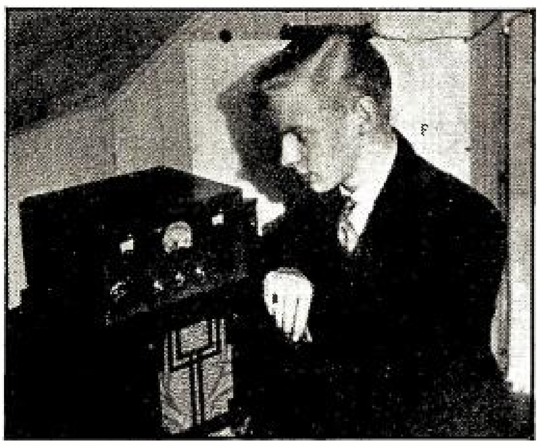
EXCEPTIONALLY FINE CATCHES

HS8PJ, Bangkok, Siam, 10,955 kc., 27.38 meters, Mondays 8 to 10 a.m.. E.S.T. (from announcement).

This new form of reporting will enable us, it is hoped, to get all reports in the issue in which they were intended and will guarantee an up-to-date time-table.

GREETINGS FROM ICELAND

L. P. O. Sigurdsson of that country says "Hello" to fellow observers all over the world. He uses a 7-tube receiver with a short-wave converter (shown on top of set)



Reports of Listening Post Observers and Other Short-Wave Readers of the DX Corner

Listed in the next column is this month's consolidated reports of short-wave stations heard by our wide world listening posts. Each item is credited with the Observer's surname. This allows our readers to note who obtained the information. If any of our Readers can supply Actual Time Schedules, Correct Wavelengths, Correct Frequencies and any other Important Information (in paragraphs as recommended) the DX Editor, as well as our Readers, will be grateful for the information. On the other hand, readers seeing these reports can try their skill in pulling in the stations logged and in trying to get complete information on these transmissions. The report for this month, containing the best information available to date, follows:

EUROPE

Radio-Coloniale, Pontoise, France; new calls for this station are reported as follows:

TPA2, 15,244 kc., reported heard 6:55-11 a.m., E.S.T. (Hynek). Chambers and Stark report this station heard at 2 a.m.

TPA3, 11,880 kc. reported heard till 12:30 p.m. E.S.T. (Twomey, Moore).

TPA4, 11,720 kc. reported 6:15-9 p.m. and 11 p.m.-1 a.m. E.S.T. (Twomey, Koehnlein, Partner).

TYB, Paris, France, 12,250 kc. re-

(*Turn to page* 30)

SHORT-WAVE LISTENING POST OBSERVERS

Spencer E. Lawton; South Carolina, Edward Bahan, Ben F. Goodlett; South Dakota, Paul J. Mraz; Tennessee, Charles D. Moss, Eugene T. Musser, Darrell Barnes; Territory of Hawaii, O. F. Sternemann; Texas, James Brown, Carl Scherz, Bryan Scott, James W. Sheppard, John Stewart, Overton Wilson, Isaac T. Davis, Arthur Immicke, Earl P. Hill; Utah, Earl Larson, A. D. Ross; Vermont, Eddie H. Davenport, Dr. Alan E. Smith, John Eagan; Virginia, G. Hampton Allison, L. P. Morgan, D. W. Parsons, Gordon L. Rich, Gaines Hughes, Jr., E. L. Myers, A. T. Hull, Jr., Wheeler T. Thompson, E. W. Turner, Douglas S. Catchim; Washington, Glenn E. Dubbe, A. D. Golden, J. Wendell Partner, Jack Perry, Wesley W. Loudon; West Virginia, Kenneth R. Boord, R. E. Sumner, Fred C. Lowe, Jr.; Wisconsin, Willard M. Hardell, Walter A. Jasiorkowski, E. L. Frost, Howard E. Sauberlich; Wyoming, L. M. Jensen, Dr. F. C. Naegeli, Eric Butcher.

Official RADIO NEWS Listening Post Observers in Other Countries

LISTED below by countries are the Official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner.

Argentina, J. F. Edbrooke, Santiago E. Roulier.
Australia, Albert E. Faull, A. H. Garth, H. Arthur Matthews, C. N. H. Richardson, R. H. Tucker, Harold F. Lower, E. O. Stafford, Ron Gurr.
Belgium, Rene Arickx.
Bermuda, Ralph Clarke.
Brazil, W. W. Enete, Louis Rogers Gray, Flavio Mascarenhas.
British Guiana, E. S. Christiani, Jr.
British West Indies, D. G. Derrick, Edela Rosa, N. Hood-Daniel, Aubrey H. Forbes.
Canada, J. T. Atkinson, A. B. Baadsgaard, Jack Bews, Robert Edkins, W. H. Fraser, Fred C. Hickson, C. Holmes, John E. Moore, Charles E. Roy, Douglas Wood, Claude A. Dulmage, A. Belanger, Robert B. Hammersley, Cyril G. Clark, Fred Cox, Arthur Church, Arthur E. MacLean, George L. Loke.
Canal Zone, Bertram Baker.
Canary Islands, Manuel Davin.
Chile, Jorge Izquierdo.
China, Baron Von Huene.
Colombia, J. D. Lowe, Italo Amore.
Cuba, Frank H. Kydd, Dr. Evelio Villar, Augusto Anca, Juan Manuel Salazar, Jose L. Lopez, Rafael Penalver y Ballina.
Czechoslovakia, Ferry Friedl, Joe Klar.
Denmark, Hilbert Jensen.
Dominican Republic, Jose Perez.
Dutch East Indies, E. M. O. Godee, A. den Breems, J. H. A. Hardeman.
Dutch West Indies, Rein J. G. van Ommeren.
Egypt, Aram Iskanian.
El Salvador, Jose Rodriguez R.
England, N. C. Smith, H. O. Graham, Alan Barber, Donald Burns, Leslie H. Colburn, C. L. Davies, Frederick W. Gunn, R. S. Houghton, W. P. Kempster, R. Lawton, John J. Maling, Norman Nattall, L. H. Plunkett-Checkemian, Harold J. Self, R. Stevens, L. C. Styles, C. L. Wright, John Gordon Hampshire, J. Douglas Buckley, C. K. McConnan, Douglas Thwaites, J. Rowson, A. J. Webb, F. Crowder, J. E. Puyenbroek.
France, J. C. Meillon, Jr., Alfred Quaglino, S. F. Carville.
Germany, Herbert Lennartz, Theodor B. Stark.
Guatemala, Luis Diez.
Holland, L. Hintzbergen, R. Groeneveld.
Iceland, Arni Sigurdsson.
India, D. R. Wadia, A. H. Dalal, Terry A. Adams, Harry J. Dent, H. W. Kamen.
Iraq, Hagop Kouyoumdjian.
Italy, A. Passini, Dr. Guglielmo Tixy.
Japan, Masall Satow, Tomonobu Masuda, Shokichi Yoshimura.
Malaya, D. A. Seneviratne.
Malta, Edgar J. Vassallo.
Manchukuo, Anatol Kabatoff.
Mexico, Felipe L. Saldana, Manuel Ortiz G.
New Zealand, Kenneth H. Moffatt, B. A. Peachey, Eric W. Watson.
Newfoundland, Frank Nosworthy.
Norway, Per Torp.
Palestine, W. E. Frost.
Panama, Alberto Palacio.
Peru, Ramon Masias.
Philippine Islands, Victorino Leonen, Johnny Torres.
Portugal, Jose Fernandes Patrae, Jr.
Scotland, Duncan T. Donaldson.
South Africa, Mike Kruger, A. C. Lyell, C. McCormick, H. Westman.
South West Africa, H. Mallet-Veale.
Spain, Jose Maria Maranges.
Straits Settlements, C. R. Devaraj.
Sweden, B. Scheierman.
Switzerland, Dr. Max Hausdorff.
Turkey, Hermann Freiss, M. Seyfeddin, A. K. Onder.
Venezuela, Francisco Fossa Anderson.

WORLD SHORT WAVE TIME-TABLE

Compiled by LAURENCE M. COCKADAY

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME															
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME				8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME				13	14	15	16	17	18	19	20	21	22	23	00
HOURS OF TRANSMISSION												Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION											
											D	13.93	W8XK	21540	Pittsburgh, Pa.	D											
												13.94	W2XE	21520	New York, N. Y.			D									
							S	S		XS	D	13.97	GSH	21470	Daventry, England	D											
							S	S		XS	D	16.86	GSG	17790	Daventry, England	D	D	D	D								
											P	16.87	W3XAL	17780	Bound Brook, N. J.	XS	D	D	D	D	D	D	D	D	D		
												16.88	PHI	17775	Huizen, Holland	P	P				S						
												16.89	DJE	17760	Zeesen, Germany	D	D	D									
												19.43	PRADO	15440	Riobamba, Ec.								S	S	S	S	
												19.52	HAS3	15370	Budapest, Hungary	S	S										
					D	D	D					19.56	DJR	15340	Zeesen, Germany												
												19.57	W2XAD	15330	Schenectady, N. Y.				D	D	D	D					
												19.60	GSP	15310	Daventry, England											D	D
												19.62	LRU	15290	Buenos Aires, Arg.				S	S	I	I	I	I			
				D	D	D	D	D	D	D		19.63	DJQ	15280	Zeesen, Germany												
										D	D	19.65	W2XE	15270	New York, N. Y.	D	D	D	D	D	D	D	D	D	D		
												19.66	GSI	15260	Daventry, England					D	D	D	D	D	D		
									D	D	D	19.68	TPA2	15244	Pontoise, France	D	D	D									
								T	T	S	V	19.71	PCJ	15220	Huizen, Holland	W	W	W									
												19.72	W8XK	15210	Pittsburgh, Pa.		D	D	D	D	D	D	D	D	D	D	
							D	D	D	D	D	19.74	DJB	15200	Zeesen, Germany	D	D	D									
												19.76	GSO	15180	Daventry, England					D	D	D	D	D	D		
												19.82	GSF	15140	Daventry, England		D	D	D								
									XS			19.84	HVJ	15121	Vatican City			I									
									D	D	D	19.85	DJL	15110	Zeesen, Germany												
				D								20.55	JVH	14600	Nazaki, Japan									E			
S	S	S										22.00	SPW	13635	Warsaw, Poland				C	C					S	S	S
			I	XS	XS							22.95	VPD	13075	Suva, Fiji Islands												
	S	S	S							V	S	25.00	RV59(RNE)	12000	Moscow, U. S. S. R.	S	S	S				S	D	D	D		
						D	D	D				25.25	TPA3	11880	Pontoise, France				D	D	D	D	D	D	D		
D												25.27	W8XK	11870	Pittsburgh, Pa.										D	D	D
												25.30	GSE	11860	Daventry, England		D	D	D	D							
												25.31	DJP	11855	Zeesen, Germany					D	D						
I	I											25.36	W2XE	11830	New York, N. Y.								I	I	I	I	I
												25.36	W9XAA	11830	Chicago, Ill.				D	D	D	D	I	I	D	D	I
												25.40	I2RO	11810	Rome, Italy	D	D	D	D	D	D						
												25.43	DJO	11795	Zeesen, Germany								D	D			
D	D	D										25.49	DJD	11770	Zeesen, Germany				D	D	D	D	D	D	D	D	D
	D	D	D	D	D					D	D	23.53	GSD	11750	Daventry, England		D	D	D	D	D	D	D	D	D	D	D
D	D	D	D									25.58	CJRX	11730	Winnipeg, Canada												
D	D	D	D	D								25.60	TPA4	11720	Pontoise, France											D	D
D	D	D										25.62	HJ4ABA	11710	Medellin, Col.				D	D					I	D	D
M	M											27.38	HS8PJ	10955	Bangkok, Siam							I					
		Sa	Sa	Sa				D	D	D	D	27.93	JVM	10740	Nazaki, Japan									E			
			Sa	Sa				I	I	I	I	28.14	JVN	10660	Nazaki, Japan	I								E			
												29.04	ORK	10330	Ruysselede, Belgium							D	D	I			
D	D											30.43	EAQ	9860	Madrid, Spain						I	I			D	D	D
							K	K				31.00	CQN	9677	Macao, Asia												
												31.09	CT1AA	9650	Lisbon, Portugal									G	G	G	I
C												31.14	I2RO	9635	Rome, Italy							D	D	D		C	C
D	D	D										31.25	HJ1ABP	9600	Cartagena, Col.												D
I	D	D	D									31.25	CB960	9600	Santiago, Chile												
D					I							31.27	HH3W	9595	Port-au-Prince, Haiti					D							D
				M								31.27	HBL	9595	Geneva, Switzerland										Sa	Sa	
												31.28	W3XAU	9590	Philadelphia, Pa.				D	D	D	D	D	D	D	XS	
					S	S			S	S	S	31.28	VK2ME	9590	Sydney, Australia	S	S	S	S								
Th	Th											31.28	PCJ	9590	Huizen, Holland												A
D	D	D										31.28	HP5J	9590	Panama City, Pana.			S	S	S	S						D
			XS	D	D	I	XS	XS	XS	XS	XS	31.32	VK3LR	9580	Lyndhurst, Australia												
	D	D										31.32	GSC	9580	Daventry, England											D	D
D	D	D	D	D						XS	D	31.35	W1XK	9570	Millis, Mass.	D	D	D	D	D	I	I	I	I	I	I	D
XA	XA	M	M									31.38	HJ1ABE	9560	Cartagena, Col.				XA	XA						S	XS
D	D	D		D	D	D						31.38	DJA	9560	Zeesen, Germany	D	D	D						D	D	D	D
D	D	D		D	D	D						31.45	DJN	9540	Zeesen, Germany	D	D	D						D	D	D	D
D	D	D	D									31.48	W2XAF	9530	Schenectady, N. Y.									D	D	D	D
									D	D	D	31.48	LKJ1	9530	Jeloy, Norway				D	D	D	D	D	D			
			D	D	D							31.55	GSB	9510	Daventry, England					D	D	D	D	D	D		
C	C	C										31.55	HJU	9510	Buenaventura, Colo.					C	C						
								XS	XS	XS		31.61	VK3ME	9490	Melbourne, Australia												
D	D	D	I	I								31.82	COCH	9428	Havana, Cuba	D	D	D	D			D	D	D	D	D	D
												32.88	HAT4	9125	Budapest, Hungary											S	
XM	XM	XM	AL									34.19	HCJB	8775	Quito, Ecuador									S	S	S	XM
			D	D	D			D	D			34.29	ZBW	8750	Hong Kong, China												
XA	XA											34.62	CO9JQ	8665	Camaguey, Cuba												
D	D											34.92	YNVA	8590	Managua, Nic.												
D	D	D	I	I	I							38.20	HC2JSB	7854	Guayaquil, Ecuador												D
												38.48	HBP	7797	Geneva, Switzerland										Sa	Sa	
											D	39.95	JVP	7510	Nazaki, Japan	D	D							AM			
											Sa	41.20	SM5SD	7281	Stockholm, Sweden												
												41.61	EA8AB	7210	Tenerife, C. I.	D	D										
												41.80	CR6AA	7177	Lobito, Angola, Afr.							L	L	L			
												42.15	HB9B	7118	Basle, Switzerland										W		
D											S	42.37	VP3MR	7080	Georgetown, B. G.	S	S	S						D	D	D	D
D	D											43.48	HI3C	6900	La Romana, D. R.					D	D						D
AC							D					44.14	HIH	6796	San Pedro, D. R.					AC	AC			S			AC
				I	I	I	I	D	D	D	D	44.44	JVT	6750	Nazaki, Japan							Z					
D	D	I	I									44.71	TIEP	6710	San Jose, Costa Rica										I	D	D
	T	T	T									45.00	HC2RL	6667	Guayaquil, Ecuador										S	S	S
XS			S	S								45.25	HIT	6630	Trujillo, D. R.					XS	XS					XS	XS
D	D											45.38	RV72	6611	Moscow, U. S. S. R.					I							
												45.80	HI4D	6550	Trujillo, D. R.				XS	XS	XS			XS	XS	XS	XS
Th	Th	Th	Th	D	D	D						45.80	TIRCC	6550	San Jose, Costa Rica				S	D	D				D	D	Th
D	D											46.01	YV6RV	6520	Valencia, Venezuela				D	D	D				D	D	D
D	I											46.08	HIL	6510	Trujillo, D. R.											D	D
O	O	O										46.22	HJ5ABD	6490	Cali, Colombia												N

WORLD SHORT WAVE TIME-TABLE

(Continued from the Previous Page)

Hours of transmission for the World's Short Wave Broadcast Stations

												FILL IN LOCAL TIME																
8	9	10	11	M	1	2	3	4	5	6	7	EASTERN STANDARD TIME				8	9	10	11	N	1	2	3	4	5	6	7
01	02	03	04	05	06	07	08	09	10	11	12	GREENWICH MEAN TIME				13	14	15	16	17	18	19	20	21	22	23	00
HOURS OF TRANSMISSION												Wave-length Meters	Call Letters	Frequency Kc.	City Country	HOURS OF TRANSMISSION											
XS	XS											46.50	HJ4ABC	6451	Ibague, Colombía												XS
D	D											46.53	HJ1ABB	6447	Barranquilla, Col.				D	D					D	D	D
												46.66	HI1S	6430	Puerto Plata, D. R.					D	D					D	D
D	D	D										46.80	TIPG	6410	San Jose, Costa Rica					D	D					D	D
												47.00	HI3U	6383	Santiago, D. R.										XS	XS	XS
D	D	D	I	I	I							47.06	YV4RC	6375	Caracas, Venezuela										D	D	D
D	D										D	47.24	HRP1	6350	San Pedro Sula, D. R.					D	D					D	D
I	I	Sa	Sa									47.54	HIZ	6310	Trujillo, D. R.					S	S	S		I	I	I	I
I	I	I										47.62	YV12RM	6300	Maracay, Venezuela												
XS	XS											47.77	HIG	6280	Trujillo, D. R.												XS
D	D	I										48.00	CO9WR	6250	Sancti Spiritus, Cuba						I	I	I	I	I	I	I
XS	XS	XS										48.12	HRD	6235	La Ceiba, Hond.					S	S						
L	L	L										48.15	OAX4G	6230	Lima, Peru												L
AM												48.19	HJ1ABH	6225	Cienaga, Colombia												AM
D	D	I	I	I								48.50	HI1A	6185	Santiago, D. R.				D	D	D						D
D	D	D	D									48.54	XEXA	6180	Mexico, D. F., Mex.												D
XS	XS	D										48.62	HJ3ABF	6170	Bogota, Colombia				D								XS
D	D	D	D									48.70	CJRO	6160	Winnipeg, Canada												
			SA	SA								48.78	VE9CL	6150	Winnipeg, Can.												
D		D	D									48.78	HI5N	6150	Trujillo, D. R.												
D	D											48.78	HJ2ABA	6150	Tunja, Colombia						D						D
D	D											48.78	YV3RC	6150	Caracas, Venezuela				D	D	D			D	D	D	D
XA	XA			S	S							48.78	HJ5ABC	6150	Cali, Colombia				D	S	S						XA
D	D	D		D	D	M						48.78	COKG	6150	Santiago, Cuba		D	D	D		D	D		D	D	D	D
	D	D	D	D								48.86	W8XK	6140	Pittsburgh, Pa.												
												48.89	CR7AA	6136	Lourenzo Marques, A.	S	S	S		D	D	D					
D	D	D	D									48.94	COCD	6130	Havana, Cuba											D	D
D	D	D	D									48.98	HJ3ABX	6125	Bogota, Col.										D	D	D
		D										49.02	W2XE	6120	New York, N. Y.												
D	D	D	D	D								49.10	CHNX	6110	Halifax, N. S.		D	XA	XA	XA	XA	XA	XA	D	SA	D	D
			Sa									49.18	W3XAL	6100	Bound Brook, N. J.									AH			
J	J	J	J	J								49.18	W9XF	6100	Chicago, Ill.												
D			XS	XS			AL	D	D	D	D	49.20	ZTJ (JB)	6098	Johannesburg, Africa	XS	XS				XS	XS	D	D	D	D	SA
D	D	D										49.26	CRCX	6090	Toronto, Canada							S	S	D	D	D	D
									XA	XA		49.32	VQ7LO	6083	Nairobi, Kenya, Afr.	E	E		D	D	D	XS	Sa				
S	XS	XS	XS									49.34	HP5F	6080	Colon, Panama					S	D	XS				S	S
D	D	D	D							D	D	49.34	W9XAA	6080	Chicago, Ill.	D	D	D	D	D	D	D	D	D	D	D	D
											XS	49.34	ZHJ	6080	Penang, S. S.	XS											
D	D											49.35	DJM	6079	Zeesen, Germany												D
							D	I	I	I	I	49.41	OER2	6072	Vienna, Austria	I	D	D	D	D	D	D	D	D	D	SA	
S	S	S	AG	AG	T							49.42	VE9CS	6070	Vancouver, B. C.						S	S	S	S	S	D	D
			D	D	D	Sa				XS	XS	49.50	W8XAL	6060	Cincinnati, Ohio	D	D	D	D	D	D	D	D	D	D	D	D
D	D											49.50	W3XAU	6060	Philadelphia, Pa.												D
												49.50	OXY	6060	Skamlebaek, Denmark				S	S	D	D	D	D	D	D	
D	D	D										49.59	HJ3ABD	6050	Bogota, Col.												D
D	D	D										49.59	HI9B	6050	Trujillo, D. R.					D						D	D
	D											49.63	HJ3ABI	6045	Bogota, Colombia												
XS	XS	XS		Sa								49.65	HJ1ABG	6042	Barranquilla, Col.					XS	XS	S				XS	XS
E												49.67	W1XAL	6040	Boston, Mass.									S	S	S	E
D	D	D										49.75	HP5B	6030	Panama City, Pana.					D				I			D
D	D	D	D	D	Th	Th						49.75	VE9CA	6030	Calgary, Alberta, Can.		XS	XS	XS	D	D	D	XS		S	S	D
												49.83	DJC	6020	Zeesen, Germany				D	D	D	D	D	D			
D	D	D				I	I					49.83	XEUW	6020	Mexico City, Mex.											D	D
		S	S	S	S					N	N	49.85	ZHI	6018	Singapore, Malaya	N											
D	D	D	I									49.90	HJ3ABH	6012	Bogota, Colombia				D	D	D	D		S	S	D	D
			Sa	Sa								49.92	COCO	6010	Havana, Cuba		D	D	D	D				D	D	D	
D	D	D	D		I							49.95	HJ1ABJ	6006	Santa Marta, Col.					D							D
												49.96	VE9DR	6005	Montreal, Can.	D	D	D	D	D	D				Sa		
D											D	49.96	HP5K	6005	Colon, Panama	D				D						D	D
				SA								49.96	VE9DN	6005	Montreal, Canada							D					
D	D	D	D	D								50.00	XEBT	6000	Mexico City, Mex.			D	D	D	D	D	D	D	D	D	D
												50.00	RV59	6000	Moscow, U. S. S. R.						I	I	D	D	D		
	E		Th									50.17	XEVI	5980	Mexico City, Mex.							S		C			
Z	Z	Z	Sa								S	50.17	HIX	5980	Trujillo, D. R.	S	S	S		D	D	D		D	D		
D	D	I										50.20	HJ2ABC	5976	Cucuta, Colombia											D	D
		D	D									50.21	XECW	5975	Xantocam, Mexico												
D	D	D										50.25	HJN	5970	Bogota, Col.				D								
									S			50.26	HVJ	5969	Vatican City							D					
D	D											50.42	YNLF	5950	Managua, Nicaragua	D				D	D	D				D	D
XSa	D	Sa	Sa									50.50	TG2X	5940	Guatemala City, G.												
D	D	D										50.59	HJ4ABE	5930	Medellin, Colombia				D	D	D					D	D
XS	XS											50.72	HH2S	5915	Port au Prince, Haiti						D						XS
D	D	S	S									50.76	HRN	5910	Tegucigalpa, Hond.					D		S	S	S	D	D	D
D	D											50.85	YV8RB	5900	Barquisimeto, Ven.					D						D	D
D												51.15	HI1J	5865	Trujillo, D. R.					D	D						D
D	D	D										51.46	TIGPH	5830	Alma Tica, Costa Rica					D	D						D
D	D											51.63	YV7RMO	5810	Maracay, Ven.				D	D					D	D	D
D	D											51.72	YV2RC	5800	Caracas, Venezuela		S	S		D	D	D	S	S	S	D	D
	AH	AH	AH									51.90	OAX4D	5780	Lima, Peru		AN	AN	AN								
			D	D	D			D	D			55.45	ZBW	5410	Hong Kong, China												
D	D	D	D	D	D	D	D	D	D	D	D	70.21	RV15	4273	Khabarovsk, Siberia	D	D								D	D	D

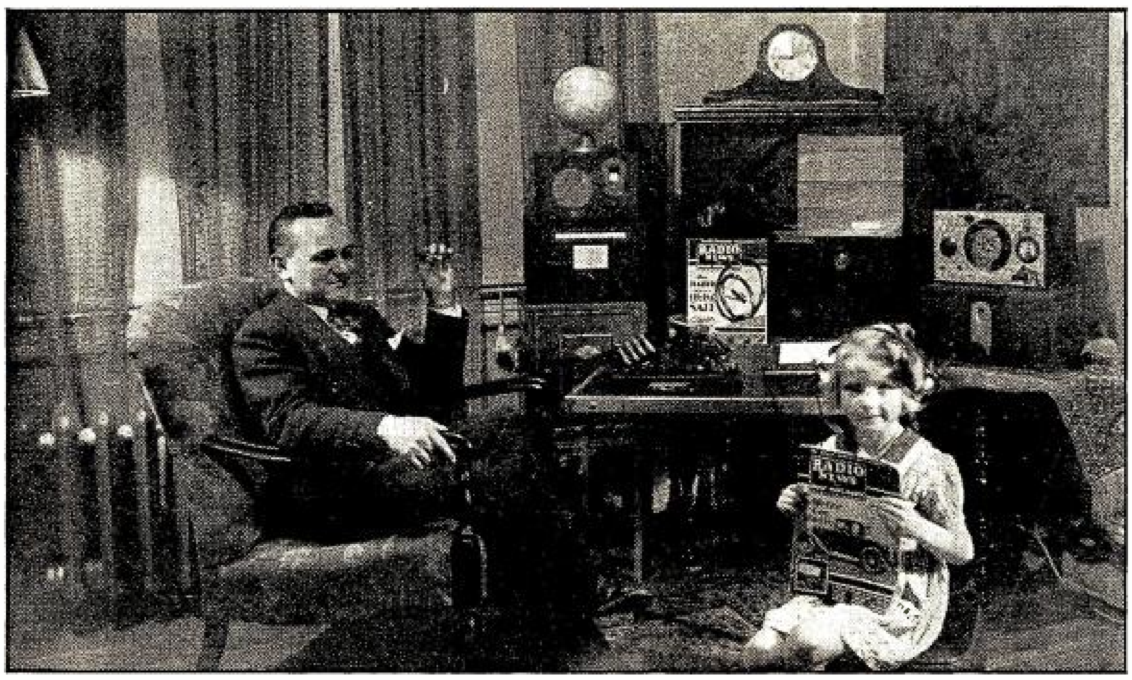
List of Symbols

A—Thursday, Sunday
C—Monday, Wednesday, Friday
D—Daily
E—Tuesday, Thursday
F—Friday
G—Tuesday, Thursday, Saturday
I—Irregularly
J—Tuesday, Thursday, Friday, Sunday

K—Monday, Friday
L—Wednesday, Saturday
M—Monday
N—Monday, Wednesday, Thursday
O—Monday, Tuesday, Wednesday, Friday
P—Except Tuesday, Wednesday
S—Sunday
T—Tuesday

Th—Thursday
V—Sunday, Wednesday
W—Wednesday
Z—Tuesday, Friday
AC—Monday, Thursday, Saturday
AG—Tuesday, Sunday
AH—Monday, Wednesday, Saturday
AL—Except Monday, Sunday

AM—Monday, Thursday
AN—Tuesday, Saturday
Sa—Saturday
XA—Except Saturday, Sunday
XM—Except Monday
XS—Except Sunday
XY—Except Tuesday, Sunday
XSa—Except Saturday



PROUD OF EACH OTHER AND RADIO NEWS

Beverly Joy, six years old and an ardent short-wave fan, helps her father George J. Ellsworth, Official Short Wave Listening Post Observer for RADIO NEWS, *in all matters pertaining to reception. From Dad's expression the trio, Dad, Beverly and "our own" magazine, seem to get along swell together*

The DX Corner (Short Waves)

(*Continued from page* 27)

ported heard 1:30-2:30 a.m. with TPA3 program (Miller).

New station in Belgrade, Jugoslavia, 6090 kc. 250 watts heard testing 2-4 p.m. E.S.T. (Stokes, Andrews, N. C. Smith, Styles, Clarke). Some of these reports say the time on the air is 3:45-4:45 a.m. and 6:30-7:30 a.m. E.S.T. Soon to be on 82.3 meters also.

CT2AJ, Azores, 4002 kc. reported heard 6:30-7:30 p.m., E.S.T. (Kentzel).

PCJ, Huizen, Holland, 9590 kc. is now on Wednesday nights 7-10 p.m. E.S.T. (Dressler, Mechling, Miller, Adams, Reilly, Thomas). They are also on the air on 15,220 kc. Sunday morning at 9:30 a.m. E.S.T. (Bourne).

DZA, Zeesen, Germany, 9675 kc., reported heard 5-7 p.m., E.S.T. (Loke, Stark, N. C. Smith, Vassallo.) Reported heard 4:45-10:30 p.m. (Scala.)

DZB, Zeesen, Germany, 10,042 kc., reported heard 5-7 p.m., E.S.T. (Jacobs, Hull, Chambers, Stabler, Horwath, Vassallo.) (Also reported heard 7-9 p.m., E.S.T. (Partner.)

DZE, Zeesen, Germany, 12,130 kc., reported heard 7-9 a.m., E.S.T. (Hull, Vassallo.)

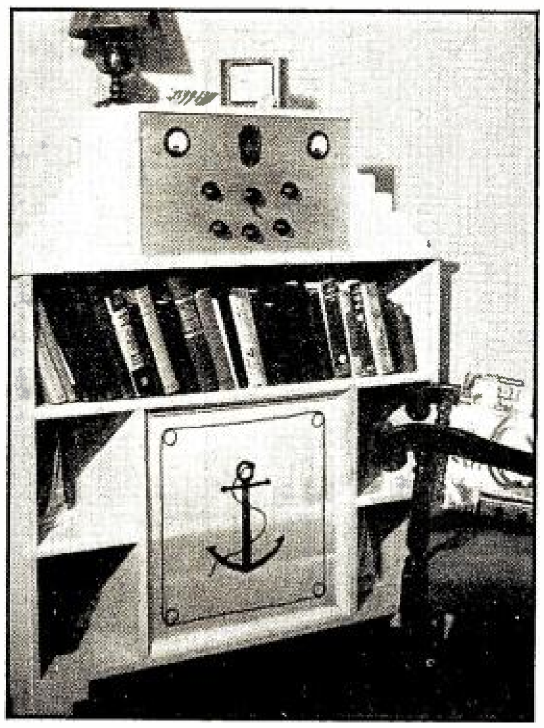
DZH, Zeesen, Germany, 14,460 kc., reported heard irregularly noon to 2 p.m., E.S.T. (Sauberlich, Ludewig, Vassallo.)

DJD, Zeesen, Germany, 11,770 kc., reported heard 4:50-10:45 p.m., E.S.T. (Herz.)

DJM, Zeesen, Germany, 6079 kc., 7:30-9:30 p.m., E.S.T. (Herz.)

LZA, Sofia, Bulgaria, 20 meters, reported heard Sundays all day long starting at 6 a.m., E.S.T. (Self.) L.P.O. Ishkanian says he heard them at 11:30 a.m.

GSH, Daventry, England, 21,470 kc., reported heard 6-8:45 a.m., E.S.T. (DeLaet.)



LISTENING POST IN VIRGINIA

This is the shipshape short-wave DX corner of L.P.O. D. W. Parsons of Virginia Beach. His receiver is a modified Lafayette Superhet installed in a cabinet of the owner's design

GSI, Daventry, England, 15,260 kc., reported heard 12:15-2:15 p.m., E.S.T. (Hynek, Thomas.)

GSJ, Daventry, England, 21,630 kc., reported heard early mornings signing off at 8:45 a.m., E.S.T. (Sauberlich.)

GSM, Daventry, England, 11,200 kc., reported heard at 1:15 a.m., E.S.T. (DeLaet.)

GSN, Daventry, England, 11,820 kc., reported heard 2:15-4:20 a.m. (Loke, Miller.) Observer Stark reports them from 12:15-2 a.m., E.S.T. Observers Sahlbach and Dickes report hearing them Saturday afternoons.

GSO, Daventry, England, 15,180 kc., reported heard 1-5:45 p.m., E.S.T. (Jacobs, Stabler, Sahlbach, Hull, DeLaet, Putnam, Coleman, Herz, Dickes, Shea, Partner, Loke, Costes, Salazar.)

GSP, Daventry, England, 15,310 kc., reported heard 6-8 p.m., E.S.T. (Atkinson, Putnam, Coover, Salazar, Herz, Stabler, Dickes, DeLaet, Shea, Costes, Partner.)

GBC, Rugby, England, reported heard talking to the *Queen Mary*. (DeLaet, Thomas.)

HAS3, Budapest, Hungary, 15,370 kc., reported heard Sunday 8-9 a.m., E.S.T. (H. R. Smith, Hartshorn,)

HAT2, Budapest, Hungary, 6952 kc., reported heard testing. (McGregor.)

HAT4, Budapest, Hungary, 9125 kc., 5 kw., reported heard 5-7:10 p.m., E.S.T. (Gavin, Andersen, Nosworthy, Stabler, Dressler, Herz, Miller, Hartshorn, Kemp, Pasquale, Scala, H. R. Smith.)

CT1AA, Lisbon, Portugal, 9650 kc., reported heard Tuesday, Thursday and Saturday, 4:30-7 p.m., E.S.T. (Putnam, McGregor, Reilly, Scala. Choo, Jordan, Hamilton.) Observer Hynek says the frequency is 9625 kc. Observer Fletcher says he also hears this station on about 11,980 kc., irregularly.

ORK, Ruysselede, Belgium, reported heard 3:50-4 p.m., E.S.T. (Adams.)

OER2, Vienna, Austria, 6072 kc., reported heard 5-6 p.m., E.S.T. (Betances.)

Radio-Phillips-Iberia, Madrid, Spain (no call letters as yet), reported heard on about 45 meters, 6750 kc., 7-9 p.m., E.S.T. (Harris.)

LKJ1, Jeloy, Norway, 9530 kc., reported heard 5-8 a.m. and 11 a.m.-5 p.m., E.S.T. (Bourne.)

SPW, Warsaw, Poland, 13,635 kc., reported heard Monday, Wednesday and Friday, 11:30 a.m.-1 p.m., E.S.T. (Vassallo, Self, Westman, H. R. Smith, Pasquale, Shea, Jacobs.)

HBF, Geneva, Switzerland, 16 meters, heard testing Sunday 10:05 to 10:35 a.m., E.S.T. (Cindel.)

HBJ, Geneva, Switzerland, 20 meters, heard testing Sunday 10:05 to 10:35 a.m., E.S.T. (Craig, Cindel.)

HBO, Geneva, Switzerland, 11,390 kc., heard on first and second Tuesdays of the month at about 1:30 a.m., E.S.T. (Chambers, Ishkanian.)

I2RO, Rome, Italy, 9635 kc., now carries the American hour 5 to 6 p.m. on Wednesdays and Fridays. (Putnam, Craig, Coover, Tucker, Choo, Andersen, Herz, Loke, Hansen, Sauberlich, Gavin.)

IAC, Rome, Italy, reported on 12,800 kc., 4 to 5 p.m., E.S.T. (Rog-

(*Turn to page* 48)

MISSOURI ON THE MAP

Meet L.P.O. Ray W. Sahlbach, shown tuning his 6-tube Zenith. His logs to RADIO NEWS *are accurate and cover the whole world*

SHORT-WAVE STATION LIST

Arranged by Countries and Cities

NORTH AMERICA

ALASKA

Location	Call	Meters	Kc.	Class
Anchorage	WXE	50.04	5,995	P

CANADA

ALBERTA

Location	Call	Meters	Kc.	Class
Calgary	VDC	66.81	4,490	P
Calgary	VE9CA	25.30	11,860	B
Calgary	VE9CA	49.75	6,030	B
Calgary	VE9CG	49.10	6,110	B

BRITISH COLUMBIA

Location	Call	Meters	Kc.	Class
Anyox	CZQ	55.56	5,400	P
Campbell River	CGT	61.66	4,865	P
Claydon Bay	CZP	66.59	4,505	P
Ocean Falls	CGO	66.59	4,505	P
Prince George	CZO	66.59	4,505	P
Prince Rupert	CGP	55.56	5,400	P
Rossland	CFU	52.58	5,705	P,B
Sage Creek	VXX	55.50	5,405	P
Slate Creek	CFN	53.00	5,660	P
TwoBrothersLake	VDV	66.81	4,490	P
Vancouver	VDO	61.66	4,865	P
Vancouver	VDO	67.63	4,436	P
Vancouver	VE9BK	62.63	4,790	P
Vancouver	VE9CS	49.43	6,070	B
Waterloo Mines	CZV	61.98	4,840	P

MANITOBA

Location	Call	Meters	Kc.	Class
Winnipeg	CJRO	48.70	6,160	B
Winnipeg	CJRX	25.58	11,730	B
Winnipeg	VE9CL	48.78	6,150	B

NEW BRUNSWICK

Location	Call	Meters	Kc.	Class
Fredericton	VE9AS	46.69	6,425	B
St. John	VE9BJ	49.26	6,090	B

NOVA SCOTIA

Location	Call	Meters	Kc.	Class
Halifax	CHNX	25.36	11,835	B
Halifax	CHNX	49.10	6,110	B
Halifax	VE9CF	49.18	6,100	B
Halifax	VE9HK	49.02	6,120	B

ONTARIO

Location	Call	Meters	Kc.	Class
Kenora	CFD	53.00	5,660	P
London	VE9BY	17.34	17,300	E
London	VE9BY	46.69	6,425	B
Red Lake	CFJ	53.00	5,660	P
Toronto	CRCX	25.40	11,810	B
Toronto	CRCX	49.26	6,090	B

PRINCE EDWARD ISLAND

Location	Call	Meters	Kc.	Class
Charlottetown	VE9EH	49.34	6,080	B

QUEBEC

Location	Call	Meters	Kc.	Class
Drummondville	CFA	43.86	6,840	P
Drummondville	CGA	16.50	18,180	P
Drummondville	CGA	21.82	13,740	P
Drummondville	CGA	22.49	13,340	P
Drummondville	CGA3	22.58	13,285	P
Drummondville	CGA4	32.15	9,332	P
Drummondville	CGA4	67.19	4,465	P
Drummondville	CGA5	30.26	9,905	E
Drummondville	CJA6	24.79	12,100	E
Drummondville	CZA	17.33	17,310	P
Drummondville	CZA	62.70	4,785	P
Montreal	VE9BA	19.75	15,190	B
Montreal	VE9BA	48.94	6,130	B
Montreal	VE9DN	19.83	15,130	B
Montreal	VE9DN	25.46	11,780	B
Montreal	VE9DN	31.40	9,555	B
Montreal	VE9DN	49.96	6,005	B
Montreal	VE9DR	25.46	11,780	E
Montreal	VE9DR	31.31	9,580	E
Montreal	VE9DR	49.96	6,005	B

SASKATCHEWAN

Location	Call	Meters	Kc.	Class
Hudson Bay Junction	VXV	54.15	5,540	P
Regina	VXU	54.15	5,540	P
Portable	VXW	54.15	5,540	P

MEXICO

Location	Call	Meters	Kc.	Class
Guadalajara, Jalisco	XEDQ	31.51	9,520	B
Merida, Yucatan	XAM	26.80	11,187	P
Merida, Yucatan	XEMB	36.56	8,205	B
Merida, Yucatan	XEME	31.51	9,520	B
Mexico, D. F.	XBJQ	27.27	11,000	P
Mexico, D. F.	XDA	25.51	11,760	E
Mexico, D. F.	XDA	32.00	9,375	P
Mexico, D. F.	XDA	51.19	5,860	P
Mexico, D. F.	XDC	31.92	9,400	E
Mexico, D. F.	XEBT	50.00	6,000	B
Mexico, D. F.	XECR	40.65	7,380	B
Mexico, D. F.	XEIO	50.25	5,970	B
Mexico, D. F.	XEVI	50.17	5,980	B
Mexico, D. F.	XEXA	48.54	6,180	B
Mexico, D. F.	XICB	41.96	7,150	B
Veracruz, Ver.	XEFT	31.25	9,600	B
Veracruz, Ver.	XEFT	49.02	6,120	B
Veracruz, Ver.	XEUW	49.83	6,020	B

Abbreviations For Class Column

A—Amateur
B—Broadcast
E—Experimental
F—Frequency Standard
P—Phone
T—Time Signals

Location	Call	Meters	Kc.	Class
Veracruz, Ver.	XFA2	45.46	6,600	P
Xantocam	XECW	50.21	5,975	B

UNITED STATES

CALIFORNIA

Location	Call	Meters	Kc.	Class
Bolinas	KEC	58.76	5,105	P
Bolinas	KEE	38.89	7,715	P
Bolinas	KEF	44.71	6,710	P
Bolinas	KEI	31.61	9,490	P
Bolinas	KEJ	33.30	9,010	P
Bolinas	KEL	43.73	6,860	P
Bolinas	KEM	19.37	15,490	P
Bolinas	KER	28.87	10,390	P
Bolinas	KES	28.82	10,410	P
Bolinas	KET	31.65	9,480	P
Bolinas	KIKB	58.71	5,110	P
Bolinas	KKL	19.39	15,475	P
Bolinas	KKQ	25.11	11,950	P
Bolinas	KKR	19.40	15,460	P
Bolinas	KKW	21.82	13,740	P
Bolinas	KKZ	21.91	13,690	P
Bolinas	KMM	14.44	20,780	P
Bolinas	KQG	16.67	18,000	P
Bolinas	KQJ	16.65	18,020	P
Bolinas	KQR	16.63	18,040	P
Bolinas	KQZ	16.69	17,980	P
Bolinas	KSS	14.41	20,820	P
Bolinas	KWE	19.44	15,430	P
Dixon	KEZ	28.85	10,400	P
Dixon	KWN	14.25	21,060	P
Dixon	KWO	19.45	15,420	P
Dixon	KWU	19.54	15,355	P
Dixon	KWV	27.68	10,840	P
Dixon	KWX	39.42	7,610	P
Dixon	KWY	39.66	7,565	P
Los Angeles	W6XKG	8.43	35,600	E
Los Angeles (Portable)	W10XFZ	7.40	40,600	E
Los Angeles (Portable)	W10XFZ	8.67	34,600	E
Los Angeles (Portable)	W10XFZ	9.65	31,100	E

CONNECTICUT

Location	Call	Meters	Kc.	Class
Storrs	....	0.75 to 3.49	86,000 to 400,000	E

FLORIDA

Location	Call	Meters	Kc.	Class
Hialeah	WNC	19.93	15,055	P
Hialeah	WND	73.23	4,097	P
Miami Beach	W4XB	49.67	6,040	B

ILLINOIS

Location	Call	Meters	Kc.	Class
Chicago	W9XAA	16.87	17,780	E
Chicago	W9XAA	25.36	11,830	B
Chicago	W9XAA	49.34	6,080	B
Chicago	W9XBS	46.69	6,425	E
Chicago	W9XF	25.26	11,880	B
Chicago	W9XF	49.18	6,100	B

MARYLAND

Location	Call	Meters	Kc.	Class
Beltsville	WWV	20.00	15,000	F
Beltsville	WWV	30.00	10,000	F
Beltsville	WWV	60.00	5,000	F

MASSACHUSETTS

Location	Call	Meters	Kc.	Class
Boston	W1XAL	13.98	21,460	B
Boston	W1XAL	19.67	15,250	B
Boston	W1XAL	25.45	11,790	B
Boston	W1XAL	49.67	6,040	B
Boston	W1XAV	4.88	61,500	E
Chicopee Falls	....	4.96	60,500	E
Chicopee Falls	....	5.41	55,500	E
Chicopee Falls	....	7.77	38,600	E
Chicopee Falls	....	8.43	35,600	E
Chicopee Falls	....	9.50	31,600	E
Chicopee Falls	....	9.68	31,000	E
Millis	W1XK	31.35	9,570	B

MICHIGAN

Location	Call	Meters	Kc.	Class
Detroit	W8XWJ	9.50	31,600	E

MISSOURI

Location	Call	Meters	Kc.	Class
St. Louis	W9XPD	9.50	31,600	E

NEW JERSEY

Location	Call	Meters	Kc.	Class
Bound Brook	W3XAL	16.87	17,780	B
Bound Brook	W3XAL	49.18	6,100	B
Bound Brook	W3XL	17.33	17,310	E
Bound Brook	W3XL	46.69	6,425	E
Deal	WMI	15.11	19,850	P
Lawrenceville	WCN	59.10	5,077	P
Lawrenceville	WKA	14.25	21,060	P
Lawrenceville	WKF	15.61	19,220	P
Lawrenceville	WKK	14.01	21,420	P
Lawrenceville	WKN	15.14	19,820	P
Lawrenceville	WLA	16.36	18,340	P
Lawrenceville	WLK	18.44	16,270	P
Lawrenceville	WMA	22.40	13,390	P
Lawrenceville	WMN	20.56	14,590	P
Lawrenceville	WNA	32.72	9,170	P
Lawrenceville	WNB	28.10	10,675	P
Lawrenceville	WNB	51.28	5,850	P
Lawrenceville	WOA	44.41	6,755	P
Lawrenceville	WOF	30.77	9,750	P
Lawrenceville	WOK	28.44	10,550	P
Lawrenceville	WON	30.40	9,870	P
Lawrenceville	WOY	63.11	4,753	P
Ocean Gate	WOO	17.51	17,120	P
Ocean Gate	WOO	23.36	12,840	P
Ocean Gate	WOO	35.05	8,560	P
Ocean Gate	WOO	63.11	4,753	P
Ocean Gate	WOY	70.22	4,272	P
Wayne	W2XE	13.94	21,520	B
Wayne	W2XE	16.89	17,760	B
Wayne	W2XE	19.65	15,270	B
Wayne	W2XE	25.36	11,830	B
Wayne	W2XE	49.02	6,120	B

NEW YORK

Location	Call	Meters	Kc.	Class
Buffalo	W8XH	7.32	41,000	E
Buffalo	W8XH	7.77	38,600	E
Buffalo	W8XH	8.43	35,600	E
Buffalo	W8XH	9.50	31,600	E
New York	W2XDV	3.49	86,000	E
New York	W2XDV	7.32	41,000	E
New York	W2XDV	7.77	38,600	E
New York	W2XDV	8.43	35,600	E
New York	W2XDV	9.50	31,600	E
Rochester	W8XAI	9.50	31,600	E
Rocky Point	WCG	28.90	10,380	P, E
Rocky Point	WDG	66.15	4,534	P
Rocky Point	WDN	65.93	4,550	P
Rocky Point	WDS	15.87	18,900	P
Rocky Point	WEA	28.28	10,610	E
Rocky Point	WEC	33.60	8,930	E
Rocky Point	WEF	28.25	10,620	P
Rocky Point	WEF	31.61	9,490	P
Rocky Point	WEG	40.45	7,415	P
Rocky Point	WEJ-W2XBJ	44.51	6,740	E
Rocky Point	WEL-W2XBJ	33.52	8,950	E
Rocky Point	WEN	40.50	7,407	P
Rocky Point	WEM-W2XBJ	40.54	7,400	P, E
Rocky Point	WES-W2XBJ	31.75	9,450	E
Rocky Point	WET	31.68	9,470	E
Rocky Point	WIY-W2XBJ	21.63	13,870	E
Rocky Point	WKM	15.91	18,860	P
Rocky Point	WKU-W2XBJ	20.23	14,830	E
Rocky Point	WKW-W2XBJ	15.77	19,020	E
Rocky Point	WLL	16.76	17,900	P
Rocky Point	WQB-W2XBJ	16.72	17,940	P
Rocky Point	WQF	16.74	17,920	P
Rocky Point	WQN	51.50	5,825	E
Rocky Point	WQO	44.61	6,725	P
Rocky Point	WQP	21.58	13,900	P
Rocky Point	WQY	14.92	20,100	P
Schenectady	W2XAD	19.57	15,330	B
Schenectady	W2XAF	31.48	9,530	B

OHIO

Location	Call	Meters	Kc.	Class
Cincinnati	W8XAL	49.50	6,060	B

PENNSYLVANIA

Location	Call	Meters	Kc.	Class
Philadelphia	W3XAU	31.28	9,590	B
Philadelphia	W3XAU	49.50	6,060	B
Philadelphia	W3XKA	5.41	55,500	E
Pittsburgh	W8XK	13.93	21,540	B
Pittsburgh	W8XK	16.87	17,780	B
Pittsburgh	W8XK	19.72	15,210	B
Pittsburgh	W8XK	25.27	11,870	B
Pittsburgh	W8XK	48.86	6,140	B
Pittsburgh	W8XKA	5.41	55,500	E

TENNESSEE

Location	Call	Meters	Kc.	Class
Memphis	W4XCA	9.50	31,600	E

WASHINGTON

Location	Call	Meters	Kc.	Class
Seattle	WVD	34.80	8,620	E
Seattle	WVD	50.04	5,995	P

WISCONSIN

Location	Call	Meters	Kc.	Class
Milwaukee	W9XAZ	9.50	31,600	E

CENTRAL AMERICA

COSTA RICA

Location	Call	Meters	Kc.	Class
Cartago	TIN	20.69	14,500	P
Cartago	TIR	34.14	8,790	P
Puntarenas	TI8WS	39.74	7,550	B
San Jose	TIEP	22.36	13,420	B
San Jose	TIEP	44.71	6,710	B
San Jose	TIFA	47.17	6,360	B
San Jose	TIGPH	51.52	5,823	B
San Jose	TIPG	46.80	6,410	B
San Jose	TIRCC	45.80	6,550	B

Location	Call	Meters	Kc.	Class
San Jose	TITE	45.11	6,650	B
San Jose	TITR	25.45	11,790	B
San Ramon	TI5HH	54.30	5,525	B

GUATEMALA

Location	Call	Meters	Kc.	Class
Guatemala City	TGF	20.69	14,500	P
Guatemala City	TGS	52.26	5,740	B
Guatemala City	TGWA	50.00	6,000	B
Guatemala City	TGX	50.12	5,984	B
Guatemala City	TGXA	48.94	6,130	B
Guatemala City	TG1X	31.75	9,450	E
Guatemala City	TG2X	50.50	5,940	B

HONDURAS

Location	Call	Meters	Kc.	Class
La Ceiba	HRV	48.12	6,235	B
San Pedro Sula	HRP1	47.19	6,357	B
Tegucigalpa	HRN	51.06	5,875	B
Tegucigalpa	HRW	27.17	11,040	E
Tela	HRY	47.24	6,350	E

NICARAGUA

Location	Call	Meters	Kc.	Class
Managua	YNA	20.72	14,480	P
Managua	YNGU	32.27	9,300	B
Managua	YNLF	50.42	5,950	B
Managua	YNVA	34.92	8,590	B
Managua	YN1GG	46.51	6,450	B
Puerto Cabezas	YNE	23.66	12,680	E

PANAMA

Location	Call	Meters	Kc.	Class
Colon	HP5F	49.34	6,080	B
Colon	HP5H	49.42	6,070	B
Colon	HP5K	49.96	6,005	B
Panama City	HPC	29.15	10,290	P
Panama City	HPF	20.69	14,500	P
Panama City	HP5B	49.75	6,030	B
Panama City	HP5J	31.28	9,590	B
Panama City	RXC	38.10	7,870	P

SOUTH AMERICA

ARGENTINA

Location	Call	Meters	Kc.	Class
Buenos Aires	LRU	19.62	15,290	B
Buenos Aires	LRX	31.31	9,580	B
Buenos Aires	LU5CZ	42.37	7,080A,	B
Hurlingham	LQA	31.25	9,600	P
Hurlingham	LSL	30.09	9,964	P
Hurlingham	LSL2	29.13	10,300	P
Hurlingham	LSM	14.20	21,130P,	B
Hurlingham	LSN	14.27	21,020P,	B
Hurlingham	LSN	14.51	20,680	P
Hurlingham	LSN	20.65	14,530	P
Hurlingham	LSN	20.72	14,480	P
Hurlingham	LSN2	30.32	9,890	P
Monte Grande	LQK	7.25	41,400	E
Monte Grande	LQL	7.31	41,040	E
Monte Grande	LSF	15.31	19,600	P
Monte Grande	LSG	15.08	19,900	P
Monte Grande	LSH	55.19	5,435	P
Monte Grande	LSI	30.50	9,830	P
Monte Grande	LSX	14.51	20,680	P
Monte Grande	LSX	28.98	10,350	P
Monte Grande	LSY	14.47	20,730	P
Monte Grande	LSY	28.82	10,410	P
Monte Grande	LSY3	16.56	18,115	P

BOLIVIA

Location	Call	Meters	Kc.	Class
La Paz	CP5	49.34	6,080	B
La Paz	CP6	32.89	9,120	B
La Paz	CP7	19.60	15,300	P

BRAZIL

Location	Call	Meters	Kc.	Class
Maripicu	PSA	14.24	21,070	P
Maripicu	PSA	18.55	16,162	B
Maripicu	PSD	19.91	15,070	P
Maripicu	PSH	29.34	10,220	P
Pernambuco	PRA8	49.77	6,028	B
Rio de Janeiro	PRF5	31.58	9,501	B
Rio de Janeiro	PSK	36.65	8,185	P
Sepetiba	PPQ	25.71	11,670	E
Sepetiba	PPU	15.58	19,260	P

CHILE

Location	Call	Meters	Kc.	Class
La Granja	CEC	15.24	19,680	P
La Granja	CEC	18.92	15,855	P
La Granja	CEC	28.12	10,670P,	B
La Granja	CEC	31.43	9,545	B
Santiago	CB615	48.78	6,150	B
Santiago	CB954	31.47	9,540	B
Santiago	CB960	31.25	9,600	B

COLOMBIA

Location	Call	Meters	Kc.	Class
Barranquilla	HJA3	20.08	14,940	P
Barranquilla	HJA3	34.14	8,790	P
Barranquilla	HJA3	39.88	7,522	P
Barranquilla	HJA3	40.16	7,470	P
Barranquilla	HJA3	46.76	6,416	P
Barranquilla	HJA3	61.66	4,865	P
Barranquilla	HJA3	70.59	4,250	P
Barranquilla	HJA3	88.83	3,376	P
Barranquilla	HJ1ABB	46.51	6,450	B
Barranquilla	HJ1ABF	49.43	6,070	B
Barranquilla	HJ1ABG	49.65	6,042	B
Barranquilla	HJ1ABK	42.46	7,074	B
Bogota	HJB	20.09	14,930	P
Bogota	HJA2	51.50	5,825	P
Bogota	HJC	40.27	7,450	P
Bogota	HJN	50.42	5,950	B
Bogota	HJP	40.19	7,465	P
Bogota	HJQ	40.54	7,400	P
Bogota	HJY	16.27	18,440	P
Bogota	HJY	30.21	9,930	P
Bogota	HJ3ABD	49.57	6,050	B
Bogota	HJ3ABF	48.54	6,180	B
Bogota	HJ3ABH	49.90	6,012	B
Bogota	HJ3ABI	49.62	6,045	B
Bogota	HJ3ABX	48.78	6,150	B
Bogota	HKE	42.08	7,130	B
Bogota	HKV	34.80	8,620	B
Bucaramanga	HJ2ABD	50.10	5,988	B
Buenaventura	HJU	31.58	9,500	B
Cali	HJ5ABC	48.78	6,150	B
Cali	HJ5ABD	46.23	6,490	B
Cali	HJ5ABE	21.25	14,120	B
Cartagena	HJ1ABD	41.21	7,281	B
Cartagena	HJ1ABE	31.38	9,560	B
Cartagena	HJ1ABP	31.25	9,600	B
Cienaga	HJ1ABH	48.19	6,225	B
Cucuta	HJA7	55.56	5,400	P
Cucuta	HJ2ABC	50.21	5,975	B
Ibague	HJ4ABC	46.50	6,451	B
Manizales	HJ4ABB	49.10	6,110	B
Manizales	HJ4ABL	49.46	6,065	B
Medellin	HJ4ABA	25.63	11,710	B
Medellin	HJ4ABD	52.08	5,760	B
Medellin	HJ4ABE	50.59	5,930	B
Medellin	HJ4ABG	42.25	7,100	B
Pereira	HJ4ABC	49.34	6,080	B
Quibdo	HJ1ABC	50.28	5,966	B
Santa Marta	HJ1ABJ	49.95	6,006	B
Sincelejo	HJ1ABE	42.25	7,100	B
Tunja	HJ2ABA	48.23	6,220	B

GUIANA, BRITISH

Location	Call	Meters	Kc.	Class
Georgetown	VP3MR	42.37	7,080A,	B
Georgetown	VP3BG	41.55	7,220	B

GUIANA, DUTCH

Location	Call	Meters	Kc.	Class
Paramaribo	PZH	42.02	7,140	B

ECUADOR

Location	Call	Meters	Kc.	Class
Guayaquil	HC2CW	35.73	8,404	B
Guayaquil	HC2ET	65.21	4,600	B
Guayaquil	HC2JSB	38.20	7,854	B
Guayaquil	HC2RL	45.00	6,667	B
Quito	HCETC	44.12	6,800	B
Quito	HCJB	34.18	8,775	B
Quito	HCK	50.98	5,885	B
Riobamba	PRADO	19.43	15,440P,	B
Riobamba	PRADO	45.34	6,618	B

PARAGUAY

Location	Call	Meters	Kc.	Class
Asuncion	ZP10	36.50	8,220	B
Asuncion	ZP11	78.95	3,800	B

PERU

Location	Call	Meters	Kc.	Class
Lima	OAX4D	51.90	5,780	B
Lima	OAX4G	48.15	6,230	B
Lima	OA4R	42.02	7,140	B
Lima	OCI	16.08	18,670	P
Lima	OCI	48.00	6,250	P

URUGUAY

Location	Call	Meters	Kc.	Class
Cerrito	CWH	22.83	13,140	P
Montevideo	CWD	51.46	5,830	P

VENEZUELA

Location	Call	Meters	Kc.	Class
Barquisimeto	YV8RB	50.85	5,900	B
Caracas	YV2RC	25.65	11,695	B
Caracas	YV2RC	51.72	5,800	B
Caracas	YV3RC	31.55	9,510	B
Caracas	YV3RC	48.78	6,150	B
Caracas	YV4BSG	50.00	6,000	B
Caracas	YV4RB	44.94	6,675	B
Caracas	YV4RC	47.06	6,375	B
El Valle	YV9RC	46.87	6,400	B
Maracaibo	YV5RMO	51.28	5,850	B
Maracaibo	YV7RMO	51.63	5,810	B
Maracaibo	YV11RMO	48.96	6,128	B
Maracay	YVR	16.40	18,296	E
Maracay	YVR	32.76	9,168	P
Maracay	YVQ	22.47	13,350	P
Maracay	YVQ	44.96	6,672	P
Maracay	YV12RM	47.62	6,300	B
San Cristobal	YV10RSC	52.45	5,720	B
Valencia	YV6RV	46.01	6,520	B
Valencia	YV13RV	47.39	6,330	B

WEST INDIES

BAHAMAS

Location	Call	Meters	Kc.	Class
Cat Cay	ZFO	56.60	5,300	P
Nassau	ZFS	66.40	4,512	P

BERMUDA

Location	Call	Meters	Kc.	Class
St. George	ZFA	59.70	5,025	P
St. George	ZFB	29.84	10,055	P
St. George	ZFD	29.03	10,335	P
S.S. Monarch of Bermuda	VQJM	33.96	8,830	P
S.S. Monarch of Bermuda	VQJM	67.72	4,430	P
S.S. Queen of Bermuda	VQJP	33.96	8,830	P
S.S. Queen of Bermuda	VQJP	67.72	4,430	P

CUBA

Location	Call	Meters	Kc.	Class
Camaguey	CO9JQ	34.62	8,665	B
Havana	COCD.	48.94	6,130	B
Havana	CMB2	51.90	5,780	E
Havana	COCH	31.82	9,428	B
Havana	CMA3	19.35	15,505	E
Havana	COCO	49.92	6,010	B
Sancti Spiritus	CO9WR	25.42	11,800	B
Sancti Spiritus	CO9WR	47.85	6,635	B
Santiago	COKG	48.78	6,150	B

DOMINICAN REPUBLIC

Location	Call	Meters	Kc.	Class
La Romana	HI3C	43.48	6,900	B
Puerto Plato	HI1S	46.66	6,430	B
San Pedro de Macoris	HIH	44.05	6,810	B
San Pedro de Macoris	HI1J	51.15	5,865	B
Santiago de los Caballeros	HI1A	48.50	6,185	B
Santiago de los Caballeros	HI3U	47.00	6,383	B
Santiago de los Caballeros	HI5M	48.78	6,150	B
Santiago de los Caballeros	HI9B	49.57	6,050	B
Trujillo	HIG	47.77	6,280	B
Trujillo	HIL	46.08	6,510	B
Trujillo	HIT	45.25	6,630	B
Trujillo	HIX	50.17	5,980	B
Trujillo	HIZ	47.54	6,310	B
Trujillo	HI4D	45.80	6,550	B
Trujillo	HI4V	46.51	6,450	B
Trujillo	HI5N	48.78	6,150	B
Trujillo	HI6Z	48.94	6,130	B
Trujillo	HI7P	44.12	6,800	B

HAITI

Location	Call	Meters	Kc.	Class
Port-au-Prince	HH2R	31.43	9,545	E
Port-au-Prince	HH2S	50.72	5,915	B
Port-au-Prince	HH2T	25.45	11,790	E
Port-au-Prince	HH3W	31.27	9,595	B

JAMAICA

Location	Call	Meters	Kc.	Class
Stony Hill	VRR4	25.88	11,595	..

VIRGIN ISLANDS

Location	Call	Meters	Kc.	Class
St. Croix	WTDW	69.85	4,295	E
St. John	WTDX	69.85	4,295	E
St. Thomas	WTDV	69.85	4,295	E

EUROPE

AUSTRIA

Location	Call	Meters	Kc.	Class
Vienna	OEJ	39.28	7,632	P
Vienna	OER2	49.41	6,072	B
Vienna	OER3	25.42	11,801	B
Vienna	OEV	16.79	17,870	P

AZORES

Location	Call	Meters	Kc.	Class
San Miguel	CT2AJ	74.77	4,002A,	B

BELGIUM

Location	Call	Meters	Kc.	Class
Ruysselede	ORG	15.62	19,200	P
Ruysselede	ORK	29.03	10,330	B
Ruysselede	ORP	22.72	13,200	P

DENMARK

Location	Call	Meters	Kc.	Class
Skamlebaek	OXY	19.61	15,300	E
Skamlebaek	OXY	31.51	9,520	B
Skamlebaek	OXY	49.50	6,060	B

FRANCE

Location	Call	Meters	Kc.	Class
Calenzana	TYZ	9.30	36,144	E
La Turbie	TY4	7.60	39,473	E
Paris	FYB	28.36	10,578	T
Pontoise	TYA	24.56	12,215	P
Pontoise	TYA2	33.19	9,037	P
Pontoise	TYB	24.49	12,250	P
Pontoise	TYB2	37.14	8,075	P
Pontoise	TPA2	19.68	15,243	B
Pontoise	TPA3	25.26	11,880	B
Pontoise	TPA4	25.60	11,720	B
Ste. Assise	FQO, FQE	24.69	12,150	P
Ste. Assise	FRO-FRE	16.44	18,240	P
Ste. Assise	FTA	25.11	11,950	P
Ste. Assise	FTD	15.12	19,840	P
Ste. Assise	FTI	30.49	9,840	P
Ste. Assise	FTK	18.89	15,880	P
Ste. Assise	FTM	15.50	19,355	P
Ste. Assise	FTN	24.47	12,260	P
S.S. Ile de France	FNTQ	33.96	8,830	P
S.S. Ile de France	FNTQ	67.98	4,413	P
S.S. Normandie	FNSK	22.71	13,210	P
S.S. Normandie	FNSK	33.96	8,830	P
S.S. Normandie	FNSK	67.98	4,413	P
S.S. Normandie	FNSK	68.34	4,390	P
S.S. Paris	FNSM	33.96	8,830	P
S.S. Paris	FNSM	67.98	4,413	P

GERMANY

Location	Call	Meters	Kc.	Class
Doeberitz	DOA	67.72	4,430	P
Nauen	DFB	17.12	17,520	P
Nauen	DFL	27.63	10,850	P
Nauen	DGK	44.91	6,680	P
Nauen	DGU	31.18	9,620	P
Nauen	DHO	14.99	20,020	P
Nauen	DIH	15.04	19,950	P
Nauen	DIP	20.83	14,410	E
Nauen	DWG	14.90	20,140	P
Nauen	DZA (DJI)	31.01	9,675	P
Nauen	DZB (DJJ)	29.88	10,042	E
Nauen	DZC	29.15	10,290	E
Nauen	DZE	24.73	12,130	P
Nauen	DZH	20.75	14,460	E
Nauen	DZS	24.73	12,130	P
Norddeich	DAF	17.38	17,260	P
Norddeich	DAF	23.54	12,745	P
Norddeich	DAF	35.42	8,470	P
Norddeich	DAF	69.44	4,320	P
Norddeich	DAN	18.00	16,665	E
Norddeich	DAN	26.46	11,340	T
Zeesen	DJA	31.38	9,560	B
Zeesen	DJB	19.74	15,200	B
Zeesen	DJC	49.83	6,020	B
Zeesen	DJD	25.49	11,770	B
Zeesen	DJE	16.89	17,760	B
Zeesen	DJG	65.50	4,580	E
Zeesen	DJK	24.93	12,035	E
Zeesen	DJL	19.85	15,110	B

Location	Call	Meters	Kc.	Class
Zeesen	DJM	49.35	6,079	E
Zeesen	DJN	31.47	9,540	B
Zeesen	DJO	25.43	11,795	E
Zeesen	DJP	25.31	11,855	B
Zeesen	DJQ	19.63	15,280	B
Zeesen	DJR	19.56	15,340	B
Zeesen	DJT	19.53	15,360	E
S.S. Berlin	DDBR	23.00	13,040	P
S.S. Berlin	DDBR	29.50	10,163	P
S.S. Berlin	DDBR	33.96	8,830	P
S.S. Berlin	DDBR	36.00	8,328	P
S.S. Berlin	DDBR	67.98	4,413	P
S.S. Bremen	DOAH	23.00	13,040	P
S.S. Bremen	DOAH	29.50	10,163	P
S.S. Bremen	DOAH	33.96	8,830	P
S.S. Bremen	DOAH	36.00	8,328	P
S.S. Bremen	DOAH	67.98	4,413	P
S.S. Cap Arcona	DHDL	23.00	13,040	P
S.S. Cap Arcona	DHDL	29.50	10,163	P
S.S. Cap Arcona	DHDL	33.96	8,830	P
S.S. Cap Arcona	DHDL	36.00	8,328	P
S.S. Cap Arcona	DHDL	67.98	4,413	P
S.S. Cap Polonio	DDCP	23.00	13,040	P
S.S. Cap Polonio	DDCP	29.50	10,163	P
S.S. Cap Polonio	DDCP	33.96	8,830	P
S.S. Cap Polonio	DDCP	36.00	8,328	P
S.S. Cap Polonio	DDCP	67.98	4,413	P
S.S. Deutschland	DHEY	18.23	16,460	P
S.S. Deutschland	DHEY	23.00	13,040	P
S.S. Deutschland	DHEY	29.50	10,163	P
S.S. Deutschland	DHEY	33.96	8,830	P
S.S. Deutschland	DHEY	36.00	8,328	P
S.S. Deutschland	DHEY	67.98	4,413	P
S.S. Europa	DOAI	18.07	16,600	P
S.S. Europa	DOAI	23.00	13,040	P
S.S. Europa	DOAI	29.50	10,163	P
S.S. Europa	DOAI	33.96	8,830	P
S.S. Europa	DOAI	36.00	8,328	P
S.S. Europa	DOAI	67.98	4,413	P
S.S. Hamburg	DHJZ	23.00	13,040	P
S.S. Hamburg	DHJZ	29.50	10,163	P
S.S. Hamburg	DHJZ	33.96	8,830	P
S.S. Hamburg	DHJZ	36.00	8,328	P
S.S. Hamburg	DHJZ	67.98	4,413	P
S.S. Hansa	DHAO	33.96	8,830	P
S.S. Hansa	DHAO	36.00	8,328	P
S.S. Hansa	DHAO	67.98	4,413	P
S.S. New York	DHRL	23.00	13,040	P
S.S. New York	DHRL	29.50	10,163	P
S.S. New York	DHRL	33.96	8,830	P
S.S. New York	DHRL	36.00	8,328	P
S.S. New York	DHRL	67.98	4,413	P
S.S. Oceana	DDFT	23.00	13,040	P
S.S. Oceana	DDFT	29.50	10,163	P
S.S. Oceana	DDFT	33.96	8,830	P
S.S. Oceana	DDFT	36.00	8,328	P
S.S. Oceana	DDFT	67.98	4,413	P
S.S. Reliance	DDFF	23.00	13,040	P
S.S. Reliance	DDFF	29.50	10,163	P
S.S. Reliance	DDFF	33.96	8,830	P
S.S. Reliance	DDFF	36.00	8,328	P
S.S. Reliance	DDFF	67.98	4,413	P

HUNGARY

Szekesfehervar	HAS3	19.52	15,370	B
Szekesfehervar	HAS5	17.51	17,130	B
Szekesfehervar	HAT	21.92	13,685	B
Szekesfehervar	HAT	55.56	5,400	B
Szekesfehervar	HAT2	41.55	7,220	B
Szekesfehervar	HAT3	35.03	8,565	B
Szekesfehervar	HAT4	32.87	9,125	B

ICELAND

Reykjavik	TFJ	24.52	12,235	B
Reykjavik	TFK	33.15	9,050	B
Reykjavik	TFL	58.94	5,090	B

ITALY

Coltano	IAC	16.90	17,750	P
Coltano	IAC	23.44	12,795	P
Coltano	IAC	35.80	8,380	P
Coltano	IAC	45.11	6,650	P
Coltano	IAC	68.89	4,355	P
Fiumicino	IAF	10.06	29,820	E
Fiumicino	IAF	55.40	5,415	P
Golfo Aranci, Sardinia	IAG	9.80	30,610	E
Rome	IRJ	22.89	13,105	P
Rome	IRM	30.52	9,830	P
Rome	IRS	30.12	9,960	P
Rome	IRW	15.37	19,520	P
Rome	IRY	18.61	16,120	P
Rome	I2RO	54.05	5,550	B
Rome	I2RO1	49.30	6,085	B
Rome	I2RO2	42.98	6,980	B
Rome	I2RO3	31.14	9,635	B
Rome	I2RO4	25.40	11,810	B
S.S. Conte Rosso	IBEJ	22.99	13,050	P
S.S. Conte Rosso	IBEJ	70.00	4,283	P
S.S. Conte di Savoia	IBLI	22.99	13,050	P
S.S. Conte di Savoia	IBLI	70.00	4,283	P
S.S. Conte Verde	IBGI	22.99	13,050	P
S.S. Conte Verde	IBGI	70.00	4,283	P
S.S. Elettra	IBDK	26.15	11,470	E
S.S. Rex	ICEJ	22.99	13,050	P
S.S. Rex	ICEJ	70.00	4,283	P

MADEIRA

Funchal	CT3AQ	26.83	11,180	B

NETHERLANDS

Dordrecht	PI1J	42.36	7,082	A, B
Huizen	PCJ	19.71	15,220	E
Huizen	PCJ	31.28	9,590	E, B
Huizen	PHI	16.88	17,775	B
Huizen	PHI	25.57	11,730	B
Kootwijk	PCK	16.30	18,400	P
Kootwijk	PCL	18.40	16,305	P
Kootwijk	PCM	16.18	18,545	P
Kootwijk	PCV	16.85	17,800	P
Kootwijk	PDK	28.82	10,410	P
Kootwijk	PDM	16.13	18,600	P
Kootwijk	PDV	24.88	12,060	P
Kootwijk	PGA	38.31	7,830	P

NORWAY

Jeloy	LKJ1	31.48	9,530	E
Jeloy	LKJ1	42.92	6,990	B
Jeloy	LKJ1	48.94	6,130	B
Jeloy	LKJ1	60.97	4,920	E
Jeloy	LKJ1	73.17	4,100	E

POLAND

Warsaw	SPW	22.00	13,635	B

PORTUGAL

Lisbon	CSL	48.78	6,150	B
Lisbon	CT1AA	19.56	15,340	B
Lisbon	CT1AA	31.09	9,650	B
Lisbon	CT1AA	50.17	5,980	B
Lisbon	CT1CT	24.93	12,082	B
Lisbon	CT1CT	31.00	9,677	B
Parede	CT1GO	24.20	12,396	B
Parede	CT1GO	48.40	6,198	B

RUMANIA

Bucharest	YOI	21.54	13,950	B
Bucharest	YOI	50.00	6,000	B

SPAIN

Madrid	EAQ	15.21	19,720	P
Madrid	EAQ	30.43	9,860	B
Madrid	EAR125	42.74	7,020	B
Madrid	EHY	14.37	20,860	P
Madrid	EHY	29.79	10,070	E

SWEDEN

Stockholm	SM5SD	41.20	7,281	B

SWITZERLAND

Basle	HB9B	42.15	7,118	B
Basle	HB9B	79.56	3,770	B
Lausanne	HB9AQ	85.11	3,525	B
Prangins	HBF	15.83	18,950	P
Prangins	HBH	16.23	18,480	P
Prangins	HBJ	20.64	14,535	P
Prangins	HBL	31.27	9,595	B
Prangins	HBO	24.94	12,030	P
Prangins	HBP	38.48	7,797	B
Prangins	HBQ	40.30	7,444	B

UNITED KINGDOM

Bodmin	GBJ	16.11	18,620	P
Bodmin	GBK	26.11	11,490	P
Bodmin	GBK	32.43	9,250	P
Daventry	GSA	49.57	6,050	B
Daventry	GSB	31.55	9,510	B
Daventry	GSC	31.31	9,580	B
Daventry	GSD	25.53	11,750	B
Daventry	GSE	25.30	11,860	B
Daventry	GSF	19.81	15,140	B
Daventry	GSG	16.85	17,790	B
Daventry	GSH	13.97	21,470	B
Daventry	GSI	19.66	15,260	B
Daventry	GSJ	13.93	21,530	B
Daventry	GSK	11.49	26,100	B
Daventry	GSL	49.10	6,110	B
Daventry	GSN	25.38	11,820	B
Daventry	GSO	19.76	15,180	B
Daventry	GSP	19.60	15,310	B
Rugby	GAS	16.39	18,304	P
Rugby	GAU	16.11	18,620	P
Rugby	GAW	16.48	18,200	P
Rugby	GBA	14.72	20,380	P
Rugby	GBB	22.08	13,585	P
Rugby	GBC	17.56	17,080	P
Rugby	GBC	22.07	13,591	P
Rugby	GBC	23.47	12,780	P
Rugby	GBC	34.56	8,680	P
Rugby	GBC	60.30	4,975	P
Rugby	GBC	67.72	4,430	P
Rugby	GBP	27.88	10,770	P
Rugby	GBS	24.49	12,250	P
Rugby	GBS	24.69	12,150	P
Rugby	GBU	13.45	22,300	P
Rugby	GBU	24.41	12,290	P
Rugby	GBW	20.78	14,440	P
Rugby	GBX	18.56	16,150	P
Rugby	GBX	28.87	10,390	P
Rugby	GCA	30.90	9,710	P
Rugby	GCB	32.33	9,280	P
Rugby	GCS	33.26	9,020	P
Rugby	GCU	30.15	9,950	P
Rugby	GCW	30.61	9,800	P
Rugby	GDS	43.45	6,905	P
Rugby	GDW	62.24	4,820	P
S.S. Aquitania	GLRZ	22.68	13,220	P
S.S. Aquitania	GLRZ	33.96	8,830	P
S.S. Aquitania	GLRZ	67.98	4,413	P
S.S. Berengaria	GBZW	22.68	13,220	P
S.S. Berengaria	GBZW	33.96	8,830	P
S.S. Berengaria	GBZW	67.98	4,413	P
S.S. Empress of Britain	GMBJ	17.00	17,640	P
S.S. Empress of Britain	GMBJ	33.96	8,830	P
S.S. Empress of Britain	GMBJ	67.98	4,413	P
S.S. Homeric	GDLJ	17.00	17,640	P
S.S. Homeric	GDLJ	22.68	13,220	P
S.S. Homeric	GDLJ	33.96	8,830	P
S.S. Homeric	GDLJ	67.72	4,430	P
S.S. Majestic	GFWV	17.00	17,640	P
S.S. Majestic	GFWV	22.68	13,220	P
S.S. Majestic	GFWV	33.96	8,830	P
S.S. Majestic	GFWV	67.98	4,413	P
S.S. Olympic	GLSQ	17.00	17,640	P
S.S. Olympic	GLSQ	22.68	13,220	P

U. S. S. R.

Baku	RIO	29.48	10,170	P
Moscow	RKF	61.54	4,875	P
Moscow	RKI	19.95	15,040	P
Moscow	RKI	40.00	7,500	P
Moscow	RKK	24.45	12,270	P
Moscow	RRZ	68.18	4,400	P
Moscow	RV59	50.00	6,000	B
Moscow	RV59 (RNE)	25.00	12,000	B, P
Moscow	RV72 (REN)	45.38	6,611	B, P
Stalinsk	RSB	55.81	5,375	P
Tashkent	RAU	19.86	15,104	P
Tashkent	RIM	19.67	15,250	P
Tashkent	RIM	39.34	7,626	P
Tashkent	RPT	50.04	5,995	P
Tiflis	RIR	29.76	10,080	P
Tiflis	RIR	59.52	5,040	P

VATICAN STATE

Vatican City	HVJ	19.84	15,123	B
Vatican City	HVJ	50.26	5,969	B

OCEANIA

AUSTRALIA

Caulfield	VK3ZX	41.10	7,300	B
Fiskville	VIZ3	26.10	11,495	P
Lyndhurst, Victoria	VK3LR	13.93	21,540	B
Lyndhurst, Victoria	VK3LR	31.31	9,580	B
Melbourne	VIY-VK3ME	24.96	12,020	E
Melbourne	VK3ME	31.61	9,490	B
Sydney	VK2ME	31.28	9,590	B
Sydney	VLJ	30.74	9,760	P
Sydney	VLJ	37.59	7,980	P
Sydney	VLK	18.37	16,330	P
Sydney	VLK	28.50	10,525	P
Sydney	VLZ	37.69	7,960	P

FIJI ISLANDS

Suva	VPD	22.93	13,075	B
Suva	VPD	38.00	7,890	P

HAWAIIAN ISLANDS

Kahuku	KEQ	40.71	7,370	P
Kahuku	KIO	25.68	11,680	P
Kahuku	KKH	39.89	7,520	P
Kahuku	KKP	18.71	16,030	P
Kahuku	KQH	18.77	15,985	P
Kahuku	KRO	51.32	5,845	P
Kalepa	KGXO	6.49	46,200	P
Manawahua	KGXA	7.58	39,600	P
Manawahua	KGXB	6.34	47,300	P
Manawahua	KGXC	8.02	37,400	P
Ulupalakua	KGXH	6.20	48,400	P
Ulupalakua	KGXJ	7.37	40,700	P
Waikiki	KGXK	6.06	49,500	P

NEW ZEALAND

Wellington	ZLT	24.40	12,295	P
Wellington	ZLT	27.30	10,990	P
Wellington	ZLT	33.71	8,900	P
Wellington	ZLT2	40.60	7,390	P
Wellington	ZLW	16.36	18,340	P
Wellington	ZLW	24.38	12,300	P

PHILIPPINE ISLANDS

Cebu, Isl of Cebu	KZGG	51.50	5,825	P
Iloilo, Iloilo Island	KZGH	51.77	5,795	P
Manila	KAX	15.02	19,980	P
Manila	KAY	20.03	14,980	P
Manila	KAZ	30.01	9,990	P
Manila	KAZ	36.95	8,120	P
Manila	KBB	34.44	8,710	P
Manila	KBI	14.19	21,140	P
Manila	KBJ	22.66	13,240	P
Manila	KBK	44.66	6,718	P
Manila	KTO	18.47	16,240	P
Manila	KTP	36.95	8,120	P
Manila	KTR	27.50	10,910	P
Manila	KUS	16.46	18,220	P
Manila	KZGF	51.72	5,800	P, B
Manila	KZRM	25.34	11,840	B
Manila	KZRM	48.86	6,140	B
Manila	NPO	33.82	8,870	T

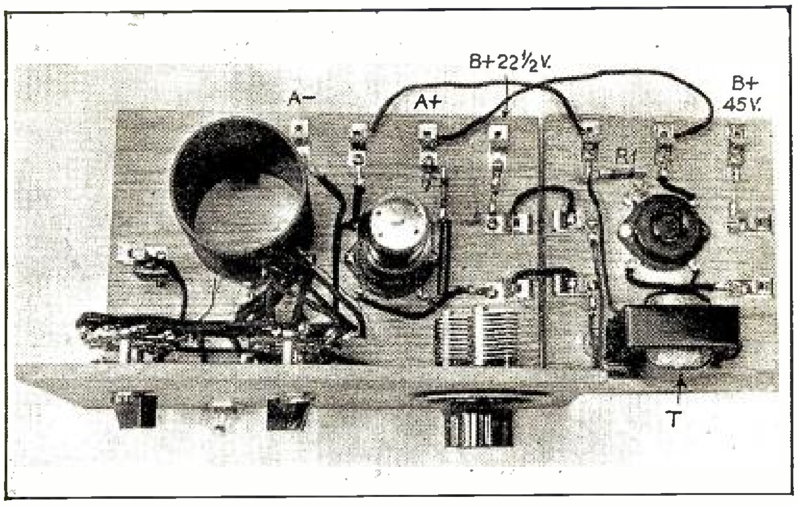
TAHITI

Papeete	....	42.13	7,120	B

(*Continued next month*)

Line Voltage Dropping Resistor

The Clarostat series "MT" line voltage-dropping resistor is housed in a standard metal tube style casing with an 8-prong octal base. The manufacturer points out that it meets the underwriters' requirements regarding "hot" terminals and high leakage resistance to ground since the "live" parts are thoroughly insulated and metal covered. It is available in several types, to provide the proper voltage drop for practically any pilot lamp and tube combination.



INSTALLING THE AMPLIFIER STAGE

Here the amplifier is shown with the 1-tube receiver described last month. The combination provides comfortably audible speaker operation on powerful local stations

Practical Construction The *Radio*

This series of articles is presented
desire to obtain a thorough working
those who have some theoretical
the practical experience which is so

Part 3—One-Stage

By John M.

FIG. 1

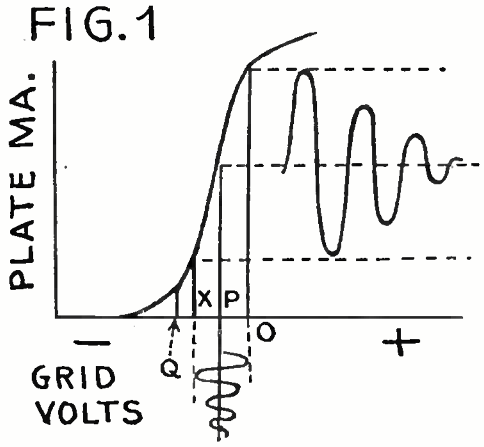
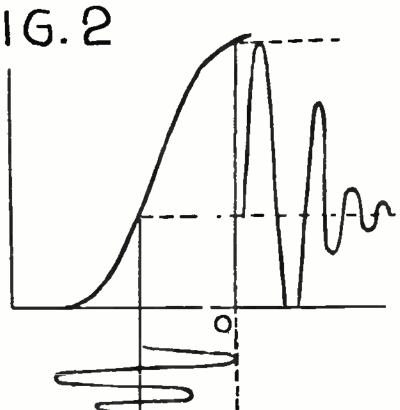


FIG. 2



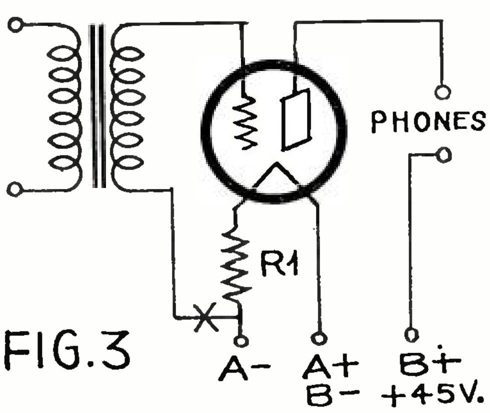


FIG. 3

BESIDES performing all the functions described in the first two articles of this series, the modern radio receiver *amplifies* the signal (multiplies its strength or intensity) many thousands of times. This article will be devoted to the addition of an amplifier tube to last month's one-tube battery set to make the received signals louder. At the same time this unit is so constructed as to adapt it for use with other crystal sets or battery sets.

Amplification can be accomplished either before or after the detector or both before and after. An amplifier ahead of the detector must operate at the original frequency of the incoming signal; it is called a radio-frequency amplifier. An amplifier stage after the detector is called an audio-frequency amplifier. The difference in results obtained is that an audio-frequency amplifier is intended primarily to make received stations come in louder. If the signal from a distant station is too weak to be detected, no amount of audio-frequency amplification can bring it in. Radio-frequency amplification increases sensitivity and will add new stations. It also provides the opportunity for additional tuned circuits and therefore sharper tuning.

Tubes Are Versatile

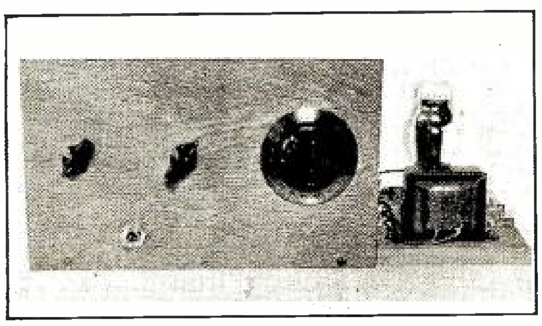
Why is it that the same tube can work as a detector or as an amplifier? This brings us back to the theory of tubes.

An amplifying stage consists of a tube and some means of coupling it to the previous tube. First let us confine our attention to the tube itself. Last month we showed a so-called "static characteristic", which illustrates the variation in plate current due to changes in grid voltage while the plate voltage remains fixed. Actually the plate voltage does not remain fixed during operation because the phone or transformer in the plate circuit has resistance and inductance which cause a voltage drop across it when the tube plate current flows. This voltage drop will change when the plate current changes, which results in a change of plate voltage. Curves which take these things into consideration are called "dynamic characteristics". These enable the radio man to determine the best plate and grid voltages, etc., and to find the other necessary constants of the circuit. However, these curves do not lend themselves to an easy explanation of the tube's functions. Therefore, we are sticking to the static characteristic which better illustrates what happens.

Used as Amplifier

Figure 1 illustrates the characteristics of a tube and shows the way it amplifies. The grid is given a fixed negative voltage so as to bring the operating point to the center of the straight portion of the curve. The detector utilizes the bend of the curve, as explained last month, but the amplifier must work on the straight part. The way to make the tube do the required work is to give it the correct fixed negative voltage or "bias" also called "C-bias" because it would require a third or C-battery. So in the case of Figure 1 if the fixed bias is equal to OP, the tube is an amplifier, if it is equal to OQ it is a detector.

When working a tube as an amplifier, there are two things to look out for. The first one is to keep the variation of grid-voltage due to the signal within the limits of the straight part of the



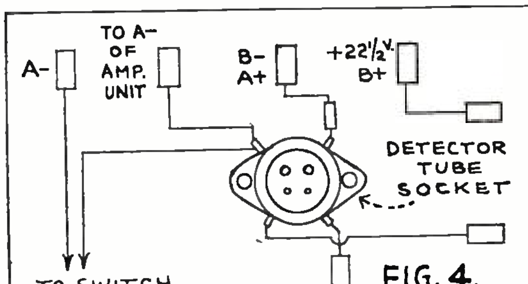


FIG. 4.

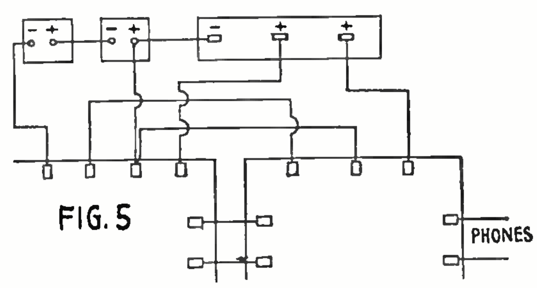


FIG. 5

and Instruction for
Beginner

for the benefit of beginners who knowledge of radio, and also for knowledge of the subject but lack essential to thorough understanding

Audio Amplifier

Borst

THE MOMENT OF SUSPENSE

The constructor's big moment of suspense comes when he is connecting up the device just before putting it into operation. If it works immediately—boy! That is the thrill of a lifetime

"curve", and never to let it run over a bent part. As long as the straight portion of the characteristic is utilized, the plate current will vary in exact proportion to the grid-voltage. As soon as the grid-voltage becomes too large so that the tube works on a bend during a part of the cycle, the plate-current variations no longer correspond to the grid-voltage variations, in other words there is distortion. This is illustrated in Figure 2. It is seen that the tops have been cut off the highest peaks. For this reason, it is essential that the applied signal voltage should never exceed OP or PX. In a good arrangement OP should equal PX.

Grid Always Negative

The second limitation is that the grid should never be allowed to go positive. As soon as this happens grid current will flow and the grid current will cause a voltage drop in the grid circuit which usually has a high resistance. This voltage drop subtracts from the signal voltage and therefore is another cause for distortion. In practice then, it is only possible to use that part of the straight portion of the characteristic which is situated to the left of the zero line.

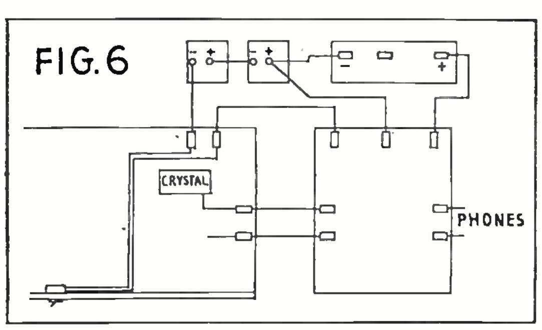
The fixed grid voltage or bias should then be chosen at the center of this straight portion.

The manufacturers have listed the proper grid bias for different plate voltages, so it is not necessary to make a curve (they are made by measurements). But this explanation should clarify the meaning of these figures. It should also be clear now that if the recommended grid bias is 2 volts, the peak of the signal voltage on the grid should never exceed 2 volts. This is equal to 1.4 volts as shown by an a.c. voltmeter as only the peaks resets 2 volts, whereas the voltmeter shows an average rather than peaks. If the signal is likely to exceed this value, one must look for another tube which has a larger fixed bias. Sometimes the same tube with a higher plate voltage will need the larger bias and would then be suitable.

The coupling device usually consists of a transformer or a network of resistors and condensers. It is important to prevent the plate voltage of the previous tube from reaching the grid of the next one. A transformer does this, generates a signal voltage in the secondary and gives some amount of step-up. The voltage in the secondary would be three times the voltage in the primary if a 3-1 ratio transformer were used, for instance. Of course this adds to the amplification.

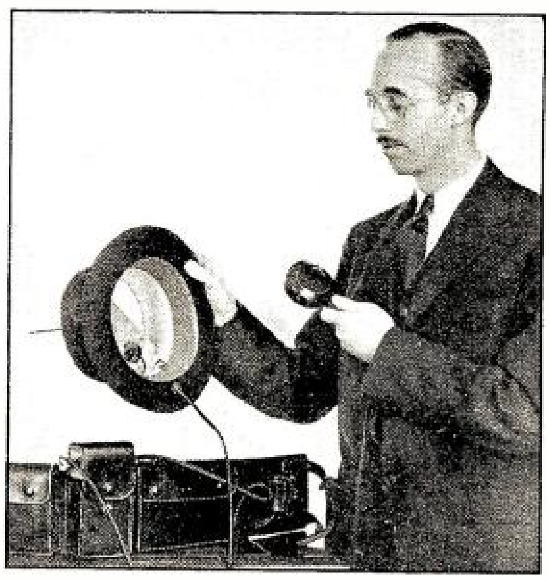
In our particular case a 30 tube is employed with a plate voltage of 45 volts. Since the plate voltage is so low and our signal is rather weak, we need a grid bias of about one volt. This can be obtained without the use of an extra battery. The filament requires but two volts while the battery supplies 3 volts, the extra volt is lost in the resistor R1. If we place this resistor in the negative leg of the filament circuit, the negative side of the battery will be 1 volt negative with respect to the negative side of the filament. All we have to do is to connect the lead marked "F" of the transformer to the negative A terminal and 1 volt (*Turn to page* 57)

FIG. 6



Unique
High Hat
Transmitter

By Victor Hall



RADIO announcers no longer feel offended when told that they are "talking through their hat." The reason for this is that now they literally do speak through their bonnets. O. B. Hanson, NBC chief engineer, and his staff, have designed a micro-wave transmitter built right into a handsome silk hat.

The talking topper was put into first practical use on Easter Sunday when announcer George Hicks, carefully groomed in a cutaway of the best Park Avenue manner, mingled with society folk to describe the Easter parade, his utterances being sent to the network studios via the tiny transmitter.

NBC's silk-hat transmitter operates on a frequency of 270,000,000 cycles with a power of 0.2 watt and a working range of 1/4 mile. At its first application, the network's mobile unit—a more powerful transmitter on a truck—relayed the walking announcer's words to the chain headquarters for rebroadcasting over regular channels.

The transmitter assembly in the crown of the hat weighs but 11 ounces. A belt of the cartridge type, to be worn under the announcer's coat, contains the power supply. The B battery unit is designed in the form of a hunter's belt, with each (*Turn to page* 59)

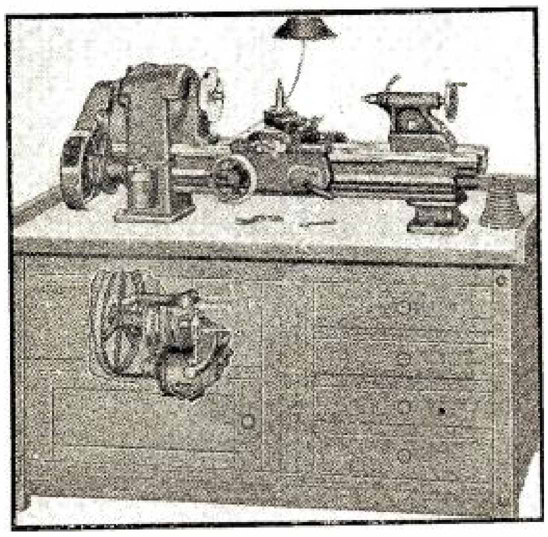
The RADIO WORKSHOP

¶ Items of interest for beginners, experimenters and radio constructors.

Conducted by The Associate Editor

Special Lathe for the Workshop

The South Bend Lathe Works announces a 9-inch lathe with underneath belt motor drive. The lathe is mounted on either a frame or cabinet bench with the motor



drive unit and motor supported on a pivoting frame to the underside of the bench top.

The lathe can be had in either the flat belt or the V-belt style. The former has a three cone headstock providing six spindle speeds which range from 39 to 630 r.p.m. The V-belt style has a four cone headstock with eight spindle speeds which range from 44 to 585 r.p.m. Both cut screw threads from 4 to 40 per inch, and with a fine screw thread cutting attachment the number is increased to 80 threads per inch.

Several new features of the adjustable type motor drive include: down drive to the lathe spindle, to insure a powerful, silent and efficient drive; completely enclosed mechanism with no moving parts exposed, screw type belt tension adjustment for any desired pulling power and belt tension release for shifting belt to change spindle speeds. Other features are: new twin gear reverse for right and left hand threads and feeds, a ball thrust bearing on the headstock spindle, larger spindle bearings, felt shear wipers on saddle, etc.

While it is primarily intended for the home workshop the lathe can be used for a great many professional applications. Readers can obtain further information by writing to the editor of this department.

Eliminating Interference Caused by Heater Controls

Tropical fish are indirectly guilty of causing radio interference. The connection lies in the thermostatic control heater employed in the fish tank for maintaining the water at a prescribed temperature. An inexpensive, poorly-constructed device of this kind causes the transmission of interfering radio waves in the immediate neighborhood, as it breaks and makes contacts to the heater element. This type of interference is easily eliminated by connecting a by-pass condenser of .5 to 1. mfd. across the contact points.

JOHN PRATT
Los Angeles, Cal.

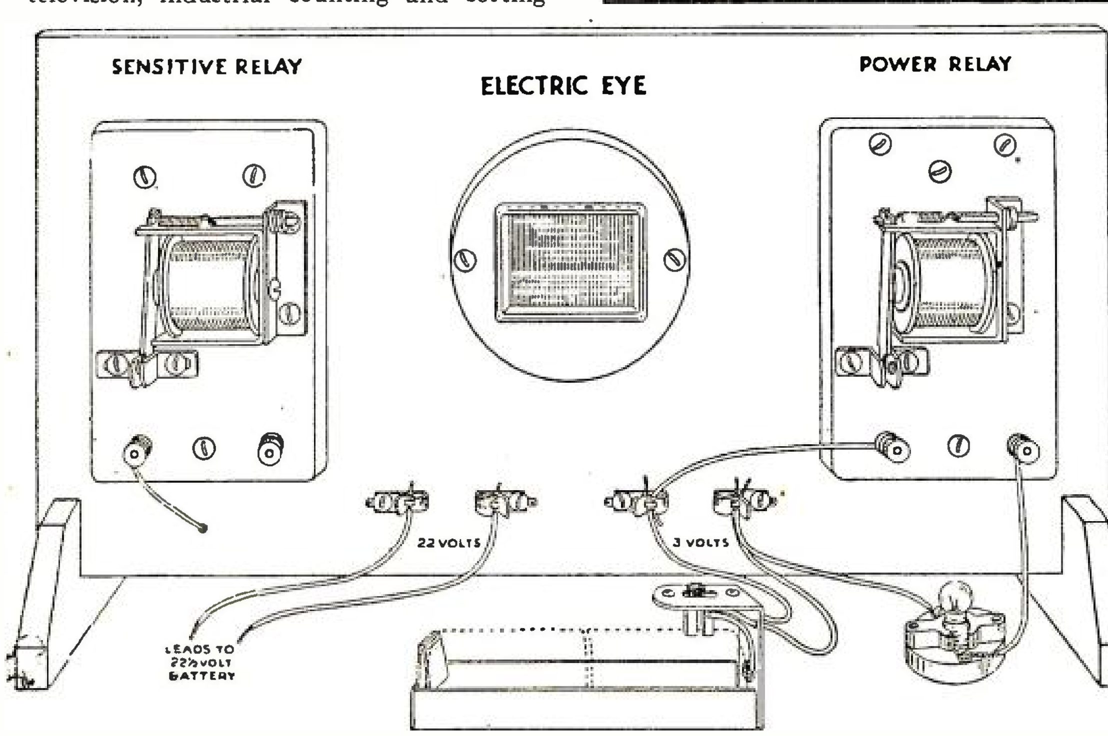
Photo-Electric Device Performs Many Experiments

American boys now have the opportunity of studying the wonders of the photo-electric cell—one of the radio industry's contributions to science. The American Toy Fair, recently held in New York, showed a trend towards scientific toys, one of the most prominent of which was the "Electric Eye" manufactured by the A. C. Gilbert Company.

The kit, practical for adult's experiments too, includes a photo-conductive type cell which uses the element selenium, a sensitive relay and a power relay all on a rack mounting. Countless stunts and experiments can be performed with the kit. Exploring the field of photo-electricity is especially fascinating in view of the wide use of the electric eye in television, industrial counting and sorting applications, talking pictures and many other fields.

The Gilbert Electric Eye contains instructions for such stunts as lighting an electric light with a match, controlling electric trains by a wave of the hand and silencing a radio with a flashlight.

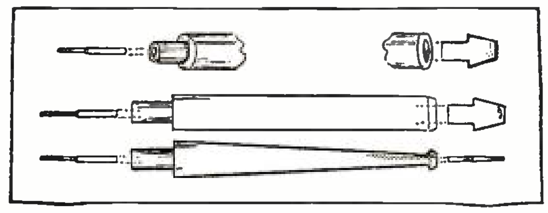
While many detailed instructions for experiments are given, the owner is encouraged to use them as a guide in devising still additional applications.



Pipe Stem Makes a Handy Lab. Tool

I believe my fellow experimenters will like my little kink of using a pipe-stem as a neutralizing tool and test prod. For the aligning tool I use a ½-inch piece of steel cut from a clock spring which is ground to fit into the end of the stem as shown in the drawing. It is held fast in the stem with glue or cement obtained at any hardware store.

To use a pipe stem as a test prod simply insert a phone tip or needle at the



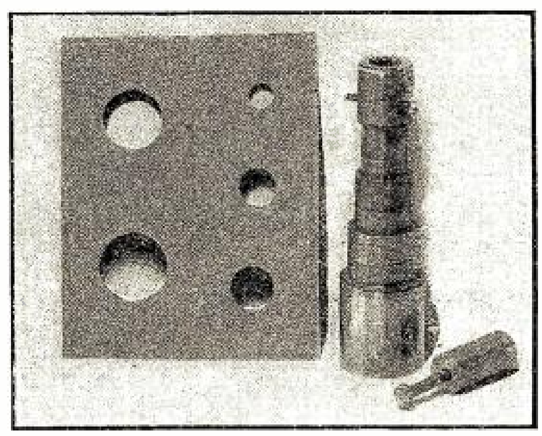
shank end with a flexible connecting lead run through the shaft of the stem.

AMBROSE T. HENNK,
St. Cloud, Minn.

A Handy Tool for the Workshop

Radio set builders and experimenters will be especially interested in the Livermore "five-in-one" multiple hand punch. It can punch out holes in sizes of ½, ¾, 15/16, 1 3/16 and 1 7/16 inches in metal up to 16 gauge

(*Turn to page* 64)



A WESTERN DX'ESS

The lady herself, L.P.O. (Mrs.) A. C. Johnson of Henry, So. Dakota, one of the few active DX listeners of the gentler sex—or are we wrong about the number?

THE DX CORNER

S. GORDON TAYLOR

(For Broadcast Waves)

DX Calendar

The DX broadcasts listed below are those which are expected to continue according to replies received to inquiries sent to the stations. Most of them are expected to continue throughout the summer although, of course, there may be some changes in present plans. The times given are Eastern Standard Time.

Wednesdays—	
8:30—9:30 p.m.	**1420 kc., KCMC, Texarkana, Ark., 100 watts, (Radio News) (tips)**
Thursdays—	
3:30 a.m.	740 kc., KMMJ, Clay Center, Nebr., 1 kw. (tips)
Saturdays—	
12:01—12:30 a.m.	980 kc., KDKA, Pittsburgh, Pa., 50 kw., (tips)
3:15—3:30 a.m.	830 kc., WEEU, Reading, Pa. 1 kw., (tips)
Sundays—	
1—1:15 a.m.	640 kc., KFI, Los Angeles, Calif. 50 kw., (tips)
1—1:15 a.m.	**1420 kc., KGGC, San Francisco Calif. (Radio News) (tips)**
Monthly—	
1:30—2 a.m.	1060 kc., WJAG, Norfolk, Neb. 1 kw., (tips) (2nd Friday)
2—2:20 a.m.	**1420 kc., WJBO, Baton Rouge, La., 1 kw., (Radio News) 3rd Saturday)**
2—4 a.m.	1420 kc. WJBO, Baton Rouge, La., .1 kw., (1st Sunday)

Those Foreign Stations

Many a disappointment is suffered by DX'ers when they tune in foreign language programs only to find, when the station signs, that they are listening to a U. S. station broadcasting in a foreign tongue. Unique among the stations doing this is WBNX, 1350 kc., New York City. This station broadcasts programs in ten different languages and will shortly have an opportunity to fool more DX'ers by virtue of the fact that its power is being increased from 250 watts to 1000 watts day and night. To further complicate matters for the DX'ers this station has just acquired a 200-watt short-wave outlet to operate under the call W2XIS daily relaying the WBNX programs daily on 31.6 megacycles.

OBSERVER COVERT

"Wireless 'Op'" of the "Good Ship DX," a feature of the KGGC broadcasts at 1:00 a.m., E.S.T., Sundays, which are skippered by Luther L. Putnam. The cat is the mascot

XEAW Verifications

Many DX'ers have had difficulty in obtaining verifications from XEAW. Their efforts are quite likely to be successful if the following suggestions are heeded: address your letter and report to Radio Station NEAW, Box 948, Mc-Allen, Texas. Mark it for the attention of Mr. H. D. Munal, Manager, and enclose 10c in coin.

Listening in an English University

We have to work here in Cambridge. In spite of this, some of us find time to listen to the radio. When I say listen, I don't mean to the short-wave stations from the distant corners of the globe. Here in England we are not very short-wave-minded yet and we tamely confine our listening to the dozen or so British Stations and a few French, Belgian and German medium-wave broadcasters which can be received without difficulty.

Facilities for listening are somewhat restricted here. I see in March RADIO NEWS that someone has fixed up an aerial of 650 feet. Well, we are forbidden by law to have an aerial longer than 100 ft. And anyway the rules of this college only allow the use of a radio on condition that it is entirely self-contained in our rooms. So I have to use an indoor aerial and earth.

However some of us DX fans can still get some fun out of the medium waves and the long waves. 1000-2000, which you are hardly familiar with in America. I remember about a year ago staying up until the early hours of the morning on several occasions with my 5-valve portable Marconi radio trying to tune in American medium-wave stations. It was the first time I'd ever done it, so you can imagine the thrill I got when I had identified eight U. S. A. stations: WABC. WJZ, WGY, WLW, WEAF, WEEI, WBZ, WTIC.

Some exciting searches can still be made among the "1 cals" on this side of the Herring Pond. Intentionally I did not say "Europe" because I have received Rabat (Morocco) and Algiers (Algeria). I have also received Reykjavik (Iceland). Several people have received Cairo (Egypt) though I have never done so.

But for the past few months I have been using a one-valve set with phones. It has been extraordinarily good for DX listening. One night I received half-a-dozen American stations quite easily.

In conclusion, I must apologize for the very English way in which I have worded all this. Doubtless you know that what I have called "aerial" is to you "antenna", "earth" is to you "ground" and "valve" is to you "tube". I should very much like to correspond with anyone at an American University. Letters may be addressed to: J. S. Phillips. Selwyn College, Cambridge University, England.

Notes from Readers

Observer Kalmbach (Cheektowaga, N. Y.): WIOD does not want reports from listeners. WCAX verified within three days. WBNY wants reports and will verify promptly. According to the Buffalo *Evening News* there is a new network known as the "Empire State Network" which includes the following stations: WINS, WBNY, WSAY, WABY, WMBO, WESG, WSYR, WIBX and WNBF. WBEN is now using 5 kilowatts during the daytime and a new vertical antenna.

Observer Lonis (Hannibal, N. Y.): The best DX heard recently at my listening post have been 1YA, 3YA and 4YA (heard best from 5 to 6 a.m. EST), also CX16 and LR1 (heard best 8:30-9 p.m. EST). Static is increasing rapidly and will probably shortly blot out the distant stations.

Observer Goss (Brooklyn, N. Y.): The TP's have been disappointing this spring. Only 1YA, 2BL and 4YA have been at all consistent and they were usually weak. Have also been able to send reports to KGMB and 3GI.

Observer Meehan (Elizabeth, N. J.): Have now received a total of 331 verifications during the past 16 months. The following list showing the number of days I had to wait for verifications from certain stations may be of interest. Many other stations took about 30 days to reply to my reports but these I am not including. WLB, 232 days; KIUP, 111 days; WHO, 49 days: WSVA, 48 days; WGY, 89 days; WWVA, 117 days; WHK, 44 days; WPAD, 100 days; WAAW, 47 days.

Observer Botzum (Reading, Pa.) has been made a member of the "6000-12,500 Mile International Radio Club". He has qualified for this appointment through verifications of 20 foreign stations over 3500 miles distant. Observer Botzum would like to correspond with American and foreign DX'ers. (Address: Robert W. Botzum, 633 Moss Street, Reading, Pennsylvania).

Observer Trice (Sharon, Pa.): A QSL card received from CMGH. 790 kc., Mantanzas, Cuba states that their daily schedule continues from 6:55 a.m. to 1 a.m. the following day.

Observer Gordon (Erie, Pa.) sends out an SOS for a copy of the March, 1935, issue of RADIO NEWS. He has every issue for 1934, 5 and 6 except this one. If any reader has this issue and doesn't need it Observer Gordon will be glad to buy it as he wants to bind his copies in book form. If you have this issue please write to him as follows: Harry M. Gordon, 317 East 10th St., Erie, Pa. Unfortunately RADIO NEWS does not have this back issue in stock.

OBSERVER BOTZUM

Recently qualified for the "Professional DX Ace" degree in the International 6000-12,500 Mile Club by submitting 20 veri's from stations 3500 miles away

Observer Parfitt (Villamont, Va.): Summing up the DX results obtained this year I find that I had three new stations in September, 11 in October, 27 in November, 15 in December, 22 in January, 29 in February and 20 in March. This makes 127 for the season and brings my total of verified stations up to 554 with 32 reports outstanding. Can any reader offer any dope on these: What Spanish-speaking station was on 650 kc. during March with good signal strength and playing Spanish music but no announcements? What Spanish-speaking station was on 1050 kc. February 28th from 4:15 a.m. to 4:45 a.m. EST? What station is on 1205 kc., 5-6 a.m. with music, yelling, dancing, laughing, etc.? (I don't think it was TGW on 1209 kc.) Station CMCO, 1200 kc., Havana, announced at 3 a.m. March 29th that international reply coupons are no good in Cuba. Does anyone have definite information on this? Heard a station on 1450 kc. giving weather and temperature for Columbia at 3-3:10 a.m. EST. Very weak and plenty of QRM. Can anyone tell me whether this was British Columbia or Colombia, South America as broken English was spoken but could not tell what accent?

Observer Diedrich (Moline, Ill.): Veris received from HIX, LR1, CMKM, 3GI, 3KZ (600 watts, Melbourne) and 2GN (100 watts,

VERIFIES WITH PHOTO

This little 100 watter on 1160 kc. verifies promptly. Reports should be addressed to CMHJ, P. O. Box 112, Cienfuegos, Cuba. (Observer Parfitt)

Goulburn, Australia). The morning of Sunday, Feb. 23rd offered most remarkable TP reception I have experienced since the spring of 1933. Transpacific stations were so clear and loud that they seemed to be right in the same room with me. Among the stations which I have heard recently are 32 TP's. Of these 4BC and 2UW are the most consistent of the Aussies; 1YA and 4YA of the New Zealanders. New Zealand stations start coming in about 3 a.m. CST and the Aussies about 4 a.m. During April a large number of TP's were heard. Have been hearing the Aussies along after daylight, in fact some of them do not come in well until daylight. On the whole the best hour seems to be from 4:30-5:30 a.m. CST.

Observer Truax (Aurora, Ill.): Several times I have heard a station on 640 kc. which I am positive signs the call COCK. I have not been able to figure this one out as I can find no record of a station with these call letters. CMBX has changed from 1380 kc. to 1060 kc. KELO, 1110 kc. can be heard here at almost any hour. LS2, 1190 kc., is heard best about 9 p.m. CST.

Observer Meade (Kansas City, Mo.): On Sunday, April 12th heard a station signing off with "Goodbye My Love" and calling itself the "23-hour station of Chicago". The call was given as WYZ, the frequency was 560 kc. and the location Galena, Illinois. I find no such station listed. On the morning of April 7th I heard WMC, Memphis, Tennessee, rendering valuable service in connection with the heavy storm then occurring in the South. I believe this station rates honorable mention for the valuable service which included, among other things, giving the names of the dead and injured and the hospitals to which the injured individuals had been taken. This once more proves the value of radio in emergencies and points out an opportunity for service which many broadcast stations have overlooked.

Observer Halsey (Texarkana, Ark.): Since February 1st I have logged 130 new stations bringing my total BB for this season to 480. Have recently been listening on the 160-meter and 75-meter amateur phone bands. On the former my best catch is K7CSZ, Ketchikan, Alaska. On the 75-meter band I have logged all U. S. districts and 34 states, Alaska, Cuba, England and all provinces of Canada.

H. V. Gribble (Minneapolis, Minn.) would like to correspond with foreign DX'ers and is particularly interested in hearing from owners of 16-tube Midwest receivers. (Address: H. V. Gribble, Traffic Box 42, Minneapolis, Minnesota).

Observer (Mrs.) Johnson (Henry, S. D.): My radio has just about folded up and until I get it repaired or get a new one my DX'ing is at a standstill. KGDY, 1340 kc., has a test program the first Sunday of each month, 4-4:30 a.m. EST. I received a nice letter of verification from this station.

Observer Davis (Elkhart, Texas): Signal strength of the TP's has improved but an increase in static has offset this increase with the result that all except a few from across the Pacific have been too broken up to copy. 4YA and 1YA have been especially strong. Incidentally 4YA announces its call and location about 4:30 a.m. CST and again about 4:45 a.m. nearly every morning. It has been stated that 3AR has moved from 630 kc. to 580 kc. If so, what station am I still hearing on 630 kc? Although I have been unable to catch the call letters, the announcer sounds exactly the same as 3AR's announcer. What station was on 1565 kc., March 14th, 8-9 p.m. CST? I could not get the call letters but they were featuring music from Warner Brothers String Band. Observer Davis arranged an excellent two-hour program dedicated to RADIO NEWS by KNET on the morning of April 19th. He reports that the program went over in a big way and that no less than 40 performers took part in the broadcast. Concerning DX he reports that April 23, 24 and 25 were the best mornings he ever experienced. During these days he succeeded in tuning in 40 Australian and New Zealand stations with crystal clearness and many other somewhat weaker.

AUSTRALIAN DOPE

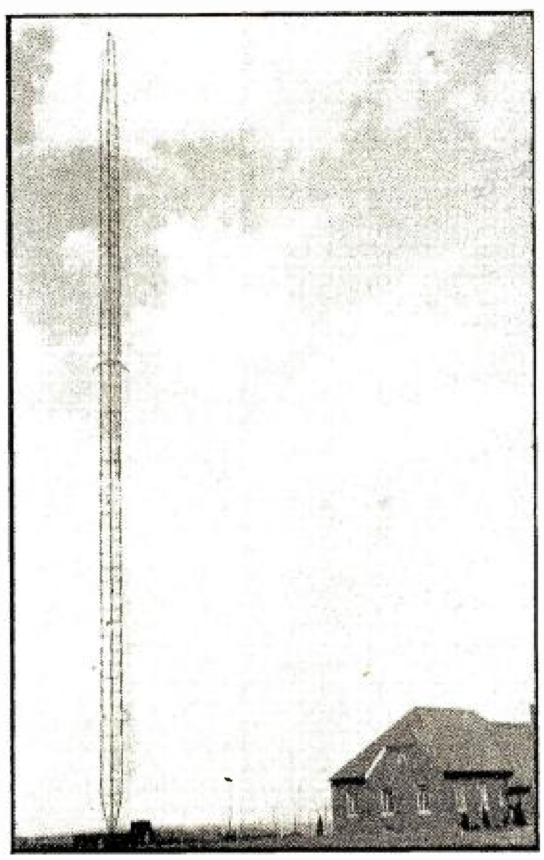
The following information and up-to-date list of Australian stations is submitted by Observer Jurd of Queensland, Australia:

The figures preceding the letters in the calls of Australian stations represent the various states. These allocations are 2—New South Wales, 3—Victoria, 4—Queensland, 5—South Australia, 6—Western Australia and 7—Tasmania. Amateur stations use the prefix VK. National stations do not carry advertising and are supported by listener taxes. Commercial stations are permitted to broadcast advertising programs and it is from this that they obtain their revenue. Amalgamated Wireless, Ltd. intend shortly to establish a short-wave station in Perth, West Australia. This will have a world-wide range and will be conducted along lines similar to VK2ME and VK3ME. The list of Australian stations now on the air is as follows: (The stations marked "A" are the National stations and "B" the Commercial stations)

Call	Kc.	Location	Kw.	Class
580	3AR	Melbourne	4.5	A
590	7ZL	Hobart	1.	A
610	2FC	Sydney	3.5	A
640	5CK	Crystal Brook	7.5	A
670	2CO	Corowa	7.5	A
690	6WF	Perth	3.5	A
710	7NT	Launceston	7.	A
730	5CL	Adelaide	2.	A
740	2BL	Sydney	3.	A
770	3LO	Melbourne	3.5	A
800	4QG	Brisbane	2.5	A
820	7HO	Hobart	.1	B
830	3GI	Sale	7.	A
850	5RM	Renmark	1.	B
870	2GB	Sydney	1.	B
880	6PR	Perth	.5	B
900	3MA	Mildura	.1	B
900	4WK	Warwick	.05	B
910	4RK	Rockhampton	2.	A
930	3UZ	Melbourne	.6	B
950	2UE	Sydney	1.	B
960	5DN	Adelaide	.3	B
970	3BO	Bendigo	.2	B
980	4AY	Ayr	.1	B
980	6AM	Northam	1.	B
990	2GZ	Orange	2.	B
1000	4GR	Toowoomba	.05	B
1010	3HA	Hamilton	.3	B
1020	2KY	Sydney	1.	B
1030	3DB	Melbourne	.6	B
1040	5PI	Crystal Brook	2.	B
1050	2CA	Canberra	.5	B
1060	4MB	Maryborough	.1	B
1060	3YB	Warrnambool	.05	B
1080	3SH	Swan Hill	.1	B
1100	7LA	Launceston	.3	B
1110	2UW	Sydney	.75	B
1120	4BC	Brisbane	1.	B
1130	6ML	Perth	.5	B
1140	2HD	Newcastle	.5	B
1150	2WG	Wagga	1.	B
1160	4MK	Mackay	.1	B
1160	2KA	Katoomba	.1	B
1170	4TO	Townsville	.2	B
1180	3KZ	Melbourne	.6	B
1190	2CH	Sydney	1.	B
1200	5KA	Adelaide	.3	B
1210	6KG	Kalgoorlie	.1	B
1210	2GF	Grafton	.1	B
1220	4AK	Oakey	1.	B
1230	2NC	Newcastle	2.	A
1240	6IX	Perth	.5	B
1240	3TR	Sale	.5	B
1260	3WR	Shepparton	.5	B
1270	2SM	Sydney	1.	B
1280	3AW	Melbourne	.6	B
1290	4BK	Brisbane	.5	B
1300	2TM	Tamworth	.05	B
1310	5AD	Adelaide	.3	B
1320	3BA	Ballarat	.05	B
1330	2BH	Brokem Hill	.1	B
1330	4RO	Rockhampton	.05	B
1340	2XN	Lismore	.05	B
1350	3GL	Geelong	.05	B
1360	4PM	Port Morseby, Papua	.1	B
1360	2MO	Gunnedah	.05	B
1370	3HS	Horsham	.05	B
1380	4BH	Brisbane	1.	B
1390	2GN	Goulburn	.1	B
1410	2KO	Newcastle	.5	B
1420	3XY	Melbourne	.6	B
1430	2WL	Wollongong	.05	B
1440	4IP	Ipswich	.05	B
1450	5MU	Murray Bridge	.1	B
1460	7UV	Ulverstone	.3	B
1470	3MB	Birchip	.1	B
1480	2AY	Albury	.1	B
1480	4BU	Bunderberg	.05	B
1500	3AK	Melbourne	.2	B

WOW

This vertical radiator, 454 feet high, is said to be doing an excellent job for this 5 kw. station at Omaha. The transmitter is located in the buildings at the right. (Courtesy Observer Atkins)



Observer Atkins (Lawrence, Kansas): Static has been prevalent here most of the night, usually clearing up about 1 a.m. I have recently received the following new stations: KGU, Honolulu; WPRP, Porto Rico (100 watts); KFQD, Alaska; WNEL and WKAQ, Porto Rico; CMG and CMBN, Havana. 4YA has also been received. Would like to correspond with foreign DX'ers and will answer all letters received. (Address: Dudley Atkins, III, 1721 Indiana St., Lawrence, Kansas).

Observer Covert (San Francisco, Calif.): KGGC which puts on a weekly Radio News tips program has been heard in New Zealand during special tests conducted late at night by the station engineers. The broadcast band has been relatively dead here for some time due to the unusually high static level.

Observer Sholin (San Francisco, Calif.): TGW, 1210 kc., 10 kw., Guatemala City, offers free samples of Guatemalan coffee to listeners who report their programs. TIGPH operates on 650 kc. with 1 kw. and is on the air until 8 p.m. or later PST. Verifies reports. Address: Apartardo 800, San Jose, Costa Rica. 1YA, 2YA, 3YA and 4YA were heard here about R7 during April. A few Aussies were also heard. The Japs have practically passed out of the picture. JOHK, 770 kc., is best but is only about R3-4.

Observer Tucker (Bluff, Alaska): In a report dated March 7th he states that reception of U. S. stations was at that time fair, but somewhat unsteady. Reception from California and Hawaii has been consistently good. The four YA's of New Zealand were received well as was also 4QG of Australia.

Observer Clancy (Lethbridge, Alberta): The Canadian Radio Commission stations were on continuously during the Moose River disaster and this permitted several new ones to be logged. CMBX seems to have settled down on 1065 kc. KNX, WHO and WJZ are among the American stations that have applied for 500 kw. power. 1YA, 2YA, 3YA and 4YA have been coming in fair to good during April.

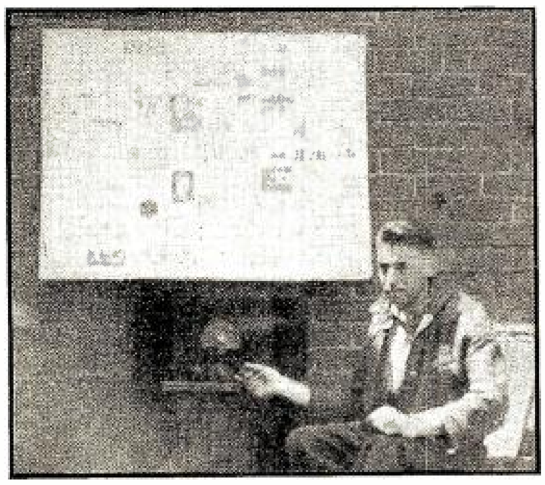
Observer Coales (Southsea, England): Beginning with April DX in English is rarely good and this season is exception as the spring months have been a washout. I did not hear a single U. S. transmitter during April and had good reception from South America only on the morning of April 5th. I wonder if DX'ers in the U. S. A. realize how lucky they are in their choice of sets specially designed for DX. Your prices are much cheaper too, and the U. S. A. manufacturers much more enterprising. Not one of our leading manufacturers supply their sets in chassis form. One has to buy the complete outfit—cabinet, loudspeaker, etc. Some of the smaller firms will supply chassis and make sets to order.

Observer Pellatt (London, England): The English transmitters will increase power from 50 to 100 kw., Regional stations first then the National stations. A conference is to be held with a view to installing a new and more powerful transmitter at London Regional. A new 20 kw. transmitter is to replace the old 1 kw. one on the Island of Askoy, near Bergen, Norway. It is expected to be testing around June 15th. Saarbrucken, Germany, 1249 kc., 17 kw., the frequency formerly occupied by Nice. Juan les Pins (France), now uses for an interval signal an extract from the song "Deutsch ist die Saar". P.T.T. Nice-Corsica has discarded its old interval signal from the "Dance of the Cuckoos" in favor of the old aria "Knowest Thou The Land" from the opera Mignon. The Sicilian station Palermo is now in the southern network and will exchange programs with Rome, Naples and Bari.

Observer Phillips (Cambridge, England): Statistics from the International Broadcasting Union in Geneva show that nearly 25,000,000 families in the European Zone (which includes North Africa, Palestine, etc.) listen to the radio. Great Britain leads the other countries with 6,780,560 licensed receiving stations. Germany is second with 6,142,921. Some countries such as Palestine have increased the number of receivers over 100% during 1935.

Observer Watson (Christchurch, New Zealand): Among the American stations heard this season are WCKY, WTCN, KVOO, WJJD, KNX, WKBZ, WTEL, WCAZ, WTMV, KFXR, KGKB, WBBM and CMKC.

M. Nishimori (Hiratsuka, Japan) sends in the following list of changes in the frequencies of Japanese stations as proposed by the Japanese authorities. The date when these changes take place has not been officially announced:



W. BARRON, NEW ZEALAND

Branch Secretary of the N.Z.D.X.R.A. and member of the N.Z.D.X. Club, this DX'er has recently qualified for membership in the International 6000 to 12,500 Mile Club

Call	kc. New	Location	kc. Old
JOAK I	590 kc.	Tokyo	870 kc.
JOJK	610 kc.	Kanazawa	710 kc.
JOKK	630 kc.	Okayama	700 kc.
JODG	640 kc.	Hamamatsu	635 kc.
JOUK	650 kc.	Akita	645 kc.
JOTK	670 kc.	Matsuye	625 kc.
JOVK	680 kc.	Hakodate	680 kc.
JOBK I	690 kc.	Osaka	750 kc.
JOCG	700 kc.	Asahikawa	655 kc.
JODK I	710 kc.	Keijo	900 kc.
JORK	720 kc.	Kochi	720 kc.
JOCK I	730 kc.	Nagoya	810 kc.
JOSK	740 kc.	Kokura	735 kc.
JFAK	750 kc.	Taihoku	670 kc.
JQAK	760 kc.	Dairen	650 kc.
JOHK	770 kc.	Sendai	770 kc.
JOPK	780 kc.	Shidzuoka	780 kc.
JOGK	790 kc.	Kumamota	760 kc.
JOIK	810 kc.	Sapporo	830 kc.
JOFK	830 kc.	Hiroshima	850 kc.
JOAK II	870 kc.	Tokyo	590 kc.
JOLK	910 kc.	Fukuoka	680 kc.
JOQK	920 kc.	Niigata	920 kc.
JOAG	930 kc.	Nagasaki	930 kc.
JOBK II	940 kc.	Osaka	1085 kc.
JONK	950 kc.	Nagano	940 kc.
JODK II	970 kc.	Keijo	610 kc.
JOXK	980 kc.	Tokushima	980 kc.
JOCK II	990 kc.	Nagoya	1175 kc.
JOBG	1000 kc.	Maebashi	970 kc.
JOFG	1020 kc.	Fukui	990 kc.
JOHG	1050 kc.	Kagoshima	1050 kc.
JOIG	1060 kc.	Toyama	1060 kc.
JOOK	1070 kc.	Kyoto	960 kc.

Five new Japanese stations are to be erected at Obihiro, Yamagata, Kofu, Miyazaki and Tottori. Their operating frequencies have not

(*Turn to page 51*)

THE SERVICE BENCH

tells YOU Something about

Installing A.V.C.

. . .

Service Kinks

. . .

Promotion

. . .

Service Sales

FIGURE 5

Conducted by Zeh Bouck, *Service Editor*

INSTALLING automatic volume control in the process of modernizing receivers capable of a reasonable degree of rejuvenation is not the simple matter most servicemen wish it were. General directions would suffice for only a handful of specific instances. As a rule, if any rule at all can be established, each receiver must be considered as an individual problem.

THE following notes on adding a.v.c. to a Majestic Model 50, contributed by G. Demey, of Bruges, Belgium, is a good example of general principles, and should be of considerable assistance to servicemen running up against comparable jobs. "The Majestic 50 is really a satisfactory receiver, its main desideratum being lack of a.v.c. In the case under consideration, I removed the 51 i.f. tube and the detector; and changed the sockets for a 58 i.f. amplifier and a 2A6 detector, with the circuit altered for a.v.c. I replaced the 645-ohm volume control with a 600-ohm fixed resistor. A new 500,000-ohm volume control was connected as shown in Figure 1, and the original resistor of 35,000-ohms was replaced with a 2000-ohm resistor (marked X). The revised connections are all shown in the diagram. The a.v.c. action and general results are all that could be desired."

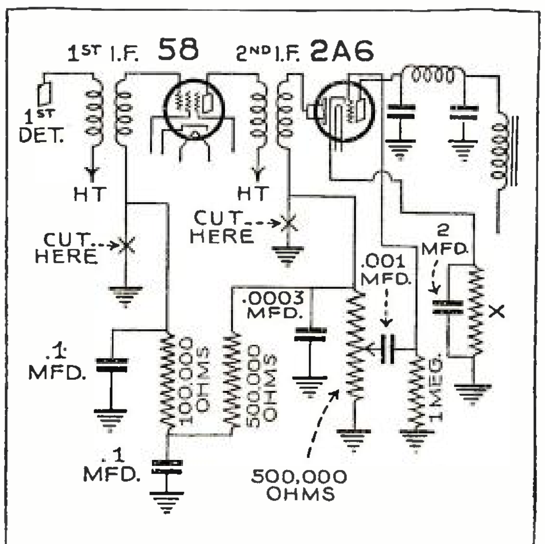
Prize Kink

To our mind the best tip to the harassed serviceman that we have come across in many moons is contributed by W. D. Wibong, of the W. and W. Radio Shop, Fort Worth, Texas. Here it is: "In trying to look around a corner in a periscopic fashion to see the end color of a resistor, I find a dental mirror to work quite nicely. It is also a great help in tracing circuits through a maze of half-hidden wires. The magnification afforded by such mirrors relieves eye strain and contributes to the speed and accuracy of many a service job. Try it on some tubular condenser with the capacity marked on the side you can't see!"

Ionization—Good and Bad

There was a time when any tube that showed a blue haze was considered a gassy—defective—tube. A present day hang-over from the 01A era has resulted in many perfectly good tubes being thrown into the discard. *Sylvania News* points out that there are three reasons for blue glow—and that only one of the three is indicative of a bad bulb. A fluorescent glow, usually around the inside surface of the glass envelope, is characteristically of a violet color and varies with the intensity of the signal. This is of the harmless variety. A similarly innocuous blue haze, due to mercury vapor, will be noticed on the types 82 and 83 rectifiers.

FIGURE 1



Gas also causes a blue haze and this *is* detrimental to the action of the tube. It will usually be discerned in the vicinity of the plate, and will be accompanied with erratic action—distortion in the case of an a.f. tube. The fact that this gas haze may also vary with the signal strength often leads to confusion between fluorescent haze and ionization in a defective tube. These hazes can be differentiated by means of a powerful horseshoe magnet. The glow in a gassy tube will not be affected by the presence of the magnetic field, but a haze deflection will be noticed in the true fluorescent phenomenon.

In cases of severe gas, the entire tube will glow, and the set will be altogether inoperative.

Philcos 620 and 16X

"I have run across several instances of trouble with the Philco 620, due to a short-circuit in the tone-control condenser connecting to the plate of the 42 power tube. Remedy: Substitute a 400-volt capacitor—.02 to .05 mfd, depending upon the depth of tone control desired. Trouble with the shadow tuner in the 16X and similar jobs can be corrected by disconnecting and transferring the leads to the plate circuit of the second intermediate-frequency tube."—Eugene C. Drobeck, Manila, P. I.

An Alignment Tip

"The Majestic 20 has probably caused servicemen more grief than any other chassis. The instructions for getting at the works are to unsolder certain wires in order to remove the bottom cover. However, I have found it much easier to remove all the screws at the bottom, permitting the parts attached to fall away still connected. To replace the bottom, all that is necessary is a 1-inch screw to hold the inside support of the condenser pack. The other parts can then be replaced quite easily with the original screws.

"One of these Majestics had been decreasing in volume for some time until at last only the very strong stations could be heard. A check-up showed all voltages and parts okay. I found it, however, impossible to realign the r.f., due to excessive capacity in one circuit. Remembering that a short-circuited turn of wire around a coil reduces its inductance, I wound one turn of bell wire around the grid end of the coil and short-circuited it. It was then easy to bring the r.f. condenser into alignment. The turn was doped in place and the owner said that the set worked better

FIGURE 4

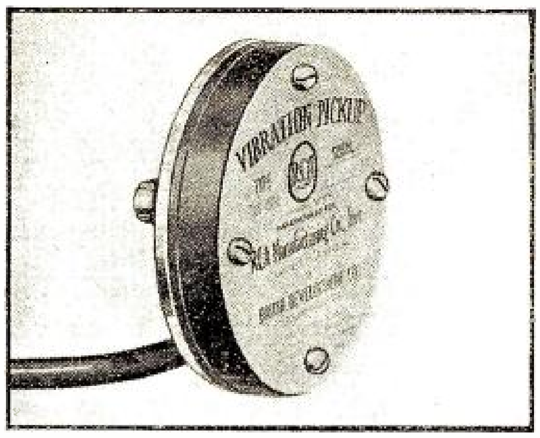


FIGURE 2

than when new. It would have been easy to remove a turn or two of wire, but this method seems as good. (This set can also be pepped up by reducing the detector cathode resistor to 2000 or 1500 ohms. Too low a value will cause distortion on strong signals, however)."—Chris L. Schultz, Brazil, Indiana.

We can't agree with our contributor on the argument that the short-circuited turn is as good as a turn or two taken off the inductor. The turn might well result in loss of signal strength or broad tuning. However, the short-circuited turn idea is *an excellent one to determine quickly if one circuit is tuning to too low a frequency*, a condition that might well be suspected if the trimmer condenser is way out and sharp alignment cannot be secured. Before leaving the turn in place permanently, or removing a turn or two from the coil, see if there isn't some way of reducing the capacity of the circuit, perhaps by bending the condenser plates, or replacing shielded grid leads with a lower capacity type. Changing the inductive value of the circuit, while it may result in better action over part of the dial, will usually upset tracking in other portions.

SERVICE SALES PROMOTION

The envelope stuffer shown in Figure 3 has brought results to Ralph S. Harrison, Bethesda, Ohio—as one might suspect from its general get-up and the sales suggestion carried on the detachable coupon. Mr. Harrison has also played up his amateur radio activities to their greatest advantage and this angle has resulted in considerable service business.

A tip to you servicemen who go in for refrigeration sales in the summer months: Take an oscilloscope and an RCA vibration pickup (Figure 2) along with you on your radio service calls. Maneuver for a chance to talk refrigeration, and ask permission to measure the vibration on the refrigerator being used. Set up the pickup and the oscilloscope—with the pickup on the refrigerator, itself, first, then on the kitchen table. Let the mistress of the house watch the test. If the vibration exceeds that of the new job you're selling, suggest that she drop into your shop to listen to and SEE a silent refrigerator. (N.B. Don't bother trying this on an Electrolux! But it's a fine sales argument for this refrigerator if it happens to be the one you're selling. However, any of the modern mechanical designs will show up well on the RCA pickup.)

The P. R. S. M. A.

Among the most active of all service organizations is the Philadelphia Radio Servicemen's Association. This affiliation publishes a highly-interesting and useful service magazine, the *P. R. S. M. A. News*, which is available to non-members at

(*Turn to page 53*)

Servicemen's PRIZE CONTEST

Announcement of Awards

Zeh Bouck
Service Editor

FIRST PRIZE

Equipment Plus Display

The letterhead of Webber's Radio and Electric Shop declares that it is the "Best equipped radio service shop in northwestern Colorado," a slogan that, judging from Figure 1, is based on fact. The equipment, which is mostly Weston, includes a model 665 selective analyzer, a 664 capacity meter, an all-wave oscillator and a tube tester. A 15-watt high-fidelity amplifier is employed for test work, and also for the sound broadcasting of news items. The speakers can be heard three and a half miles out of town! A similar 30-watt amplifier is used on P.A. work, in conjunction with a crystal and ribbon mike.

The generator on the counter is for charging storage batteries, which are placed beneath. The screen suspended from the ceiling, in front of the tube display, is employed as an aerial in testing and servicing auto radios. Equipment shortly to be added consists of an R.C.A. oscilloscope, signal generator and modulator.

FIGURE 2

FIGURE 1

The busy season at Webber's is during the fall and winter, when as many as thirty-eight radios have been in the shop at one time! Automobile radio service hits its high in the summer.

Electrical wiring is a sideline, as are electric ranges, one of which may be seen on display in the photograph.

SECOND PRIZE

A Most Efficient Layout

The shop of the Ansol Radio Service (Figure 2) offers an encouraging note to the newcomer in the radio service game, who may be worried about that little item known as overhead, and who may wonder where he can find space for a fully equipped shop. Much of the essential test apparatus will be recognized in the photograph—the Supreme 385 Automatic, Weston-Jewell analyzer and the Triplett Master Unit Model 1200, volt, resistance and milliampere meter—so arranged that they can be readily demounted for use in the field. The bench itself is sturdily constructed, as is attested by the dressed four-by-four legs.

Mr. Soloway is a member of the Radio Manufacturers Service, and specializes in Philco, RC.A. and Zenith.

THIRD PRIZE

Eye Level Charts

The serviceman who has fumbled about in drawers and folders for tube and calibration charts will appreciate the disposition of them by Mr. Blend, as shown in Figure 3.

The instrument panel is thirty inches high and seven feet long, constructed of plywood sections twelve inches wide. Thus any single panel can be remodeled without disturbing the others. The equipment includes a point-to-point tester, an all-wave signal generator, two speakers with universal input transformers, a Supreme 85

THIS MONTH'S PRIZE WINNERS

FIRST PRIZE—Ten dollars to Webber's Radio and Electric Shop, P. O. Box WW, Steamboat Springs, Colorado, *for display!*

SECOND PRIZE—Five dollars to S. Soloway, of Ansol Radio Service, 12 Jefferson Street, Monticello, N. Y., *for a tip to the newly trained serviceman,* showing how a service bench can be located in almost any corner of the house!

THIRD PRIZE—Four dollars to Harvey Blend, Liberty Radio Service, 830 Blue Hill Avenue, Dorchester, Mass., for arranging his tube charts and instrument calibrations *where they do the most good!*

FOURTH PRIZE—To G. Demey, 31, Gerard Davidstraat, Postchecker, 112265, Bruges, Belgium. Three dollars for a picture of *how a foreign serviceman works!*

Congratulations and thanks from RADIO NEWS *and its thousands of servicemen readers!*

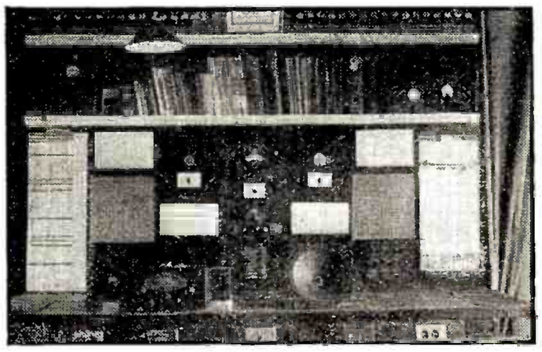


FIGURE 3

tube checker, neon condenser tester, the RADIO NEWS tube tester plus ohmmeter ranges and a neon short tester. Current radio periodicals and service manuals are all within easy reach. The central instruments are lighted by a small hooded light, such as may be purchased in any five-and-ten-cent store. The main light is arranged on a sliding rod so that it may be best positioned for work.

FOURTH PRIZE

A Belgian Service Shop

G. Demey, who, as Figure 4 would suggest, specializes in Midwest radios, nevertheless writes to us from across the Atlantic: "In the upper part of the photo you will see the American and Belgian certificates of membership in the Radio Relay League, Rider's manuals, "Modern Radio Servicing," and a Philco oscillator.

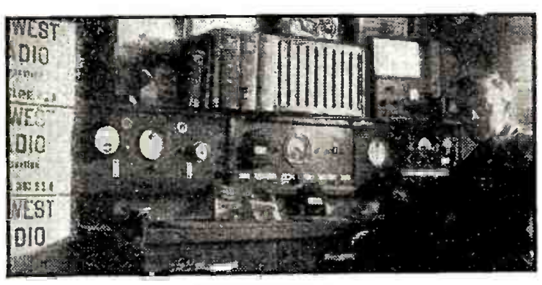


FIGURE 4

The panels from left to right contain an ammeter (most useful in the power line of a set being tested), a full complement of voltmeters, ohmmeters, an output meter and the RADIO NEWS tube tester."

The Contests will be suspended for the summer months for vacations, to be resumed in October.

ELECTION YEAR PROFITS

for Servicemen

by Zeh Bouck

THE public is being sold on the idea that "radio will elect the next President." Ever since that immortal cry of "twenty-four votes for Underwood" plagued the weary ether at the Democratic National Convention back in 1924, radio's place in politics, particularly in a presidential campaign, has been firmly fixed in the minds of the listening public.

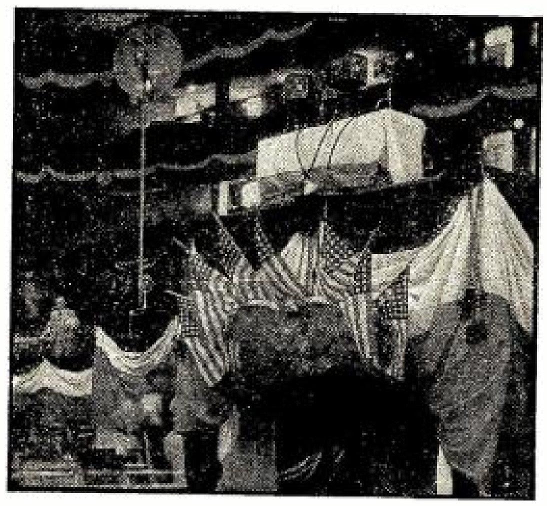
WITH every succeeding year, radio has become more and more the campaigner's stump, and it is probable that more radio receivers are in operation on election night than on any other given time throughout the year. It is America's favorite program!

It is inevitable that the radio serviceman will capitalize on this vast amount of listening, even without special effort on his part. However, with organized endeavor, he can do much to make the cash register tinkle, not merely as a result of emergency calls on election eve, but to a more consistent tune from now until November 4th. Regardless of what candidates lose, the alert serviceman is bound to win!

The logical start, if you get to this article in time, is to circularize your old customers and new prospects on the theme of the Republican and Democratic National Conventions. We suggest something along the following lines, mimeographed, and accompanied with a short personal note differentiating between your established clientele and new contacts:

> The fight is on! Bigger and better than anything in the prize ring! Will you be at your ringside seat, reserved for you by radio, during the Republican and Democratic National Conventions?
>
> Should your radio let you down at a crucial moment, call on us. Emergency work is a part of our service. But why not let us anticipate any possible trouble by putting your radio in first-class condition NOW—with a special CAMPAIGN MONTH'S GUARANTEE, that is our contribution to a matter of national importance.
>
> We'll guarantee to put your receiver in perfect working order, *and to protect you against all possible types of failure*—excepting line power—*from now until the morning after Election Day!* This guarantee covers not merely our own work, but everything previously done to the set, manufacturer's parts, tubes—everything.
>
> This guarantee assures you perfect reception of every campaign speech—of every return on Election Night—with the added probability of unqualified radio entertainment far into the winter!

The serviceman will admit that this is an attractive guarantee. At the same time, it is an easy one to live up to. Check all tubes carefully and discard those that are the least suspicious. Result: Immediate tube sales, plus practically one hundred percent protection on the tube question. As for other possible failures not concerned with your own immediate servicing, tack fifty cents on each bill, and you will be more than compensated for the one set out of ten that may go bad between now and November 4th. As a matter of actuaries, the average set put in really first class



condition by the observant serviceman is a good risk for better than six months.

Election Headquarters

The serviceman should erect a campaign bulletin board in his show window, announcing all important political addresses scheduled for broadcasting. Such events may also be used as the basis for follow-ups to such prospects as did not respond to former sales literature. Needless to say, the serviceman should install loudspeakers in front of and within his store for the transmission of such speeches and for the announcement of election returns.

A "plurality contest" is also an excellent idea for attracting prospects to your shop, and making the public generally conscious of you as a radio serviceman. Offer whatever prize you can afford—a new receiver, complete set of tubes, one year free radio service, etc.—to the person making the closest guess as to the plurality with which either Republican or Democratic presidential candidate will win over the other. All entrants should be required to fill out a blank, stating, in addition to the estimated plurality, name, address and type of radio owned. This latter information will be useful in later circularization. A daily bulletin should be published announcing the highest estimated pluralities for both candidates, the average estimated pluralities, and the percentage of entrants favoring the leading candidate. These announcements will attract repeat customers to your shop.

Merill Lindley, serviceman of Indianapolis, Ind., is making recordings of important political radio addresses, and renting them, plus equipment and services, to local political organizations for their own rallys.

Make your service shop RADIO ELECTION HEADQUARTERS—and see to it that your activity is publicized in your local papers!

Election Day Reminders

In many states and districts, registration some time previous to election is a requirement to vote on November 3rd. A small card will be appreciated by many of your clients:

> To vote on Election Day, you MUST REGISTER.
>
> Your local registration booth is at .... (insert address), and you may register from .... to .... (time), on .... (give date or dates).
>
> DON'T NEGLECT YOUR VOTE —nor the (*Turn to next page*)

opportunity of learning at the earliest possible moment by radio just what happened to it! Why not have us check your radio to insure perfect reception Election Eve and Night?

A week before election day, a follow-up will be effective in many delinquent cases:

ELECTION DAY—Tuesday, November 3rd! Your voting place is located at .... (give address). Polls open at........ a.m. (time), and close promptly at...... p.m. First returns are scheduled to be broadcast by station............ (insert call letters and frequency) at......... p.m.

BE PREPARED! All bars and liquor stores are closed while the polls are open! Also, we shall probably be flooded with emergency radio repair work Election Eve. Why not let us check your radio NOW, and guarantee you perfect reception THEN?

Another short card:

Election returns will be broadcast over our public-address system, Election Evening, starting at........ (insert time). We shall be happy to repeat them for the benefit of those 'phoning in for information. However, why not receive them directly? We have a supply of radios attractively priced—and also for rent at special Election Night rates.

Or let us check your own receiver, and guarantee you against failure as the returns come through!

A variation of the above:

Election returns will be broadcast over our P.A. system, Election Evening, starting at.......... We shall be happy to repeat them for the benefit of those 'phoning in for information. Call us, if your set fails, for service or returns.

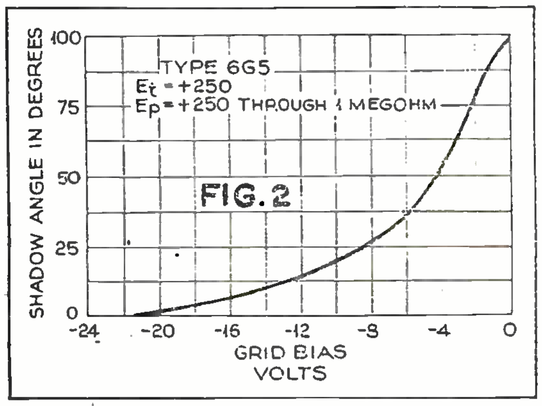
However, why not let us check your set *today* and guarantee you perfect reception *Tuesday evening?*

Tuning Indicator

(*Continued from page* 18)

only an 8-volt range, consequently a voltage divider was required to prevent overload on strong, local signals, causing reduced sensitivity to weak signals. In most designs, a voltage divider is not needed with the new 6G5.

The installation in a typical a.v.c. circuit is shown in Figure 1. An incoming signal causes current to flow in the diode detector circuit and the resulting voltage drop across R1 is applied through the a.v.c.



network resistors R2, R3 and R4 to the control grid of the 6G5. A ray-control electrode which regulates the flow of electrons to the target of the 6G5 is attached directly to the plate of the triode section of this tube. The voltage supply for this plate is obtained through the 1-megohm resistor. When a strong signal is present in the receiver detector circuit, the a.v.c. voltage is a maximum and therefore the negative voltage applied to the control grid of the 6G5 is likewise high. Under such conditions, very little current is drawn by the 6G5 triode plate and little current will pass through the 1-megohm plate resistor. The potential of the ray-control electrode will therefore be substantially the same as that of the target and will have little control action. For weak signals, the grid bias will be less, the plate current greater, and the resulting voltage drop across the plate resistor higher. The ray-control electrode will then become negative with respect to the target, repelling the flow of electrons to the screen. This causes the characteristic shadow to appear on the circular target. Figure 2 shows the shadow angle in degrees resulting from various grid-bias potentials on the 6G5 tube.

This tube should be of particular interest to servicemen, since it simplifies the installation of a tuning indicator on any set which has a.v.c. Many other applications, such as tube voltmeter, output meter, high-resistance continuity testing, etc., will suggest themselves.

Metal Tubes

(*Continued from page* 16)

itself perhaps rather minor, but accumulated they reach rather important proportions. Perhaps the most striking argument in favor of the metal tube is that the use of metal for the envelope of a tube opens up a whole new line of development. The glass-enclosed vacuum has been under investigation and development for the past forty years, first in the incandescent lamp manufacturing plants and laboratories and later by radio tube manufacturers. The result is that its development had been perfected to what now appears to be the highest possible degree. In the case of the metal tube all of the problems encountered in the development of the glass tube have been overcome in a few short months. If this period of time had only succeeded in bringing the metal tube up to the glass tube standard it would be distinctly worth while, but actually the metal tube has progressed somewhat beyond this point and it is a practical certainty that the next year or two will see further developments in metal tubes which have not been accomplished with glass. As a matter of fact, there are two metal tubes shortly to be introduced, one of which has already progressed beyond the possibilities of glass construction—and this is only the starting point for metal tubes.

The foregoing is at the moment perhaps a somewhat intangible point in favor of the metal tubes, but it must nevertheless be recognized as an extremely important one if vacuum-tube and therefore radio development is to continue to progress. There are a number of other, definitely tangible points worthy of consideration. The metal tube, for instance, carries its own shield. Shielding accessories are therefore not required and the shielding is more effective. Moreover, the variations in capacity and resistance in critical r.f. and i.f. circuits, resulting from improperly replaced tube shields, are eliminated. With glass tubes many of the complications which are so hard to track down in a new design, even in audio amplifiers, are due to inadequate tube shielding. This source of trouble is automatically eliminated when metal tubes are used.

The smaller size of the metal tubes is an obvious advantage. Then, too, the shell is unbreakable and the entire internal structure is stronger and more rigid due to special spring bracing and to wider spacing of the internal leads between the elements and the tube base.

Many believed that it was not possible to maintain a high vacuum in a metal shell, but actual development work on this one problem has been carried to a point where the metal tube, as now being made, is equal if not superior to the glass tube in this respect. Actual life tests also show that the modern metal tube can be depended upon to average at least as many hours of service as its glass equivalent.

The skeptics brought up numerous points when metal tubes were introduced, supposedly, to prove that metal tubes had inherent drawbacks. It would be interesting to look back on some of these in the light of the experience of the past year. One point was that one could no longer tell whether the filaments were lighted in a receiver. This is obviously a fact, but is of little consequence, as a metal tube will remain cool if the filament is unlighted. If a tube is warm to the touch after the filaments have been turned on for a few minutes it is certain that the filament is lighted. Another objection was that the metal tubes run hotter to the touch than do glass tubes. It is true that the metal tubes *feel* warmer, but in no case does their actual temperature reach unusual proportions. The metal is a better conductor and radiator of heat. Obviously, the amount of heat generated for a vacuum tube is the same regardless whether the shell be glass or metal. Neither glass nor metal tubes become hot enough to be in any way dangerous and the *feel* of the tube is of little importance. No tube that is handling any appreciable amount of power is comfortable to handle in any case. More important is the fact that the metal shell radiates heat better than glass.

Higher internal capacity was prophesied for metal tubes and *has* materialized. For certain

(*Turn to page* 51)

THE TECHNICAL REVIEW

CONDUCTED BY ROBERT HERTZBERG

Advance Laboratory Practice in Electricity and Magnetism, by E. M. Terry and H. B. Whalin. Third edition. McGraw-Hill Book Co., 1936. This book was written for students who are following a college course in physics. It will be of interest to radiomen because considerable space is given to measurements employed in radio work. There may be some advantage in the study of a book which deals with all electrical phenomena rather than with a limited subject. The physics laboratory employs instruments which are foreign to many radio workers and it would seem that some of these instruments may become useful.

The opening chapter advises the reader regarding the best systematic way of making experiments, then turns to the definition of electrical units and the relations between the electrostatic, the electromagnetic and the practical systems. The second chapter consists of a discussion of galvanometers. Thereafter the chapter headings are: Measurement of Resistance; Measurement of Potential Difference; Measurement of Current; Measurement of Power; Measurement of Capacitance; Magnetism; Self and Mutual Inductance; Elementary and Transient Phenomena; Sources of Electromotive Force and Detecting Devices for Bridge Methods; Alternating Current Bridges; Conduction of Electricity Through Gases; Photometer and Optical Pyrometer; Fundamental Radio-Frequency Measurements; Electron Tubes; Oscillators and Amplifiers.

Each chapter gives some of the theory of the subject and discusses the principles and practice of measurement of the required electrical constants.

Technical Manual, published by Hygrade Sylvania Corp. This is a new edition of the now familiar tube manual. This time several improvements have been included. It is supplied with a spiral binding so that it will lay flat when opened. Then, each tube has a page or several pages to itself; the headings no longer start half-way down the page. Of course, this manual contains all the new tubes and metal tubes which were available at the time of printing. The information on each tube consists of a socket connection diagram, characteristics showing the proper voltage, currents, etc., and a discussion on the best way of using the tube.

In addition there is considerable data on tubes in general, typical circuits, a list of interchangeable tubes and a bias resistor chart.

Clarostat Volume Control Replacement Guide. Compiled and presented by Clarostat Mfg. Co., Inc., Brooklyn, N. Y. 80 pages, 8½ by 11 inches.

This well-prepared book tells the serviceman just what control to use for every volume control and tone control replacement job. It lists hundreds of different receivers, of both old and new styles, and should prove of real value to practicing servicemen who want to make a profit out of their business.

Review of Articles Appearing in the April, 1936, Issue of the Proceedings of the Institute of Radio Engineers

Automatic Compensation for Class B Bias and Plate Voltage Regulation, by R. J. Rockwell and G. F. Platts. A method of automatically compensating for the effects of bias and plate-voltage regulation in class B stages is outlined. It obviates the necessity of using heavy current bleeders where rectifier bias supply is used, and is shown to be more desirable than battery bias. A typical installation using low power tubes is described, but the principle may be applied to installations of any desired power.

Scanning Sequence and Repetition Rate of Television Images, by R. D. Kell, A. V. Bedford and M. A. Trainer. This paper considers factors which affect the apparent steadiness of television images, namely: line flicker, flicker of the image as a whole, alternating current ripple in the deflecting circuits, a.c. ripple in the video frequency signal and various kinds of beating of the a.c. ripple with the various scanning frequencies.

A Proposed Wattmeter Using Multielectrode Tubes, by John R. Pierce. For direct measurements of small amounts of power, or measurements over a wide range of frequencies, standard dynamometer wattmeters are unsatisfactory. The author proposes a new method using vacuum tubes.

Radio Panel Lamps and Their Characteristics, by J. H. Kurlander. The deceiving simplicity of dial lights has caused set manufacturers no small amount of trouble. The author treats these lamps as an integral part of the receiver and gives some practical information about them that radio men will appreciate.

A Fundamental Suppression Type Harmonic Analyzer, by J. H. Piddington. The principles and design of an harmonic analyzer of novel form are described. It operates by suppressing the fundamental and passing the harmonics through an amplifier with a calibrated gain control to a cathode ray oscillograph or vacuum tube voltmeter.

Frequency Control by Low Power Factor Line Circuits, by C. W. Hansell and P. S. Carter. This paper points out the advantages of concentric conductor lines as lower power factor of high Q resonant circuits for controlling the frequency of very high frequency oscillators.

Calculation and Design of Class C Amplifiers, by Frederick Terman and W. C. Roake. A method of calculating the performance of a class C triode amplifier is presented. It is shown how the results of the analysis may be applied in a straightforward manner to lay out class C amplifiers on paper, and to predict power output, power input, plate loss, etc., for any particular set of operating conditions.

Description and Characteristics of the End-Plate Magnetron, by Ernest G. Linder. A new type of magnetron is described which is especially adapted to the generation of centimeter waves.

Review of Contemporary Literature

Better Mixer Controls, by A. E. Thiessen. General Radio Experimenter, April, 1936. Description of a new type of step-by-step volume control that combines the essential features of low noise level and absolute dependability.

Power Supplies. The Aerovox Research Worker, February and March, 1936, issues. Current radio receivers employ power packs of varying complexity, some so involved that their operation is not readily understood from the usual circuit diagram. This two-part article clearly explains the functioning of all types of packs, both for receiving and transmitting purposes.

Coil Manufacturing Costs, by M. E. Fagan. Radio Engineering, April, 1935. A complete analysis of one of the most important phases of radio receiver manufacture.

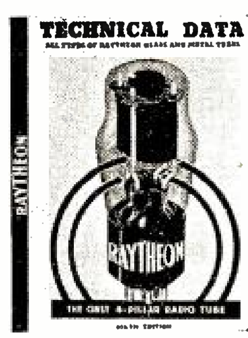
The "Turnstile" Antenna, by George H. Brown. Electronics, April, 1936. A new ultra-high-frequency radiating system which economizes energy by concentrating it in a horizontal plane equally in all directions.

Calibrating Microphones by Means of a Rayleigh Disk, by Michael Rettinger. Communication and Broadcast Engineering, April, 1936. The purpose of this article is to outline the theory and practice associated with the determination of the frequency response of microphones.

Free Bulletins

Engineering Bulletin

A 14-page bulletin, bearing the title, "The Relation of Modulation Products with Multi-Tone Signal to Harmonic Distortion with Mono-Tone Signal in Audio Amplifier Analysis", is issued by the Engineering Department of the Ken-Radio Corporation. Copies are obtainable free of charge from RADIO NEWS, 461 Eighth Avenue, New York City.

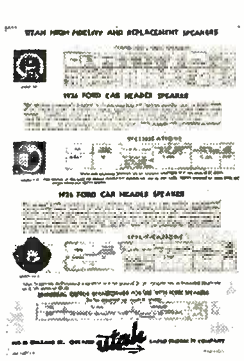


A Valuable Tube Chart

Readers will find the 9th edition of the Raytheon tube chart of great assistance in their work. It measures 11 by 32½ inches, is printed in two colors and the internal connections, as viewed from the tube sockets are given on all types of tubes. The operating characteristics of the tubes are very complete and the information is compiled in such a manner for easy and quick reference. A copy of this chart is available to our readers free of charge. Address requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Public Address Equipment

The general catalog of the Operadio Manufacturing Company describes a very extensive line of high-quality fixed and portable sound reproducing systems, loud speakers, microphones, complete call systems and other essential accessories. Sound engineers will find it a worthwhile guide. Copies are obtainable free of charge from RADIO NEWS, 461 Eighth Avenue, New York City.



Latest Bulletins

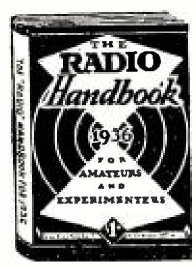
A series of large catalog sheets describing loud speakers, power transformers and audio chokes for amateur equipment and audio amplifying systems, volume controls and replacement auto vibrator units, are available free for the asking from Utah Radio Products Company. Send requests to RADIO NEWS, 461 Eighth Avenue, New York City.

Refrigeration Booklet

A new booklet entitled "Information About Commercial Refrigeration" has just been issued by the Frigidaire Corp. Compiled from field studies and laboratory research, the book contains a wealth of information on the subject of refrigeration and would be a very helpful book to radio men who expect to enter the refrigeration field as a companion business. For a free copy write to RADIO NEWS, 461 Eighth Avenue, New York City.

New Catalog of Short-Wave Receivers

Short-wave listeners and amateurs will want to obtain a copy of the Harrison 1936 catalog listing a full line of popular communication type short-wave receivers, a novel multi-kit unit and popular antenna systems and other accessories. Through the courtesy of the Harrison Radio Company, this catalog is free to our readers. Send in your request to RADIO NEWS, 461 Eighth Avenue, New York City.



"Radio Handbook" Reference Manual for Amateurs and Experimenters

Containing 360 pages and hundreds of diagrams, charts and tables, the 1936 edition of "The Radio Handbook", published by the Pacific Radio Publishing Co., is rapidly establishing itself as the standard reference manual of short wave fans experimenters and amateurs.

The fundamentals of radio are explained, and constructional data are given on receivers and transmitters to satisfy both beginners and "old timers".

The price of this fine book is $1.00. Readers desiring copies may order them directly from RADIO NEWS, 461 Eighth Avenue, New York City. Send check or money order; do not put cash in the mails.

RADIO NEWS Booklet Offers Repeated

For the benefit of our readers, we are repeating below a list of valuable technical booklets and manufacturers' catalog offers, which were described in details in the February, March, May and June, 1936, issues. The majority of these booklets are still available to our readers free of cost. Simply ask for them by their code designations and send your requests to RADIO NEWS, 461 Eighth Avenue, New York, N. Y. The list follows:

F1—Catalog of Radio arts. The National Co., Inc. Free.

Mh1—Sound Equipment catalog. Inter-World Trading Corp. Free.

Mh2—Radio Parts catalog of Bud Radio, Inc. Free.

Mh3—Amateur Equipment catalog of Wholesale Radio Service Co., Inc. Free.

Mh4—Tube Tester Booklet of Supreme Instruments Corp. Free.

A1—Condenser Replacement Manual of P. R. Mallory Co., Inc. Free to servicemen.

A2—"Your Future in Radio", 32 page book of Sprayberry Academy of Radio. Free to readers seriously considering a modern education in radio.

A3—Radio Capacitor Catalog of Solar Mfg. Co. Free.

(*Turn to page* 51)

HERE'S ONE TO TRY FOR

The owners of this station sent in this card showing how they verify reception for listeners who hear their station. We recommend that our readers try for it

The DX Corner (Short Waves)

(*Continued from page 30*)

ers.) Also reported on 17,699 kc. with program to Asmara 10:30 to 11 a.m., E.S.T. (Hull, Holt.)

IQA, Rome, Italy, 14,730 kc., heard transmitting program to Asmara 10 a.m., E.S.T. (Hull, Holt.)

RV59, Moscow, U. S. S. R., 6000 kc., has an English program Monday, Wednesday and Sunday, 4 to 6 p.m., E.S.T. (Westman.)

RNE, Moscow, U. S. S. R., 12,000 kc., now heard Wednesday, Friday and Saturday. 12 m. to 2:30 a.m., Moscow time. (Reilly, Shea.) Observers Hull, Cox and Salazar say they are on daily 4 to 6 p.m., E.S.T. Observer Twomey says that he hears them 11:15 to 11:30 p.m., E.S.T. Still another report says Sundays 9 to 10 p.m., E.S.T.

ASIA

RIS, Tiflis, Transcaucasian Republic, 13,740 kc., heard testing 3:30 to 4 p.m., E.S.T. (Hull.)

HS8PJ, Bangkok, Siam, 10,995 kc., reported on the air Mondays 8 to 10 a.m., E.S.T. (Sholin, Partner, Shea.) Observer Kemp says he has heard them also on 10,070 kc. with the call HS5PJ. They have also been reported heard on 10,190 kc.

ZHI, Singapore, S. S., 6010 kc., reported heard Mondays, Wednesdays and Thursdays 6 to 8:10 a.m., E.S.T., and also on Sunday after 7 a.m., E.S.T. (Sholin.) Observer Costes says the frequency is 6018 kc. and that they are on daily 5:40 to 10 a.m., E.S.T., Sundays 6:10 to 8:40 a.m., E.S.T.

ZHJ, Penang, S. S., 6080 kc., reported heard 7:40 to 8:40 p.m., E.S.T. (Costes.)

F3ICD, Saigon, French Indo-China, will soon be on the air again on 9520 kc. (Lunn, Lower.)

XGOX, Shanghai, China, reported heard on 9600 kc., then on 9500 kc., then on 9460 kc. and lately on 9550 kc., transmitting daily 6:30 to 8:20 a.m., E.S.T., on Sundays 7:30 to 9:30 a.m., E.S.T. (Partner, Costes.)

ZBW, Hongkong, China, 8750 kc., reported heard as per time-table regularly. (Gallagher.)

CQN, Macao, 9490 kc., reported heard Mondays and Fridays 4 to 7 a.m., E.S.T. (Brown.) Observer Scala says the frequency is 9605 kc. and reports hearing them 7 to 8 a.m., E.S.T.

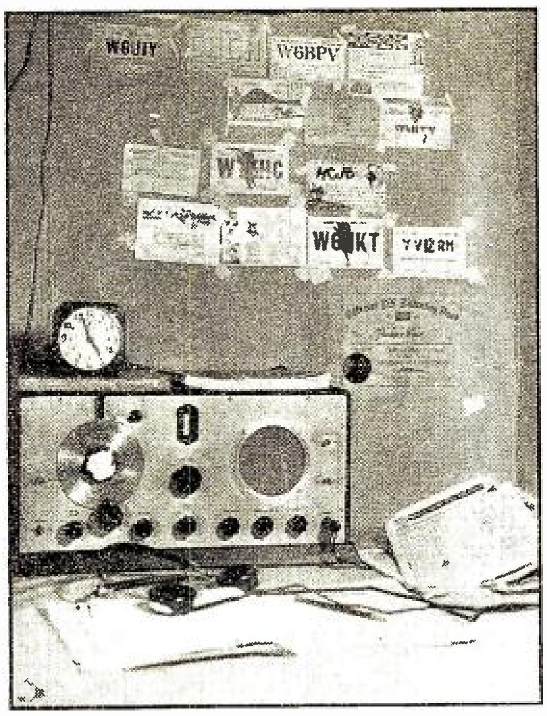
JVM, Nazaki, Japan, 10,740 kc., on the air 4 to 5 p.m. on Tuesdays and Thursdays with American test program. (Coleman, DeMarco, Perry, Twomey, Ishkanian, Messer, Hartner, Gallagher.) They are also reported on the air Saturdays 10:30 p.m. to 12:45 a.m., E.S.T. Observer Richardson reports them daily 4 to 7:30 a.m., E.S.T.

JVN, Nazaki, Japan, 28.14 meters, reported carrying same program as JVM, 4 to 5 p.m., E.S.T., Tuesday and Thursday. (Shea, Jacobs, Gallagher, Messer.)

JVH, Nazaki, Japan, 14,600 kc., reported on same program and time as JVM and also on 12 m. to 1 a.m., E.S.T. This station may replace JVN entirely for the rest of the summer. (Perry, Partner.)

IN PEACE AND QUIETUDE

Not all of our short-wave observers have these kind of surroundings in which to read of short-wave activities in RADIO NEWS. *Werner Howald, L.P.O. for California, is the lucky reader pictured*



ARIZONA DX CORNER

Here's the set-up of Observer Harry Wolf of Camp Verde, Arizona. Notice the prized certificate and ever-present RADIO NEWS *Short-Wave Time-Table*

JVP, Nazaki, Japan, 7510 kc., reported heard Mondays and Thursdays 4 to 5 p.m., E.S.T., irregularly. (Pasquale, Ishkanian, Messer.)

PMN, Bandoeng, Java, 10,260 kc., reported heard Sunday 7 to 10 a.m., E.S.T. (Self.)

PLP, Bandoeng, Java, 11,000 kc., reported heard 6:30 to 10 a.m., E.S.T. (Richardson, Amos, Gallagher.)

AFRICA

CNR, Rabat, Morocco, 12,830 kc., heard after 3 a.m. (Chambers.)

ZTJ, Johannesburg, South Africa, 6098 kc., heard 5 to 6:30 a.m. and 3 to 5:30 p.m. E.S.T. (DeMarco, Mallet-Veale.)

CR6AA, Lobito, Angola, Africa, 7170 kc., reported heard Wednesday and Sundays 2:30 to 4:30 p.m., E.S.T. (T. Adams.)

VQ7LO (Narobi, Africa, reported heard as per Radio News time table. (Ishkanian.)

CR7AA, Lourenca Marques, Mozambique, 6137 kc., 300 watts, reported heard daily 12 N. to 3 p.m., E.S.T. (Westman.)

FIQA, Tananarive, Madagascar, 6000 kc., reported heard 10 to 10:45 a.m. E.S.T. (T. Adams.)

ETB, Addis Ababa, Ethiopia, 11,955 kc., heard Sundays 4:30 to 4:50 p.m., E.S.T., asking for reports to be sent to Radio News. This station due to recent developments in Ethiopia may now be off the air, however. (Styles, Shea, Messer, Hull, Kentzel, Nosworthy, Rogers, H. R. Smith.)

NORTH AMERICA

TFJ, Reykjavik, Iceland, 24.52 meters again on the air as per schedule. (Messer.)

VE9DR, Montreal, Canada, 6005 kc., reported heard Saturdays, 5-6 p.m., E.S.T. (Kentzel, Scala, Rogers, Shea, Millen.) Observer Herman says he hears them 8 a.m.-1 p.m., E.S.T.

VE9DN, Drummondville, Quebec, Canada, 6005 kc., ½ kw., reported heard Saturday nights with messages for the far north, 10:30 p.m.-12:30 a.m., E.S.T. (Herman, Twomey, Sahlbach.)

VE9CA, Calgary, Alta, Canada, 6030 kc., reported heard 7 p.m.-1 a.m. (Loke.)

CRCX, Toronto, Canada, 6150 kc., reported heard 6-12 p.m., E.S.T. (Craig, Ishkanian, Puyenbroek.)

W9XG, West Lafayette, 2800 kc., 1 kw., reported heard Tuesday and Thursday, 7:30-8:30 p.m., E.S.T. (Kemp.)

W2XAF, 31.48 meters, reported best heard American station, 6-8 p.m., E.S.T. (Allison, T. Adams, Ishkanian.)

W2XAD, Schenectady, N. Y., 15,330 kc., reported heard 11 a.m.-2 p.m. E.S.T. (Millen, T. Adams, Puyenbroek.)

W3XL, Bound Brook, N. J., 6425 kc., heard testing with W1XAL. (Cox.)

WIEW, an American Airlines plane was recently heard testing while flying along the Connecticut River to N.B.C. and sending flood conditions to that agency. (Kemp.)

CFAC, 960 k.c. conducts a DX tips program by L.P.O. A. E. MacLean and his partner every Saturday night, 1:30 a.m. E.S.T.

W9XF, Chicago, Illinois, 6100 kc., 10 kw., is now on the air Tuesday, Thursday, Friday and Sunday, 12 noon-1 a.m., 5-12 p.m. and on Monday, Wednesday and Saturday, 12-1 a.m., E.S.T. (Immicke, Ellsworth.)

W8XAL, Cincinnati, Ohio, 6060 kc., 10 kw., reported heard now 6:30 a.m.-8 p.m. and 11 p.m.-2 a.m. E.S.T. (Immicke.)

W2XGB, Hicksville, L. I., 6425 kc., heard 8-10 p.m., E.S.T., and asking for reports. Will verify. (Brown, Belanger, Graham, Lopez, Dressler, J. E. Shields.)

W9XAA, Chicago, Illinois, 11,830 kc., is now on from 8 a.m. onwards. (Kentzel, Adams, Styles.)

WQP, Rocky Point, L. I., 13,900 kc., has been heard relaying N.B.C. programs Sundays, 2-2:45 p.m. E.S.T. (Kentzel.)

W2XE, Wayne, New Jersey, has the following program, 21,520 kc., 11 p.m.-1 a.m.; 15,270 kc., 1-4 p.m.; 11,830 kc., 4-10 p.m.; 6120 kc., 10-11 p.m., E.S.T. (Putnam.)

A DX tip program on KCMC, Texarkana, is held on Wednesdays, 8:30-9 p.m., E.S.T., conducted by O.L.P. James Halsey and O.L.P. Charles Holt of Radio News.

W6XKG, Los Angeles, Calif., 35.6 megacycles reported heard 1:30-5 p.m., E.S.T. (Wennberg.)

KEJ, Bolinas, Calif., 9010 kc., reported heard 11 p.m.-12 midnight E.S.T., relaying N.B.C. programs. (Hull.)

KKQ, Bolinas, Calif., 11,950 kc., heard relaying N.B.C. programs 11 p.m.-12 midnight, E.S.T. (Hull, Moore.)

KKZ, 13,690 kc., heard about 7:50 p.m., E.S.T. (Rogers.)

XECR, Mexico City, Mexico, 7380 kc., heard Sunday 6 to 8 p.m., E.S.T. (Herman, Ishkanian, H. R. Smith, Nosworthy.) Observer Frost says the time is 7 to 9 p.m. E.S.T.

XEQ, Mexico City, Mexico, heard testing on 14,700 kc., 5 to 7 p.m. (Frost.)

XEXA, Mexico City, Mexico, has changed frequency from 6180 kc. to 6130 kc. and is on the air from 8 to 9 p.m. E.S.T. onwards, according to Observer Betances.

XEUW, Mexico City, Mexico, 12,000 kc., reported heard Sundays. (Brown.)

XEME, Merida Yucatan, Mexico, 8190 kc., reported heard 10 a.m. to 3:30 p.m. and 5:30 to 10:30 p.m., E.S.T. (Betances.)

XEFT, Vera Cruz, Mexico, 9620 kc., heard testing 8 to 9 p.m. E.S.T. (Twomey). Observer H. R. Smith says he heard them testing on 6120 kc. at 11:30 p.m., E.S.T., Sunday.

XEWR, Mexico City, Mexico, heard testing on 25 meters just below DJD. (Pasquale.)

CO9WR, Santi Spiritus, Cuba, has changed frequency to 6240 kc. and is heard from 4 to 6 p.m. daily E.S.T. and Wednesday and Saturday 9 to 11 p.m., E.S.T. (Salazar, Sahlbach, Frost.) Observer Betances says they have changed frequency to 6280 kc. Observer Frost says they have changed to 6295 kc. Take your choice.

COKG, Santiago, Cuba, 6150 kc. is heard evenings until 1:45 a.m. E.S.T. (Sands, Salazar, Hansen, Akins, Stokes, Gavin.)

COPG, Santiago, Cuba, reported heard on about 11,435 kc. irregularly by Fletcher.

VRR4, Kingston, Jamaica, 11,599 kc., reported heard 4-5 p.m. and at about 9.45 p.m., E.S.T. (Gavin, Rogers.)

CENTRAL AMERICA

HH3W, Port au Prince, Haiti, 9595 kc., reported heard 1-2 p.m. and 7-9 p.m., E.S.T. (MacLean, Kosvnsky, Brown, Hynek, Stabler, Shea, Salazar, Costes.) Station signs off with the sound of a train running.

HH2Y, Port au Prince, Haiti, heard on 31 meter band Sundays about 10:30 a.m., E.S.T. (Salazar.)

HI3C, Santiago, D. R., 43.48 meters heard 7:30-9:30 p.m., E.S.T. (Harris, Dickes.)

HI9B, Santiago, D. R., 6050 kc., reported heard 6-11 p.m., E.S.T. (Lowe, Hynek, Stabler.)

HIT, Trujillo, D. R., 6630 kc., 200 watts, reported heard daily except Sunday 12:30-2 p.m., 6-9 p.m. and on Sunday 11 p.m.-1 a.m., E.S.T., with a DX program. (Atkinson, Gavin, Kosvnski, Ballina, Clarke, Mechling, Style, Oxrieder, Lowe.)

HI1S, Puerto Plata, D. R., 6420 kc., reported heard 7-8 p.m. (Kentzel.)

HIZ, Trujillo, D. R., 6300 kc., 200 watts, reported heard Sundays, 7:40-10:40 a.m., daily 12:10-1:10 a.m. and 4:40-5:40 p.m., E.S.T. On Tuesdays and Fridays they are also on from 8:10-10:10 p.m., E.S.T. (Gavin, Sahlbach.) Observer Betances says the frequency is 6280 kc.

HI5N, Trujillo, D. R., 6130 kc., reported heard 1:30-2 a.m. (Costes.) Observer Betances says the frequency is 6145 or 6150 kc.

HI1A, Santiago de los Caballeros, D. R., signs off at 8 p.m., E.S.T. (Allison.)

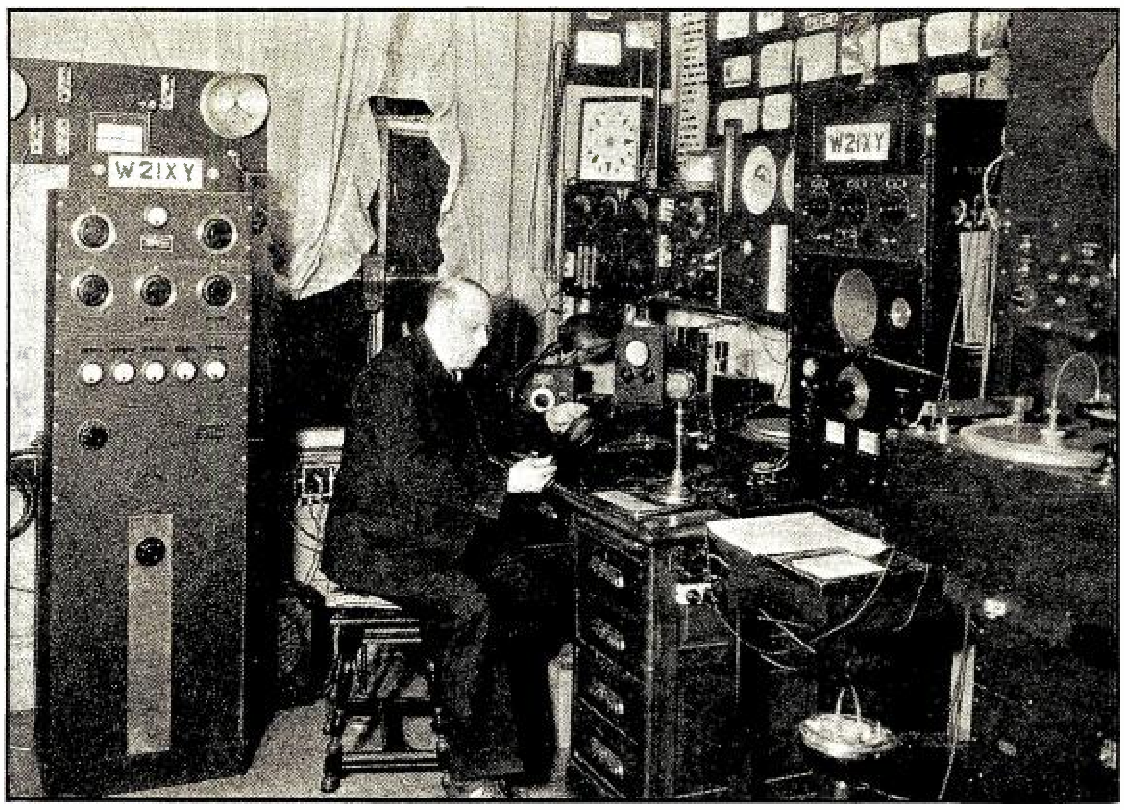
HI4V, Trujillo, D. R., 6475 kc., reported heard 9-10 p.m., E.S.T. (Osbahr, Ballina, Carville.)

TIEP, Trujillo, D. R., 6710 kc., this station reads reports made to the station by American listeners 8-9 p.m., E.S.T. (Gavin.)

TIRCC, Trujillo, D. R., 6550 kc., 500 watts, heard daily 12 midnight-3 a.m. and 5-6 p.m., on Thursdays they are on from 7-12 p.m. and Sundays on from 12 noon to 9 p.m.

HRD, La Ceiba, Honduras, 6235 kc., 250 watts, reported heard daily 7 to 10 p.m., E.S.T., and on Sundays 12 noon to 11 p.m., E.S.T.

(*Turn to page* 54)



CAPT. HALL'S PAGE

HERE in the eastern part of the United States we have found through actual experience and correspondence that there are very few short-wave stations that the listeners living in these parts cannot tune in. African, Asian and Australian stations are our most distant catches, but even these can be (and are) snared by the careful and patient tuner. Some of the newest and rarely heard stations have been logged by East Coast listeners when they had escaped the early attention of most of our Western listeners. Whether this is due to the fact that we spend more time at our receivers here or pay more attention to our antennas, we will not attempt to say.

DURING the past month our reception report has proved to be varied and in some instances rather perplexing, as several stations were only heard once and then some are as yet unidentified. Of course, the most interesting stations proved to be the 14 meg. phone amateur band with the low-powered Australian "hams" taking first place. Between the hours of 11:30 p.m. and 2 a.m. the "Aussies" rolled in and a dozen could be logged with no difficulty at all. Among the best heard were VK3KX, VK5JC, VK2AZ, VK2BK, VK2YW, VK2GF. European amateur stations were often elusive during the winter, but with the coming of summer they started up at twilight and carried on all through the evening. EA5BE and EA3ER, Spain; G5ML and G5NI, England, are on the air nightly. But real DX began when J4CP was logged one morning at 3:45. Mexican, Costa Rican and South Americans are here, there and everywhere.

Turning our attention from the DX possibilities of the 20-meter amateur band we find the 31-meter band bristling with new stations. By far the best is "Radiodefusora Cartagena," whose call letters, after much disputing, have been definitely settled as HJ1ABP. This station (using American custom-built equipment) operates on 9.60 megs. and requests reports be sent to Post Office Box 32, Cartagena, Colombia, S. A. Their programs consist of American recordings, English and Spanish announcements.

HJ1ABE, "La Voz de los Laboratorios Fuentes," abandoned the terribly congested 49-meter band and took a chance on 31 meters, only to find conditions there almost as bad. This station's 9.50 meg. signals are now being heard with good signal strength and excellent quality. Reports should be addressed to Post Office Box 31, Cartagena, Colombia, S. A.

A newcomer operating on 6.12 megs., with the call letters HJ3ABX and located in Bogota, Colombia, has been heard nightly until 11:15 p.m. Signature sign-off is the striking of chimes and the playing of "Indian Love Call." The announcer repeatedly informs listeners that they are "La Voz de Colombia."

XEWI, 11.94 megs., Mexico City, is often heard requesting that reports of reception should be sent to Post Office Box 2874 or telephone in.

GAA, 14.72 megs., Rugby, England, is active nearly every morning at 10 a.m., calling "Hello, LSL or LSY, Buenos Aires."

"La Voz de la RCA-Victor," or HIT, signs off every night at 8:30 p.m. with the playing of "Victory." The station announcer requests that reports be addressed to Apartado 1105, Trujillo City, Dominican Republic.

HJ1ABB, 6.45 megs., Barranquilla, Colombia, has been striking the inevitable gongs (three, then one) during the course of station announcements. Rarely is this station free of code interference.

HC2JSB, Guayaquil, Ecuador, may have a regular schedule, but rarely adheres to it. Heard operating on 7.85 megs., but with a weak, poor signal strength and code and rhumbas were coming through together.

HI3C, La Romana, Dominican Republic, has a fine signal whenever heard on their special broadcasts on Monday from 10:30 to 11:30 p.m. The frequency used is 6.9 megs. Four chimes are used for an identification signal and with the playing of "Sousa's March," this station signs off.

YSJ, San Salvador, has been heard testing on 14.48 megs. and 8.19 megs. This is a fairly new commercial phone circuit and the operator has been "caught" counting from one to ten and A-Z at very unusual times: viz., 10 a.m. or 10 p.m. and midnight.

VJZ, Rabaul, New Guinea, has been heard on Sunday between 5:30 and 6:00 a.m. operating on 13.88 meg. Invariably the program consists of recordings.

VK4HA advises us that they are testing on Mondays between 4 and 4:30 a.m. on 7.12 meg. Power 20 watts (try and log them!). Address reports to: H. B. Mangle, Sisley Street, St. Lucia, Brisbane, Queensland, Australia.

Are you one of those verification collectors who sent a report of reception to XBJQ, the Mexican station operating on 11 meg. and *ARE YOU STILL WAITING FOR AN ANSWER?* Here is the reason your veri never came through. Senor R. Bravo, operator of XBJQ, owned by the National Bank of Mexico, informed us that although from 100-200 reports reached him every day, he answered each and every one. But the QSL cards were sent to the New York branch of the bank to be forwarded to the listeners. Senor Bravo requests that all future reports of reception of either XBJQ or his amateur station (XE1Q) be addressed to P. O. 2825, Mexico City.

The 6 meg. (RV59) Moscow station has been eluding listeners but RNE, 12 meg., has been heard every day at about 3:30 p.m. On the even hour the "Internationale" is played and the woman announcer says, "Hello. Hello. Here is Moscow." Musical selections are played, but the inevitable discussion of Soviet conditions continues to be the popular fare.

HC2RL, insists that they are operating on 45 meters (6.66 meg.) and that they broadcast twice weekly, on Sunday from 5:45 to 7:45 p.m. and on Tuesday from 9:15 to 11:15 p.m. The output power is 150 watts using 100% modulation. They begin and conlude each broadcast with the playing of the Ecuadorian anthem. Address all reports to Dr. Roberto Levi, P. O. Box 759, Guayaquil, Ecaudor. By the way—this station has a new card which is very attractive.

Metal Tubes

(*Continued from page 45*)

applications—particularly in ultra-high-frequency operation—this actually proved to be a drawback, but so far as operation on frequencies up to 30 megacycles is concerned it is by no means a serious consideration. Moreover, this characteristic is one which can be altered when and if the popularity of the ultra-high-frequencies warrants.

This brings us to the one feature that makes the metal tubes less desirable than glass at the present time and that is the matter of price.

It would seem that even the most pessimistic of unprejudiced observers will have to agree that in view of the fact that metal tubes are amenable to future development, whereas basic improvements in glass tubes had just about come to a standstill, the advantages of the metal over the glass mark the season of 1935-1936 as one of distinct fundamental progress so far as tubes are concerned.

The DX Corner (Broadcast Band)

(*Continued from page 39*)

been determined as yet but will be selected from the following frequencies: 119, 600, 620, 660, 800, 820, 840, 850, 860, 890, 900, 960, 1010, 1030 and 1040 kc.

The Technical Review

(*Continued from page 47*)

My1—Information on a new antenna system. Technical Appliance Corp. Free.

My2—Condenser bulletin of Cornell-Dubilier Corp. Free.

My3—Free. Instructive bulletins on measuring resistance and proper use of resistors to extend meter ranges. Aerovox Corp.

My4—Free. Folders on Polyiron core coils. Aladdin Radio Industries, Inc.

My5—1936 condenser catalog. Sprague Specialties Co. Free.

Je1—Sound Equipment Catalog of the Webster Co. Free.

Je2—Radio Parts Catalog of Allied Radio Corp. Free.

Je3—Transmitter Bulletins of the Collins Radio Co. Free.

Je4—Radio Supply Catalog of Wholesale Radio Service Co., Inc. Free.

Je5—Spring Radio Catalog of Radolek Co. Free.

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 52. Resonance

IF the e.m.f. applied to a series circuit having inductance and capacitance is kept constant, but the frequency is increased, the current in the tuned circuit varies as shown by the *resonance curve* at (A) of Figure 1. At first the current increases slowly, then as the resonant frequency (400 kc. in this case) is approached, the current increases very abruptly and after passing through a sharp maximum at 400 kc. (peak), falls very rapidly at first and then more slowly. The voltages across the tuning coil and condenser go through similar changes. The phase between the current and the e.m.f. also changes. It is a negative angle (current leads e.m.f.) at frequencies below resonance, since the capacitive reactance predominates; it is zero at resonance (current and e.m.f. changes are in phase) and becomes a positive angle at frequencies above resonance (current changes lag behind voltage changes), since then the inductive reactance predominates. At the low frequencies the reactance of the condenser is high, so very little current flows. *receiver is said to "tune sharply."* If the resonance curve is more flattened due to resistance, there is not very much difference between the current set up in the tuned circuit by the wanted station and that set up by other unwanted stations of different frequencies, so they may all be heard at once, causing interference, *and the receiver is said to "tune broadly."*

At resonance, the magnitude of the current in the circuit is controlled entirely by the resistance. Its effect is very important in the tuned circuits of radio receivers. The curves at (B) of Figure 1 show the effects of adding various resistances to the circuit whose resonance curve was shown at (A). The smaller the resistance of the circuit, the greater are the voltages across the condenser and the inductance coil. This is due to the fact that the voltage across these reactances is equal to the product of the reactance and the current ($E = XI$). The latter, controlled entirely by the resistance at resonance, in turn produces greater voltages across the reactance when less resistance is in the circuit.

It is seen from (B) of Figure 1 that in the tuned circuits having the higher resis-

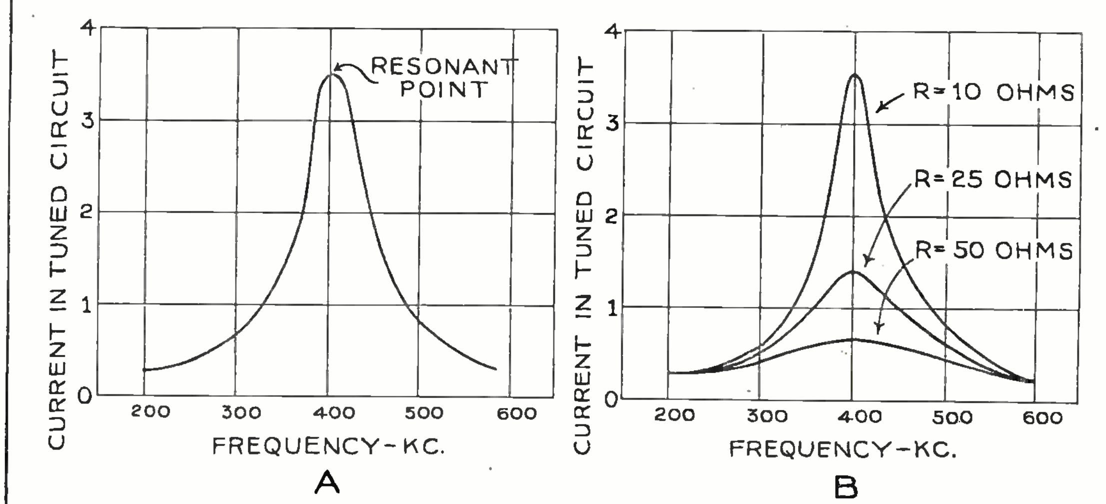


Figure 1. Resonance curves for series tuned circuit, showing the effect of resistance on the current which will flow, and the sharpness of tuning, when a constant voltage of various frequencies is applied to it

Likewise, at the high frequencies the reactance of the coil is high, so very little current flows. This principle is used in radio receivers to separate the signal of the station it is desired to receive from those of all other stations which may be induced in the antenna at the same time by the passing radio waves. When the tuned circuits of the receiver are set at resonance for a particular station broadcasting on a certain frequency, the signal currents from this station will build up comparatively large voltages across the inductances and condensers in the tuned circuits and hence the signal is heard loudly. The tuned circuits offer a much higher impedance to the flow of currents of all other frequencies both above and below this resonant frequency, as shown by the resonance curves. Consequently the incoming voltage impulses from stations of other frequencies cannot set up much current in the tuned circuits, and hence very little voltage is developed across the tuning inductors and condensers and applied to the grid input circuits of the amplifying tubes. If the resonance curve is sharply peaked, the current falls off sharply for all frequencies other than the resonant frequency, and *the*

tance, the current at resonance is very much less than that in the circuits having low resistance, for the above reasons. These are *broadly* tuned circuits. For frequencies much above or below resonance, the currents are practically the same in each case, for here the ohmic resistance is only a small part of the total impedance of the circuit, since the inductive and capacitive reactances do not equal each other, and therefore the current is determined mainly by the net reactance. The curves are not symmetrical about the resonance frequency line, because below the resonant frequency the *capacitive reactance predominates,* and above the resonant frequency the *inductive reactance predominates.*

New Aluminum Recording Blanks

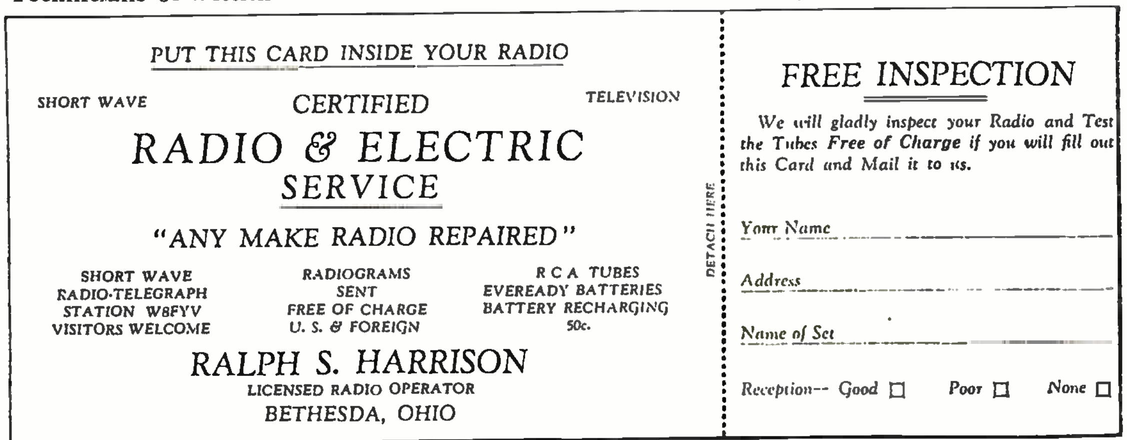
To have a minimum of groove or background noise, the new aluminum recording blanks made by the Universal Microphone Company are put through a special heat treatment, have a highly polished surface and are coated with a composition of special alloy aluminum material which is not subject to deterioration with age.

The Service Bench

(*Continued from page* 41)

$1.00 a year. The scope of their activities—or should one say oscilloscope?—is somewhat indicated in the photograph of Figure 4, showing their booth at the Philadelphia Radio Show. The oscilloscopes are to the left and right. The P. R. S. M. has certainly demonstrated, beyond cavil, the benefits to be gained by intelligent organization.

Servicemen in British Columbia should get in touch with The Associated Radio Technicians of British Columbia. This organization is a live gang of servicemen, working for the good of the craft, and publishing an interesting monthly magazine. The address is Vancouver, B. C.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"ANY MAKE RADIO REPAIRED"
SHORT WAVE RADIO-TELEGRAPH STATION W8FYV VISITORS WELCOME
RADIOGRAMS SENT FREE OF CHARGE U. S. & FOREIGN
R C A TUBES EVEREADY BATTERIES BATTERY RECHARGING 50c.
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LICENSED RADIO OPERATOR
BETHESDA, OHIO
DETACH HERE
FREE INSPECTION
We will gladly inspect your Radio and Test the Tubes Free of Charge if you will fill out this Card and Mail it to us.
Your Name ____
Address ____
Name of Set ____
Reception— Good ☐ Poor ☐ None ☐

FIGURE 3

SERVICE NOTES

Tobe Deutschmann announces that their neon light condenser tester can be modernized to provide positive indication on intermittents by shorting (with a convenient switch) the common plate-grid lead to one side of the O1A filament. Turn the controls to "Leakage 1", "Voltage 5" and "Regulator 100". This test should not be used on electrolytic condensers.

The lads are passing around the word that the new Lynch under-car auto aerial is an excellent bet as the auto radio season is getting into full swing. Many prospects can be caught going and coming—a good auto antenna needed for the summer vacation, and a new one on their return, after a few weeks of rutted mountain roads have scraped everything clear except the crankcase and running boards.

Taking a page from the auto service industry—and perhaps a line or two from RADIO NEWS—the R. C. A. (Parts Division, Camden, N. J.) has developed the serviceman's "Three Point Plan"—combining technical assistance and service merchandising.

The "Three Point Plan" consists of an attractive filing cabinet containing technical data, a book entitled "101 Service Sales Ideas," and a book on "Service Business Methods," written by John F. Rider. These components are illustrated in Figure 5 and will prove invaluable to the progressive serviceman and can be had on a typical merchandising plan from R. C. A. at what amounts to a truly nominal cost.

Ham Gadget

(*Continued from page* 21)

across the terminals "A" and "B" to provide a closed path for the grid bias voltage.

For use with low resistance circuits, the instrument may be operated as an output meter of extreme sensitivity without any external apparatus. The link is left closed, the loop is removed and the circuit under test connected to the loop terminal posts. At audio frequencies, the 50 mmfd. tuning condenser will have no effect. This will be found quite useful for aligning, checking hum levels, etc.

R2 is specified as 300,000 ohms. With some type 30 tubes, it may be necessary to change this value slightly. The value should be such that the no-signal current reading on the 1 mil meter is 30 to 50 micro-amps.

The "Ham" Shack

(*Continued from page* 21)

may have had a good signal strength, but when a stronger one came in on top of it, it "passed out of the picture."

While, as we already have proved, carrier strength in microvolts is entirely dependent on the antenna and the sensitivity of the receiver, under a given set of conditions, it is possible to determine more accurately by meter the comparative signal strength of an incoming signal than by most other means available to the amateur. It means, too, if amateurs relied on meter readings in giving R reports, they would be (perhaps) more disappointing to the listener on the other end, but at the same time they would show what chance a signal has of competing with the QRM at a given location, with a given receiver and antenna. A milliammeter in the plate circuits of the i.f. tubes of the superheterodyne will be quite suitable for this purpose and will show up any difference in carrier.

All this is by way of proving that by giving some attention to the receiving antenna much better results may be had. It would appear from these tests that the doublet gives better results than the L type and vertical antennas. It might be pointed out, however, that the vertical antenna might have been a better performer on signals having vertically polarized waves. Most amateurs use horizontal antennas and therefore the polarization is largely horizontal.

The half-wave receiving antenna, like the transmitting antenna of similar type, gives its best performance when operating at the frequency for which it is cut. Results will be satisfactory on other bands, however, but if good two-band operation is desired, such as 20 and 40, a doublet antenna may be used. A number of the aerial kit manufacturers are making these units for the amateur bands as well as the short-wave broadcasting bands. Also several sellers of kits have doublets that are suitable for all-band operation. One of these in particular has a 30-meter half-wave doublet section with 78-foot feeders, and is so designed that, providing the feeders are kept at their exact length (even though it may be necessary to coil them up in a corner), it will give good results on all

(*Turn to page* 54)

The "Ham" Shack

(*Continued from page* 53)

amateur bands from 160 meters down.

Another important point in using a doublet receiving antenna is to be sure the feeders are matched to the input of the receiver. Receiver antenna input impedances range from as low as 72 ohms (the impedance of the average twisted pair) to 600 ohms. Most of them are in the vicinity of 400 ohms. A 400-ohm line would be one with No. 14 wire spaced at about 2 inches. Variation of as much as 50 ohms in impedance match will make little difference. Obviously, the twisted-pair feeder far from matches the input impedance of the average receiver. Therefore, it is necessary to use some form of matching transformer to meet the requirements of the particular receiver.

On receivers that are not equipped with antenna connections for a doublet, but have only antenna and ground terminals, a special coupling transformer may be used. Such an arrangement will not throw the feeders out of balance, whereas if the feeders were connected to the antenna and ground posts of the set, one side of the line would be grounded to the chassis, and consequently unbalance the feeders. Many set manufacturers make or recommend a specific type of coupler for their receivers.

If it is found that a particular location provides only enough space for a good transmitting antenna, there is no reason why the transmitting antenna should not be used for reception as well. It would naturally be as good a receiving performer as on transmitting. The only problem, of course, is switching from transmitting to receiving. With the Zeppelin type antenna and its normal 600-ohm line, the problem of changeover is somewhat complicated. Several stations have been known to install relay switches in each side of the line which automatically connect the antenna to the transmitter when the power switch is thrown. Manual control could be used, although it is somewhat more inconvenient. The spacing between feeders should not be decreased at the switching point, if at all possible, as this would vary the impedance of the line at this point.

However, with the twisted-pair type of feeder or a medium-impedance, spaced line (400 ohms) a double-pole, double-throw switch may be used conveniently. With the former type the voltage in the line is comparatively low and insulation is not an important factor. Therefore switching from antenna to receiver is a simple matter.

Another important advantage in using a doublet for receiving is the fact it is possible to get away from man-made interference. The antenna may be strung far enough away from such equipment so that the pick-up is slight.

Similar input tests made on the 40- and 75-meter bands showed that the antenna was just as important there.

The DX Corner (Short Waves)

(*Continued from page* 49)

(Anca, Salazar, McKay, Gavin, Pickering, Kosynsky, Sands.) Observer Sahlbach says daily 8 to 11 p.m., E.S.T.

HRN, Tegucigalpa, Honduras. This station has an American appreciation hour Sundays 8 p.m. to 12 midnight, E.S.T. (Young, Osbahr.)

TGWA, Guatemala City, Guatemala, 9450 kc., 8 p.m. to 12 midnight, E.S.T. (Richardson, Sauberlich.)

TG2X, Guatemala City, Guatemala, 5940 kc., heard daily 1:55 to 2:30 a.m. and 5:30 to 6:30 a.m., E.S.T., relaying long-wave station TGW. (Cox, Sands, Akins.)

YN1GG, Managua, Nicaragua, 6400 kc., reported heard 1 to 2:30 p.m. and 7 to 10 p.m., E.S.T. (Loke.)

YNLF, Managua, Nicaragua, has changed frequency to 6451 kc. and is reported heard 8 to 9 a.m., 12:30 to 2:30 p.m. and 6:30 to 10 p.m., E.S.T. (Amos.)

YNVA, Managua, Nicaragua, 8675 kc., reported heard irregularly. (N. C. Smith, Ballina.)

HP5K, Colon, Panama, 6005 kc., reported heard 7:30 to 9 a.m., 12 noon to 1 p.m. and 6 to 9 p.m., E.S.T. (Bower.)

YSJ, San Salvador, El Salvador, 14,485 kc., reported heard 11 to 11:30 p.m., E.S.T., testing with music. (Hull.) Observer Frost says the frequency is 14,450 kc. and he reports hearing the station 4 to 5 p.m., E.S.T.

SOUTH AMERICA

VP3MR, Georgetown, British Guiana, 42.4 meters reported heard 4:30-9 p.m., E.S.T. (Harris, Shea.)

PZ1AA, Paramaribo, Dutch Guiana, reported heard evenings on about 14,050 kc. (Kentzel.)

HJ1ABB, Barranquilla, Colombia, 6447 kc., 300 watts, reported heard 11:45 a.m.-1 p.m. and 5:30-10 p.m. (Ishkanian, Dressler, Craig, Gavin.)

HJ1ABE, Cartagena, Colombia, has changed frequency to 9560 kc. with the same schedule as before. (MacLean, Costes, Stabler, Cox, Carville, Mechling, Dickes, Stokes, Ortiz, Partner.)

HJ1ABP, Cartagena. Colombia, 9600 kc., reported heard 6:45-9:45 p.m., E.S.T. (Harris, Styles, Hartshorn, Jacobs, Brown, Gavin, Salazar, Sahlbach, Messer. Partner, Horwath, Pickering, Holt, Mechling, Moore, Wilkinson, Perry, Akins.) The station announces in Spanish, English and French. Observer Anca says the program is 8-10 p.m. Observer Rich says the program is from 8-11 p.m., E.S.T. Observer Oxrieder says frequency is 9610 kc.

HJ2ABC, Cucuta, Colombia, has reported change in frequency from 5900 to 5970 kc., according to Observer Loke.

HJ3ABE, Bogota, Colombia, reported heard on approximately 12,510 kc., 10:30-11:20 p.m., E.S.T., rings four gongs as identification. (Hull.)

HJ3ABX, Bogota, Colombia, 6125 kc., reported heard 5:15-11:30 p.m., E.S.T. (Perry, Costes, Betances.)

HJ4ABC, Ibague, 6451 kc., reported heard 7-10 p.m., E.S.T., except Sundays. (Hull, Gavin, Loke.)

HJ4ABD, Medelin, Colombia, 5760 kc., reported heard 6-11 p.m., E.S.T. (Kentzel.)

HJU, Buenaventura, Colombia, 9510 kc., 1 kw., reported heard Mondays, Wednesdays and Fridays 12 noon to 2 p.m. and 8-11 p.m., E.S.T. (Trice, Gavin, Perry, Partner, Holt, Styles, Lamb, Moore, Cox, Amos, Frost, Spielman.)

YV6RV, Valencia, Venezuela, 6520 kc., reported heard 5-1:30 p.m., E.S.T. (Sands, Gavin.)

YV3RC, Caracas, Venezuela, 6150 kc., reported heard 11 a.m.-2 p.m. and 4-10 p.m., E.S.T. (Gavin, Jordan.)

YV5RMO, has been off the air for weeks. Who knows why? (Betances.)

YV8RB, Barquisimeto, Venezuela, has changed frequency from 5880 to 5900 kc. Observer Oxrieder says the change is to 5895 kc.

LRU, Buenos Aires, Argentina, 15,280 kc., 19.6 meters, 5 kw., has been reported heard announcing in Spanish and French on Sundays, 11 a.m.-4:30 p.m. (Partner, Stokes, Adams, Jacobs, Gavin, Westman, Hansen.)

LRX, Buenos Aires, Argentina, 9580 kc., 5 kw., reported heard 8-10 p.m., E.S.T. (Partner.)

LSX, Buenos Aires, 10,350 kc., reported heard Wednesdays 10-11 p.m., E.S.T. (Richardson.)

OCEANIA

ZLT, Wellington, New Zealand, 11,050 kc., reported heard 12:45-1:15 a.m. (Kentzel.)

VPD, Suva, Fiji Islands, 13,075 kc., 12:30-1:30 a.m. (Kentzel, Putnam, Moore, Miller.)

VJZ-VKZ, Rabul, New Guinea, 12.9 meters, reported heard 2-3 a.m. and also from 6 a.m. onward. (Lower, Costes.)

VK2DL, Canterbury, Sydney, Australia. This is the station of Mr. W. T. Phelps and transmits music on 41.1 meters, Sundays, 7-9 p.m., E.S.T. Reports appreciated, will verify. (Lunn.)

VK2ME, Sidney, Australia, 9590 kc., reported heard 1-2 a.m., Saturday nights, and on Sundays, 5-9 and 9:30-11:30 a.m., E.S.T. (Gallagher, Shea, Amlie, N. C. Smith, Choo, Schram. Tortoriello, Carville.)

NK3LR, Lyndhurst, Australia, 9580 kc., reported heard 3:15-7:30 a.m., E.S.T. (DeMarco, Gallagher, Bourne, Spielman, Schram, Shea, Amlie. Puyenbroek. Choo.)

VK3ME, reported variously on 9490 kc., 9495 kc., and 9510 kc.. heard 4:30-7 a.m. (Koehnlein, Nosworthy, Choo, Allison, Amlie, Schram, Oxrieder, Tortoriello.)

KKH, Kahuku, Hawaii, 7520 kc., heard at 2:30 a.m., E.S.T. (Spielman, Dressler, Mallet-Veale, Holt, H. R. Smith.)

KZRM, Manila, Philippines, 6140 kc., reported heard 5-7 p.m., E.S.T. (Sholin.)

Readers Who Are Awarded "Honorable Mention" for Their Work in Connection with This Month's Short-Wave Report

S. F. Carville, James A. McGregor Jr., R. B. Oxrieder, Peter J. Tortoriello, Charlie E. Hansen, Rafael Penalver y Ballina, J. E. Puyenbroek, Fletcher W. Hartman, Vincent W. Thurn, George L. Loke, John C. Kalmbach Jr., Oliver Amlie, Edward DeLaet, W. J. Thomas III, Preston C. Richardson, Hans Andersen, John Hartshorn, Fred Leonard Gilmore, Terry A. Adams, Howard Adams Jr., Ralph Clarke, C. McCormick, John G. Hampshire, Joe Klar, Bob Katzenburg, U. L. Jacobs, J. Lunn, H. Mallet-Veale, N. C. Smith, E. L. Frost, Earle R. Wickham, George Sangrik, Arthur B. Coover, G. Hampton Allison, Charles Spielman, Caleb A. Wilkinson, R. W. Sahlbach, James M. Coleman, J. T. Atkinson, G. L. Harris, Leo Herz, Robert Roger, R. H. Tucker, Chan Hwa Choo, Albert Pickering, Arthur Hamilton, Thomas P. Jordan, Ted Stark, Louis Horwath Jr., Frank Nosworthy, George C. Akins, Howard Sauberlich, R. L. Young, George James Ellsworth, Jose L. Lopez, Fred A. Pilgrim, Harry Wolf, Harold H. Flick, R. C. Messer, Joe H. Ziglinski, Werner Howald, Arni Sigurdsson, Harold Self, G. W. Twomey, Manuel E. Betances, H. Francis Shea, Gabriel M. Costes, Kenneth Dressler, R. O. Lamb, Frank Andrews, Juan Manuel Salazar, Leon Stabler, Lewis Miller, Rodney M. Craig, Jarold E. Shields, George H. Fletcher, James Brown, A. Belanger, Joseph Stokes, George W. Osbahr, Harold F. Lower, James E. Moore Jr., R. C. Ludewig, Sydney G. Millen, Fred Cox, F. T. Reilly, G. C. Gallagher, O. C. Dickes, Melton and Gilpin Amos, William Koehnlein, S. G. DeMarco, Charles Holt, Jerry M. Hynek, Wade Chambers, Tom Mechling, J. Wendell Partner, Manuel Ortiz, Clayton D. Sands, R. N. Putnam, A. Kosynsky, A. T. Hull Jr., Ed McKay, Robert Herman, John Wennberg, Howard Adams Jr., R. H. Graham, Arthur Immicke, Orville Brown, Paul V. Trice, Malcomb L. Gavin, Augusto Anca, Harry E. Kentzel, Jack Perry, Fred C. Lowe Jr., George Sholin, Anton J. Cindel, A. E. MacLean, H. Westman, Aram Ishkanian, Harold W. Bower, Enrico Scala Jr., S. Kuromochi, Arthur Leutenberg, Harold R. Smith, C. W. Bourne, H. Kemp, L. C. Styles, George Pasquale, Edgar J. Vassallo, Federico Salas h., C. C. Faulkner, Ian C. Morgan.

Seeing's Believing

(*Continued from page 19*)

supervised the performance of the equipment to the visiting writers. None would officially forecast just "how long" it will take for television to be presented on a commercial scale. And if there's no telling *how long* a thing will take to come about, there's no telling *how soon*, either.

The RCA acknowledged standard of 343 lines, at 30 frames per second, was used at the demonstration and will be applied in the forthcoming New York transmissions.

The RCA official took occasion to declare that his organization is "second to none in the scientific and technical development of television." This can be interpreted as meaning that the RCA, at its will, with the sanction of the Federal Communications Commission, could duplicate or surpass the British and German visual transmissions already announced or started.

Discussions have already been started before the F.C.C. to prepare for the handling of commercial television applications. The preliminary report of T. A. M. Craven, chief engineer of the Commission, calls for keeping television on an experimental basis so that the principal economic effects could be more accurately predicted before the Government gives consideration to the issuance of commercial television permits. The commission, after reading Mr. Craven's report, set June 15, 1936 as the date for a public hearing at which all radio and television interests concerned will be represented.

Mr. Craven's suggestion of keeping visual broadcasting on a test basis seems a formal and essential procedure, but it is apparent that a long delay between the experimental and commercial television stages would let Europe get a long head start on the U. S. A.

As these lines are being written, a report from London indicates that England may have a counterpart of the contemplated New York-Philadelphia co-axial cable in operation before the long-planned American line is in use. The British cable will link the cities of London and Birmingham and will be capable of conveying some 200 telephone messages as well as television transmissions. This cable, now being laid by British Post Office engineers at an approximate cost of $5,000 a mile, tends to indicate that Birmingham will be the first Provincial city to receive the London television service from the Alexandra Palace studios.

In announcing June 29 as the date of starting the service, Mr. Sarnoff declared that experimental receivers in the hands of technical men would determine the requirements and further development necessary to the establishment of a "public television service."

"We have gone much beyond the standards fixed elsewhere for experimental equipment," he declared. But at this point, the usual addendum of caution was made, as follows: "But this is a far cry from the expectations of such a service aroused by pure speculation on the subject. There is a long and difficult road ahead for those who would pioneer in the development and establishment of a pure television service."

5-600 Meter Superhet

(*Continued from page 25*)

W5AXF and W9GIC.

A few of the stations heard on 40 meters include: W9KGW, W9LEP, W9UZJ, W6MLM, W9LXN, W9AA, W9RME, W4OUT, W9PKZ, W4AZK, W8OKY, CO8YB (phone), W3FM, W5FNG, W8OMR, CM6RC, W9KA, VE3AEM, W5EXW, PZ2AK and W9CRP.

The 10-meter amateur band was practically dead during the entire time the receiver was on test. Only during one evening did it open up, then, in addition to a number of local stations, W9FFU, W5JC, W6IWY, W9BLU, OA4J and NY2AE were heard.

Few signals on 5 meters could be copied due to no fault of the receiver, but because most of the transmitters used on this band are modulated oscillators and, of course, suffer a good deal of frequency modulation. The selectivity of the i.f. amplifier is such that it does accommodate the broad character of these "swinging" signals. However, it was found that about 20 percent of the 5-meter signals were stable enough to be intelligible. One crystal-controlled 5-meter signal was copied, and its stability and quality compared favorably with 20-meter 'phone signals.

Some Other Checks

During the short time this receiver was under test at the New York Listening Post in University Heights, the Bronx, some excellent results were obtained on the short-wave broadcast bands. A brief check was also made on some of the amateur bands. Here again the results were excellent. On the 20-meter phone band, for instance, the following stations were heard: VP3BC, HI5X, NY2AE, G6LK, CO2HY, G5JO, G5NI, G5BY, F8CU, G5PT, TI2FG, VO1I, XE3AG, G5QS, PAOFB.

So far as short-wave broadcasting is concerned no attempt was made to compile a really extensive log. It was concentrated rather on picking up some of the more difficult or more distant stations. Of course a flock of European stations in Italy, Germany, France, England, Spain and Holland were brought in. These are just the garden variety of reception. It should be pointed out, however, that many of these stations were tuned in at frequent intervals with decidedly favorable signal-to-noise ratio and with far more than ample volume for ordinary home use.

A better indication of the sensitivity and favorable noise level of this receiver is found in the fact that at this listening post it was found possible to tune in Australian, Japanese and Russian stations; also Portuguese, Belgian and Swiss. On the whole, the record of reception was particularly good considering the short duration of operation at this location.

In the 50-meter band where congestion is extremely bad the crystal filter proved highly effective as an aid in separating stations which operate so close together in frequency as to cause serious heterodynes. In some cases it was possible to separate two stations which without the crystal filter were both completely masked by the heterodyne caused by the beat of their carriers.

Calibration Checks

A final check was made to determine the accuracy of the dial calibration. This check was made on the amateur phone ranges as follows: in the 1800-2000 kc. band the calibration was off only 4 kc. At 3900-4000 kc. it was right on the dot. The greatest variation was in the 14150-14250 band. Here the calibration was 60 kc. off, or one part in 230. In the 10-meter range, 28000-29000 kc., it was off one part in 315. On the 5-meter band the calibration was almost unbelievably accurate, there being no detectable error whatsoever. A crystal controlled station known to be operating on 56 meg. came in exactly on 56 meg. and another station which was known to be operating almost exactly on 60 meg. came in at 60 meg. on the dial.

Intended particularly for amateur operation, the RADIO NEWS tests give convincing evidence that the designers of the ACR-175 have succeeded in building-in a high degree of efficiency. This efficiency seems to be maintained on the short-wave broadcast ranges as well. The receiver is therefore a highly satisfactory one for all types of short-wave reception and demonstrates more than average efficiency even on the regular broadcast band of 540-1500 kc.

Your Vote

(*Continued from page* 10)

even to the President of the United States, all held in such high esteem, may we not appeal for the choice word and the measured phrase, spoken with malice toward none and charity toward all?"

According to Thomas H. Reed, chairman of the Committee on Civic Education by Radio, in a study prepared for the Radio Institute of the Audible Arts, broadcasting has revolutionized the technique of the political campaign. Dr. Reed, a distinguished educator, declared: "The radio audience, not being a mass audience, is not to be influenced by bellowing, arm-waving, or even by any of the subtler physical arts by which a speaker sways a crowd. The radio audience is made up of myriads of individuals and small family groups. No one likes violent noises in his living room, and even small noises reach portentous volume as they emerge from a loudspeaker. The mere strength of wind and nasal resonance have ceased to be factors in politics to the manifest advantage of democracy. Today, any man who has something to say, and can get a chance on the air, can say it to his countrymen without regard to whether his voice is a light tenor or a rumbling bass."

Dr. Reed's point is an intelligent one for the listener, but it is not practiced politically. For example, the Democratic vice-presidential candidate of 1932—John Garner—was kept as far from a microphone as possible, because he did not possess a "radio voice" and his broadcast utterances as Vice-President were so rare indeed that it is difficult to recall one of them. President Roosevelt, on the other hand, an acknowledged good "radio voice," keeps up a schedule of frequent radio talks which, while technically non-political, do carry political significance. It has been noted, too, that Hoover, since leaving the White House, has greatly improved as a radio speaker. His former monotone has yielded to an enlivened style of delivery including inflections and emphasis lacking in the past.

The Republican radio committee has been operating about a year for the current campaign. Thomas Sabin, formerly of Station WBZ, Boston, directs the G.O.P. radio activities. He is assisted by John Elwood, a former vice-president of NBC. Elwood is a nephew of Owen D. Young. William Dolph, former radio chief of the NRA and manager of Station WOL, Washington, heads the Democratic radio committee.

In addition to the usual talks put on by the respective parties in every campaign, indications are that a strong degree of showmanship will be injected. Such devices as theme songs, entertainers, playlets, etc., can be expected to exploit the candidates just as they exploit other sponsors' products. But it's a long way from tenors to tenures and it will take more than music to get a candidate into office.

It is estimated that about a half-million dollars will be spent on combined political broadcasts this year. But this does not represent added profits to the networks. Because other commercial programs have to be cancelled to make room for the political periods, the figure largely represents substituted rather than increased revenue.

Political events will claim a large share of the news commentaries of such men as Edwin C. Hill, Gabriel Heatter and Lowell Thomas, on NBC; and Frederic William Wile and Boake Carter on CBS. The "March of Time" feature of CBS also expects to devote a large portion of the series to political dramatizations.

So keep your ear to the loudspeaker these days and follow the candidates and commentors through the campaign. You will hear plenty! How will it affect your vote?

5-Meter M.O.P.A.

(*Continued from page* 23)

transformer-coupled to the 59 driver. This unit provides sufficient gain for a crystal mike, but it is not shown, as it is assumed that most every "ham" has his own "pet" speech amplifier and mike.

Construction of such a transmitter is relatively simple and can be achieved by the average amateur with very few tools. The chasses measure 17 inches by 12 inches by 2 inches and are finished in black crackle. For optimum results the layout shown should be followed carefully. Special precaution should be given to the isolation of the final stage from the metal sub-panel. It has been found that losses as high as 30-40% result when coils and condensers as well as the tube itself are mounted close to the metal base. Consequently, to avoid this the entire chassis around the final stage was cut out and a piece of bakelite fastened in its place. This design also eliminates the necessity for shielding the 802 buffer. It might be assumed that chances of oscillation in this stage would be high, but such is not the case.

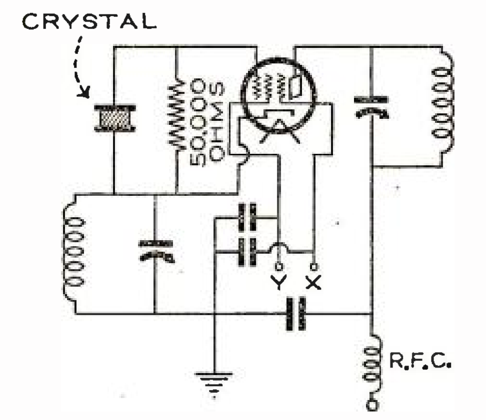


FIG. 3

If a circuit is well laid out and isolation of high-impedance circuits kept in mind, shielding can be almost entirely dispensed with and, as a result, higher efficiency achieved.

All coils are wound with No. 14 enameled copper wire with the exception of the oscillator grid and final plate, which are of No. 12. The remainder of the transmitter is more or less straight-forward practice, as can be seen in Figures 1 and 2.

In adjustment, nothing could be more simple. With the 801, 802 and 89 doubler out of their sockets, apply plate voltage to the oscillator. Check the screen and suppresser voltage with a voltmeter. They should read approximately 200 volts and 45 volts respectively. This tube should oscillate immediately and can be checked with a neon bulb. Operation is identical with any other electron-coupled oscillator.

The plate circuit is tuned to 10 meters by watching for a dip in plate milliameter of this tube. It is possible to use the crystal oscillator circuit, shown in Figure 3, with this rig with similar results when substituted for the electron-coupled input circuit. The 89 doubler is then plugged in its socket and its plate circuit also tuned to resonance. Likewise with the 802 buffer. The next step is quite important and deals with the loading of the 802 buffer with the grip of the 801.

This can be done most effectively by disconnecting the plate voltage from the final stage and placing the 801 in its socket. By watching the grid meter on this tube and rotating the grid condenser, a sharp rise in grid current will result. When properly tuned, the grid current should read between 18 and 20 milliamperes. If a lower reading is obtained, bend the grid coil near or further away from the buffer plate coil. Once this coupling is found, the stage should be neutralized in the usual manner by checking the dip in grid current as the tank condenser is rotated through resonance.

The antenna coupling will depend on the type of antenna or feeder used. In the original tests a Zepp feeder was used, inductively coupled to the plate end of the tank. The remaining step is to connect the modulator and speech and the rig is ready for QSO.

The first stations worked were "locals," all of which gave R9-plus carrier and broadcast-quality modulation reports, stating that it was the best quality they had heard on the band. Later contacts were made at a greater distance with W2BW and W2DKJ in New York City, both reporting very sharp R9 signals. On one particular QSO, W2BW was able to receive our signals through an extremely high noise-level, which practically blotted out even stations less than a mile away. This would tend to indicate that a sharp signal will push through QRM and QRN much better than the average "wobbulated" signal.

At another time, it was possible for W2ECE at Cedarhurst, Long Island, to receive our signals on one of the newer all-wave superhets which go down to 5 meters. In this case perfect reception was accomplished when tuned to zero beat with the beat oscillator operating. His report was: "Just like 20-meter 'phone." Nothing could have been more encouraging than that!

Audio Oscillator

(*Continued from page* 18)

and known it makes little difference what the response is except for convenience, as a calibration curve may be made of the apparatus.

Thirdly, we minimize the lock-in effect through the use of a screen-grid tube in one of the oscillators, supplemented by placing the separate oscillator coils at right angles or by shielding. Thus we can get down to practically a smooth zero-beat. The layout otherwise is not in the least critical. So now for some construction details.

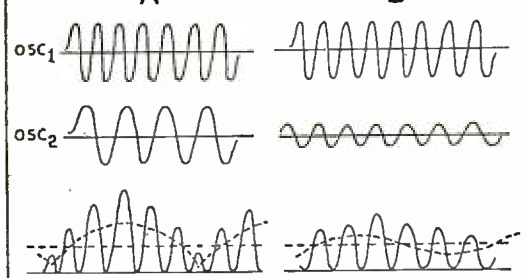
Referring to Figure 1, a 6A7 functions as an electron-coupled oscillator and mixer. Then we have a 6A6, one triode of which performs the duty of beat-oscillator while the other is employed as a one-stage audio amplifier.

Six-volt tubes allow convenient operation from either storage battery or transformer. Well-filter d.c. should be supplied the plate circuits if a power pack is used in place of small B batteries. However, the drain here is very low, making the use of B batteries practical.

The 300- and 500-ohm resistors should be wire-wound, while all other resistors may be of the carbon type. The 10-mmfd. condenser which couples the 6A7 tube to the second plate of the 6A6 may be made by wrapping some No. 26 d.c.c. wire upon an inch length of push-back wire. The amount of coupling is increased from a few turns until the quality of the audio output signal gets no stronger but begins to get a little secondary fuzz on it. This will not be difficult to determine, and then removing one or two turns leaves us at optimum conditions. Some weak signals may come through with no coupling condenser at all. This is nothing to be alarmed about, since it is negligible.

The two tuning coils consist of 225 turns of about No. 30 d.c.c. wire on a 2-inch form, wound in side-by-side pies with center-tap. All sections must be wound in the same direction.

FIG. 2



RECTIFIED R.F. DET. COMPONENT AND AUDIO WAVE (DOTTED)

SHOWING AN AUDIO WAVE POINTED ON ONE SIDE WHEN R.F. WAVES OF EQUAL AMPLITUDE BEAT TOGETHER.

SHOWING AUDIO WAVE OF LESS AMPLITUDE BUT BETTER WAVE-FORM, DUE TO ONE WEAK R.F. WAVE.

For zero beat the total tuning capacity across each coil should be the same for each circuit and the 350-mmfd. tuning condenser should be at minimum. In order further to spread out the lower audio frequencies it is advisable to use a straight-line-frequency type condenser and modify the lower capacity end of C2 by filing the rotor to give a more gradual contour at minimum capacity setting. C12, across the other oscillator coil, serves to set the audio signal to zero when the tuning condenser is at minimum. If zero beat cannot be obtained with the condensers available, take a few turns off the coil of the circuit which must be made to oscillate at a higher frequency. For greater high-frequency range, reduce the mica shunting capacities simultaneously across both tuned circuits. The output transformer may have a secondary to suit any particular need and is left to the builder.

And lastly, about calibrating,. This is very nicely done if a piano is handy, as one can plot ten or twenty points over the range on graph paper and then neatly mark the tuning dial accordingly. Also, a city 110-volt supply makes a nice source, since a small amount of coupling can be made to an audio amplifier and then the oscillator can be made to beat with the 60 cycles, all its harmonics and sub-harmonics. Above this limit, say 300 or 600 cycles, a good ear can easily double any given frequency heard and thus provide the next higher point. A 50-percent increase in frequency is had from the "sol" key of the "do-mi-sol-do" scale.

Beginners Series

(*Continued from page 35*)

bias results. See the circuit of Figure 3. In our model, the very strongest stations could just reach the maximum signal allowable of 1 volt peak.

Constructional

The illustrations clearly show the layout and construction of the unit. The Fahnestock clips are so arranged that it is easy to connect the two units together, or to operate either one separately. It was found necessary to make a small change in the unit described last month in order to have the original switch control the filament of both tubes. This is done by adding a Fahnestock clip and connecting it to the negative filament terminal of the detector socket. The original A— clip is moved over towards the left and the new one put in its place; then both are connected as shown in Figure 4.

The amplifier is built on a ½-inch baseboard 5 inches wide and 6 inches deep (the same depth as the old unit). Mount the parts as shown in the top view photograph. The transformer has its wires marked; the side which has the plate (P) and B+ wires coming out should be turned towards the front. The socket is mounted with the filament terminals towards the back.

The Fahnestock clips on the left edge of the baseboard should be placed so that they come exactly opposite the phone terminals of the one-tube set. Soldering lugs should be employed at each Fahnestock clip. You should also use a small drill to make holes for all screws to avoid splitting the baseboard.

The wiring is simple. Be sure to connect the transformer wires right. The red wire, marked G, goes to the grid terminal of the socket, while the one marked F should go to the A— Fahnestock clip, the one which has the resistor connected to it. This is important for obtaining the right negative bias on the grid.

Operation

Connect the two units together as shown in the top view, keeping in mind the polarity of the A terminals. Then connect the batteries as shown in Figure 5. A 45-volt B battery is employed, the same one as used with last month's set. Those who wish may try higher voltages, but then a 3-volt battery should be inserted at X, with the negative side connected to the transformer, the positive side to A—. The actual operation and tuning remain the same as described last month, because the addition of the amplifier stage does not add any controls.

Readers who made the crystal set described in May can also employ this amplifier unit. The two units can be connected up without any further changes except that there is no filament switch. You would have to take the tube out or disconnect one of the filament wires to turn off the amplifier. The remedy is to put a switch on the main panel and place two Fahnestock clips at the back of the baseboard, the connections are then as shown in Figure 6.

It is possible to use this amplifier with the diode detector described in the May issue, but this would be rather impractical and wasteful. It is therefore recommended that those having the diode receiver convert it for triode operation as described in the article last month. In this way greater sensitivity and output volume will be obtained. Then the one-stage audio amplifier described in the present article can be added as explained above.

Parts List

Amplifier unit:

R_1—15-ohm wire-wound filament resistor

T—United Transformer Co. interstage transformer, type U31

1 Eby base mount socket, four-prong

8 Fahnestock clips, 1 inch overall

Baseboard, 5 inches by 6 inches by ½ inch thick

Lugs, screws, push-back wire

Hearing Aid

(*Continued from page 17*)

and not half-heartedly.

Churches are particularly interested in multi-hearing-aid equipment, probably more so than any other institutions devoted to public gatherings. Most individual hearing aids employed by the hard-of-hearing are found unsatisfactory for use in churches or theaters where the speaker is some distance away from the listener. Church officials are keenly aware of the need of group hearing-aid systems to carry the complete service to those hard-of-hearing and can usually find a way to raise funds for apparatus of this kind.

A complete group hearing-aid system especially designed to meet the above requirements has been developed by H. L. Shortt, Chief Engineer of the Lafayette Radio Manufacturing Company and is shown in the accompanying photograph. In the design, particular attention was given to easy installation and simple operation. Heretofore, such a group hearing-aid system ran into considerable money but this new basic system which includes a 5-watt power amplifier, crystal microphone with desk stand, and six listening station control boxes (but not including the headphones), can be had for approximately $45.00.

In the upper right-hand corner of the illustration is shown the station control-box with its individual volume control and headphone jack. In the lower left-hand corner is the crystal microphone and at the bottom and right are shown headband and lorgnette type headphones. The power amplifier, a four-stage, high-gain circuit employs a type 6C6 as a pentode in the first stage, the output of which is resistance-coupled to another 6C6 tube which is in turn resistance-coupled to a type 6B5 power amplifier tube, a relatively new one in which the output of the first section of the tube is direct-coupled internally, to the second section. Through its use 5-watt power output is obtained. The amplifier is equipped with a jack connected in the input circuit of the first tube, permitting direct operation with a velocity or crystal type microphone. There is also a high-level input jack connected in the input circuit of the second stage for use with a carbon microphone or phonograph pick-up. The amplifier has tone control and an output connection arrangement for an electro-dynamic type speaker.

The specifications show that the harmonic content of the amplifier output is 6 percent at 5 watts, the frequency response flat within 2 db. from 100 to 10,000 cycles, and the gain 116 db. The power line is fused and for safety the amplifier is completely enclosed in a protective, well-ventilated steel screen. The overall dimensions of the amplifier are 6¾ by 7¼ by 12 inches.

Calls Heard

By J. F. Quigley, 645 Polk Boulevard, Des Moines, Iowa, on 20-meter 'phone: EI2J, G5ML, ON4VK, VP9R, CO2AN, CO2AL, CO2KC, CO2WZ, CO6OV, CO6ML, HI2K, HI5X, HP1A, LU5CZ, LU6AP, TI2AV, TI2RC, XE1G, XE2CV, XE2N, K5BL, K6FJF, K6LJD, CO2HY, VE1FE, VE1CR, VE1EQ, VE2FR, VE2SQ, VE2EW, VE2BW, VE2BE, VE2AM, VE2BG, VE2HP, VE2CJ, VE2HY, VE3DF, VE3IT, VE3QS, VE3LL, VE3KV, VE3NF, VE3KF, VE3EO, VE3PM, VE3HC, VE3IX, VE3OK, VE3AAQ, VE3MU, VE3BK, VE4HI, VE4GD, VE4FI, VE4LA, VE5CL, VE5DK, VE5JK, VE9AL.

By Nathan Solmon, 501 West 156th Street, New York City, on 20 meter 'phone: CO2AO, CO2HY, CO2KC, CO2KY, CO2OL, CO2RA, CO2RY, CO2WZ, CO6OM, CO8YB, EA8AF, HH2V, HI1W, HI2KA, HI2W, HI5X, HI6O, HI7G, HK1ABM, HP1A, K4BBH, LU5CZ, LU6AP, NY2AE, TI2AV, TI3AV, VO1I, VP9R, XE1DG, XE1G, XE2CK and YN1OP.

By H. Mallet-Veale, Silverland, Private Bag, P. O. Dindhoek, S. W. Africa, on 20 meter 'phone: W1BR, W1CHG, W1HV, W1JRC, W2BDA, W2BNR, W2BSD, W2EDW, W2FF, W2GDU, W3AHS, W3APO, W3AYU, W3BFH, W4AKY, W4DBO, W4FK, W4YC, W4ZCM, W5BFS, W5ECL, W9GUY, W9KAA.

By F. Earle Hall, Winchendon, Mass., on 20 meter 'phone: LU8DR, LU4BH, LU4BL, LU4AW, LU8AB, LU6KE, LU7AZ, LU6AP, LU5CZ, LU1EX, LU9EA, LU1DA, LU5AN, LU5AR, CX2AK, YV4AC, HCJB, HK1Z, VR2AB, VP3MR, PY1CK, PY2BJ, PY1GK, G2IN, G6XR, G6GO, G5RV, G6YU, G5NI, G5ML, G5VL, G2XV, G5PT, G6FS, G5VM, G6FR, G2BD, G6CW, G5IS, G5CV, G5AU, G5JO, LU2CL, G5YU, G6ON, G6GF, VP7NC, VP9R, VP5AC, VP6YB, G6LK, G5BD, G6QS, F8WK, F8PU, F8DR, F8NH, EI2J, LA1G, HB9AQ, HB9B, ON4PA, ON4AC, EA8AI, EA8AF, EA8AH, EA8AJ, EA2BT, EA3CI, EA3ER, EA3AA, CT1BY, CT1CB, HH5PA, HH2B, K4SA, K4DDH, TI2RC, TI2EA, TI5AG, ZE1JR, VU7FY, PK1MX, VK2QR, VK2BQ, VK5LD, VK2XU, VK2UG, VK3KX, VK2NO, VK3PL, VK7JB, VK2AS, VK2RA, VK2UC, VK3GU, VK3RE, OA4R, OA4J, YN1OP, YN1IP, K7VH, K6FJF, K6CMC, K6FKN, K6KKP, K6LJB, K6KDX, TI6OW, VE5OQ, NY2AE, VE5IK, VK3WW, TI3AV, VP9H, VP2KM, HI2P, VE5DK, HI6O, TI6F, HI5X, HJ1ABJ, VE5JB, TI2FG, VP5AT, NX2Z, HP1A, VE5RC, HK1ABM, VE5OT, VE5CL, VE5HN, VE5KY, PY5AF, VE5ES, X1G, X2FM, X2CK, X2N.

By H. Francis Shea, East Machias, Me., on 20 meter 'phone: W6NLT, W6JJ, W6CLS, W6JYH, W6MXW, W6CC, W6AM, W6BUY, W6KPH, W6EBJ, W6KFJ, W6CNQ, W6DZX, W7FU, W7AXS, W7RF, W7VS, K4SA, K4DDH, K6BAZ, K6KKP, K6KDX, K6CMT, K7DH, K7ELM, VE5OT, VE5KY, CO6OM, CO2WZ, CO2HY, CO7CX, CO8YB, CO2RA, CO2LL, EA3ER, EA4AO, EA6AB, EA8AF, F8DP, G6LK, G5ML, G5IS, G5NI, G6QS, G6DH, G5SP, G5JO, G6XR, G5CV, EI2J, HI5X, HI7G, HK1Z, HC1FG, HP1A, HB9J, HB9BJ, LU8DR, LU8AB, LA1G, NY2AE, ON4AC, ON4CSL, ON4PA, PAIDW, PAFB, VO1H, VO1I, VP2CD, VP9R, VP6YB, VP3BG, PY2ZA, VP4BK, TI2RC, TI2AV, TI3AV, XE1A, XE1G, XE1M, YN1OP.

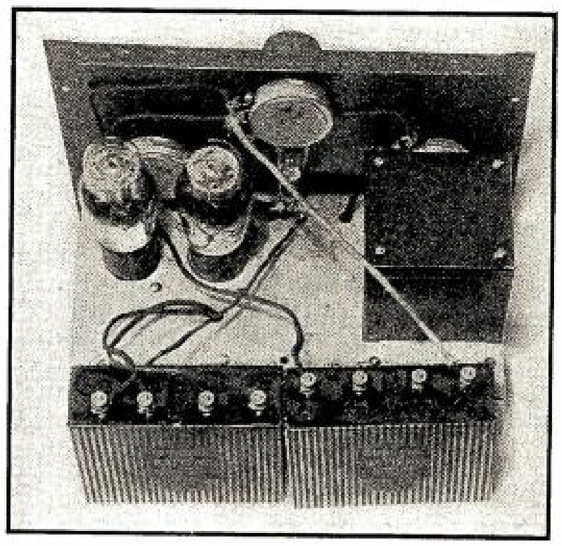
By F. G. Carmichael, 69 Twenty-ninth Avenue, North Hull Estate, Hull, East Yorkshire, England, on 20 meter 'phone: W1BR, W1GG, W1HHQ, W1VA, W1FHY, W1AF, W1FT, W1HCG, W1IFB, W2BF, W2AM, W2GDU, W2HBI, W2FLO, W2HVI, W2GFH, W2BSD, W2IXY, W2BFD, W2EO, W2EOY, W2UK, W3BFH, W3PB, W3BIL, W3BG, W3AU, W3PG, W8HAL, W8HALF, W9BHO, YB4RC, VE2BG, VE1BC.

By N. C. Smith, Kent, England, on 20 meter 'phone: VE1DR, W2EDW, W9KAA, W1DR, W8LCI, W3DHJ, W1IYI, OH2NE, CT1BY, W2HVI, W2ELO, CO2WZ, W2GMG, W2DH, W8GTA, YN1OP, W8HIH, W3AS, TI2RC, W8HAL, W3EHY, CO2FB, CO6OM, W8HAF, W4DAA, W8HEQ, W3CNY, W4CVQ, W8TVF, W9ARK, W9EPI, W1CTD, W1AJZ, W1DKU, W1CHG, W9ATI, W1ADM, W1DFN, W2AIO. On 20 meter c.w.: W8CFF, VE2DC, VE1ET, W2GDU, W3BQJ, W2HNO, OH6NN, W2FLF, W1DEO, W8CJI, SM6WL, U3VC, W8OWB, W8CGI, W1LZ, VE2GO, W8CPV, VK2AE, K6DCU. On 40 meter c.w.: YT7VN, W8NKI, HAF2L, CT2BD, VK2PX, VE1HJ, LA5Y, VE1EP, VK2KS, LX1JW, W3GU, W3GAP, W8ADN, K4CVV, W3HZ, U3VE, FA8WH, HB9AJ, YR5PI, VK3UH, U6WB, SU5NK, VK6KZ, U1CV, U1BC, CM7AB.

The CQ'er

(Continued from page 24)

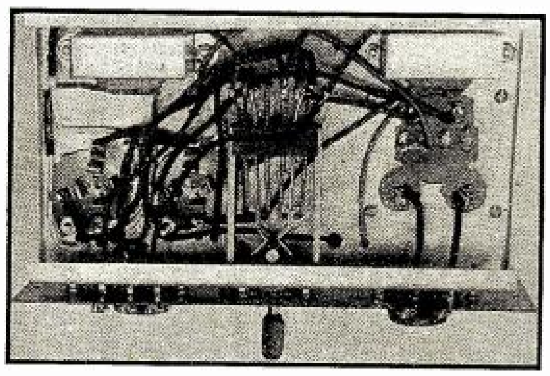
serves also as the plate battery for the oscillators and the 3-volt value is ample for the purpose. The oscillator filaments are connected in series, making the total filament drain 60 milliamperes, and a 4½-volt C battery is used to supply this and will last for months in the average station. Thus the total battery equipment consists of two of these 4½-volt C



batteries, the extra 1½-volt portion of the microphone battery serving to operate the 2-volt, 60-ma. pilot light.

The transformers used in the oscillator circuits are two of the tiny push-pull input transformers ordinarily used in midget receivers. Their quality is unimportant. The microphone transformer is a good quality Amertran "Silcor" type J-771.

The unit as shown here is adaptable to all sorts of changes. It may be used with a single-button microphone, and for those who do not care for the dual-tone idea, one oscillator may be eliminated. Likewise this oscillator scheme whereby the tone is varied by means of either



a filament rheostat or a grid-return potentiometer is applicable to code practice oscillators and because of its continuously variable frequency range will be found much more convenient than the usual shunt resistor or shunt condenser arrangement.

For this particular model a Federal anti-capacity switch of the four-pole-double-throw type was employed. A Yaxley gang switch would serve the purpose just as well, although less compact. The Insuline cabinet employed accommodates the equipment nicely. Its dimensions are 9 inches long, 5 inches wide and 6 inches high. The chassis is also a standard Insuline unit 8½ inches by 4¾ inches by 1½ inches. Clarostat potentiometers (200 ohms) and rheostat (50 ohms) were used, although any other units of similar values would serve the purpose.

One or two hints may be useful to those who may want to duplicate this model using the same chassis and cabinet. The chassis is a little wide to slip into the front of the cabinet due to the front flanges on the side walls. If part of one of these flanges is cut away, this difficulty will be overcome. In the model shown here a section about 2 inches long by 5/16 inch wide was cut away between the mounting screw holes in the flange at the right. This cut-out section is hidden from view when the panel is in place. If this plan is followed it will be necessary to insert 3/16 or ¼-inch bushings between the panel and chassis. No screws need be used for this purpose, as the mounting screws used for the lower terminal strips and the switch plate will serve to fasten the chassis rigidly to the panel. It is a good idea to attach the chassis direct to the panel in drilling these mounting holes in order to be sure that the holes will line up exactly and also to save duplication of effort.

16-Tube Super

(*Continued from page 22*)

type IV rectifier for the grid-bias supply.

Front panel controls are sufficient in number to provide the utmost flexibility for all types of service. They include r.f. gain, fidelity—selectivity, main tuning, bandspread tuning, i.f. gain, a.f. gain, tone, and beat frequency pitch. In addition there are five switches: send—receive (standby), a.v.c.—manual, c.w.—phone, headphones—speaker and a.c. off-on.

The construction is unusually rugged throughout. The band-change switch was designed especially for this receiver. It is built in five sections, each completely shielded from the others. Each section consists of a double-pole, five-position unit in which silver-plated knives engage spring contacts of silver-plated bronze. Each of these contacts has six separate fingers to insure dependable and low-resistance connections. The switch has no stop and may therefore be rotated in either direction from one position to any other position.

Controlled by this switch are twenty-five coils in separately shielded compartments of five coils each, thus the four coils for any given range are individually shielded from another. The five antenna coils are provided with electrostatic shields between their primaries and secondaries to avoid capacity coupling between the antenna and the first two. This makes the use of a good doublet antenna particularly effective and permits the fullest advantage to be taken of the characteristics of a good antenna, both from the standpoint of signal pick-up and noise reduction. The receiver is available in either rack or table mounting form. There is also a model available which includes a crystal filter.

The author has had one of these receivers in operation for some weeks in his listening post and has been obtaining excellent results from every standpoint. Particularly impressive is the excellent signal-to-noise ratio and the resulting high degree of usable sensitivity. A more complete report covering "on the air" tests which are now in progress at this listening post will follow in a later article.

Crystal Control

(*Continued from page 24*)

5-meter band in metropolitan areas.

The photograph accompanying this article shows the transmitter installed at the Westchester Listening Post (W2JCY) from which station some of the experimental transmissions were carried out. The exciter is mounted in one of the new Insuline sectional, unit-mounted cabinets recently developed for amateur use. The bottom section contains the power supply, the middle section contains the audio channel and the top unit contains the exciter. At the top are shown the three Triplett meters, the first for plate current on the first three tubes, the center one for grid current on the final and the third plate current on the final exciter stage. The meter in the second section is, of course, for registering plate current on the modulator. The four controls attached to the tuning condensers, for lining up the various stages, are shown on the top section. The two snap switches at the right of the lower panels are for the filament and the two at the left of these panels are for the plate supply for the modulator and r.f. units. Most of the test work on this transmitter has been conducted from the author's home and also at various heights from some of the tall buildings in lower New York. These tests have been made under the calls W2IRM and N2IRM. As the experimental work on this type of transmitter comes to completion and the final model is placed on the air at W2JCY, a complete description of the rig will be given in RADIO NEWS.—*Ralph Clark, Lieutenant J. G., U.S.N.R.*

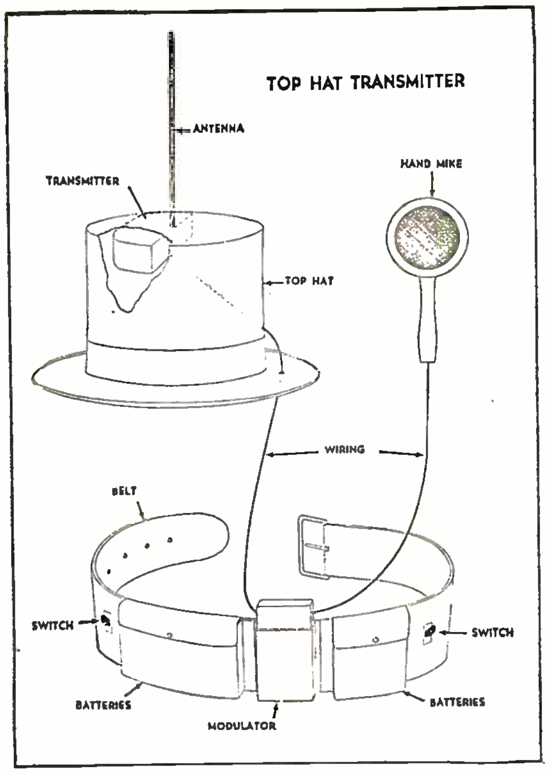
Unique Transmitter

(*Continued from page 35*)

of the thirty cells resembling an elongated 14-gauge shotgun shell. These deliver 180 volts for the set's plate circuit. The other side of the belt carries a 4-cell A battery of 6 volts for the filament circuit and a standard type flashlight battery of 1½ volts to energize the hand mike. The belt also contains controls and switches.

The microphone is of convenient size. It is a high-level output unit of the carbon type. A not-too-conspicuous wire links all circuits with the transmitter and antenna in the hat. The antenna consists of a hollow aluminum rod sticking 6½ inches out of one side of the hat.

So, these days when an announcer puts on his top hat for an assignment, the program is likely to be "on the hair" as well as on the air.



6L6 Tube

(*Continued from page 17*)

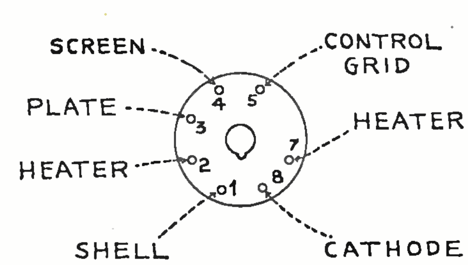
in the unusually low percentage of distortion in the push-pull Class A and Class AB circuits.

The operating instructions warn especially against exceeding the ratings. It is important not to exceed the dissipation rating with normal line voltage variations. Similarly, the heater voltage should be kept close to 6.3 volts; in no case should it go above 7.0 volts.

Resistance coupling can be employed only when no grid current flows, that is in Class A, and Class AB, conditions and only in self-biased circuits. The resistance in the grid circuit should not exceed 0.5 megohm. Furthermore, resistance coupling should not be used if the filament voltage is likely to rise more than 10 per cent. above its normal value. In fixed biased circuits, the maximum allowable resistance in the grid circuit is 50,000 ohms.

The physical dimensions of the tube are: maximum overall length 4 5/16 inch, maximum diameter 1⅝ inch. This is the first of the metal tubes which has a greater diameter than the standard 1 5/16 inch of all the others. A standard 7-pin octal socket is used and the prong arrangement is shown in Figure 1.

Figure 2 and Figure 3 are families of plate-voltage, plate-current curves for different values of grid-bias and for two different screen-voltages. Technical information for this article was supplied by RCA engineers.



BOTTOM VIEW OF BASE

FIG. 1

R. M. A. Convention

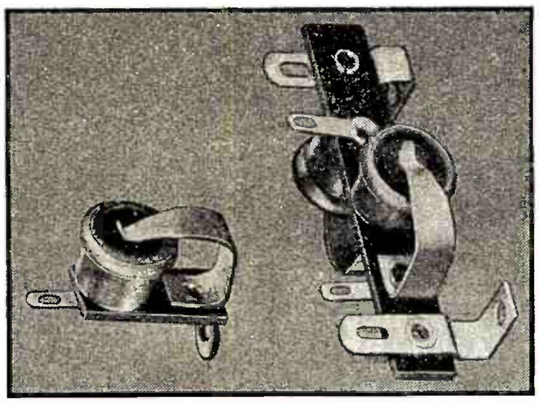
Washington, D. C.—The Radio Manufacturers Association will hold its twelfth annual convention on June 17-19 in the Stevens Hotel of Chicago, Ill. Plans for sales promotion projects will be presented to the convention.

WHAT'S NEW IN RADIO

WILLIAM C. DORF

(*Continued from page 9*)

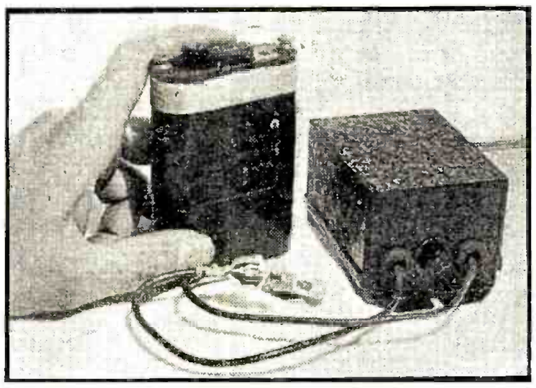
tubes in a radio receiver. Special mountings have been developed and can be obtained either as an individual unit or as an in-



tegral part of a strip for connecting several cells in series.

Tiny Storage Battery

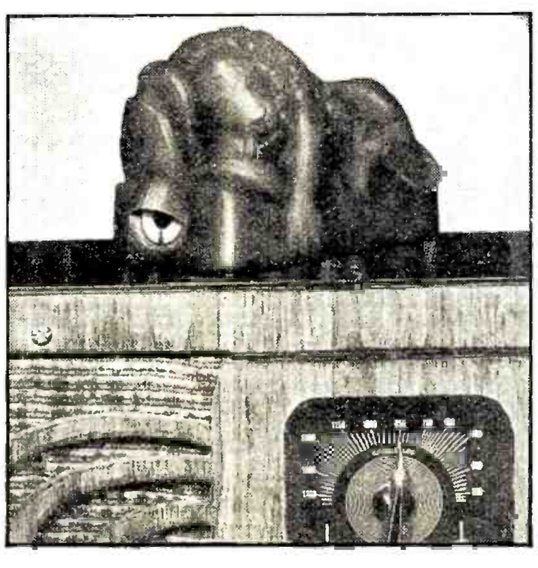
A rechargeable battery measuring only 1 by 2⅞ by 3½ inches, especially designed for use with hearing-aid equipment, is introduced by the H. E. Clark Company. It is available in three types to deliver 2.2,



4.4 and 6.6 volts with a single charge capacity three times that of the standard hearing-aid dry cell of equal size. The battery is "spill-proof" and may be safely carried in the pocket. Its weight is only a few ounces. The dimensions of the small self-regulating charger also marketed by this company is 2 by 2½ by 4 inches. It operates from the 110-volt a.c. line supply.

Cathode-Ray Tuning Indicator

The Magic Lion Manufacturing Company introduces a cathode-ray tuning indicator device housed in a bronze-finished metal statuette of the "Lion of Lucerne," copied after the famous statue hewn from the solid rock in Lucerne, Switzerland. The device presents a pleasing appearance and at the same time is a helpful tuning indicating device for the receiver. It can be



easily connected to any type of set whether or not it incorporates an a.v.c. circuit. The tubes employed include the 6G5 and either the 6E5 or 2E5 "magic eye."

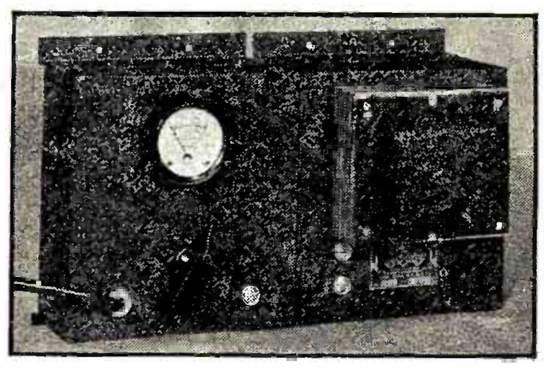
Portable Set Analyzer

The Clough-Brengle Company introduces an improved model 85 "Unimeter" with an easy-to-read 5-inch fan type meter. This convenient point to point set analyzer and all-purpose testing unit has a.c. and

d.c. voltage ranges of 0-15, 150 and 750 volts, resistance ranges up to 2 megohms and current ranges to 150 ma.

Line Voltage Compensator

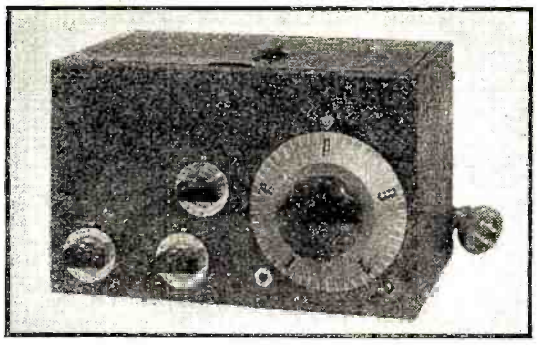
The Sales-On-Sound Corp. makes this special line-voltage regulating device to compensate for fluctuating power line



voltages. A unit of this kind safeguards theatre amplifiers and makes it possible in those locations troubled with variable line voltages to provide a smooth-running performance. It maintains a 110-volt input to the amplifiers at all times, from line voltages of 80 to 145 volts.

Beat-Frequency Oscillator Kit Now Available

Servicemen will be interested in the Philco beat-frequency oscillator kit, designed to be quickly and easily assembled and wired. All of the necessary eyeleting work on sockets and output connections is done beforehand by the manufacturer and the shield cans are spun into place on the sub-base, which should make it a simple matter for the serviceman to mount the necessary parts on the chassis and wire the units in accordance with the instruction sheet furnished with the kit.



Super-Regenerative Receiver

The latest product to be announced by the National Company is the Model 1-10 ultra-high frequency super-regenerative receiver which has a wavelength coverage of 1 to 11 meters (frequency 300 to 27 megacycles). The circuit comprises one r.f. stage using a 954 type "acorn" tube, a self-quenching super-regenerative detector with a type 955 "acorn" tube which is transformer-coupled to the first audio stage employing a 6C5, in turn resistance-coupled to the 6F6 power-output tube. Single-control tuning is employed, utilizing the famous National "micrometer" dial.

R.F. Plate Chokes

The Ohmite Manufacturing Co. recently brought out a new line of single-layer wound r.f. plate chokes for transmitting equipment. The new units are wound on porcelain tubes and are covered with an insulating moisture-resisting material to hold the turns firmly in place. Because of the single-layer winding, the difference in potential between the adjacent turns is small and the possibility of breakdowns between turns or collapse due to inductive effect are minimized. Four types are available for use with equipment from 5 to 160 meters.

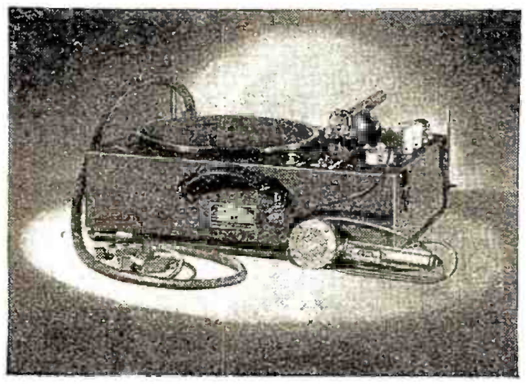
New Velocity Microphone

The Electro-Voice Manufacturing Company has introduced a series of high-fidelity velocity microphones, new in

design and construction. The ribbon assembly is suspended from the frame in a shock-proof mounting and it is protected by an inner screen. To obtain maximum flux a cobalt magnet of improved design is employed. The microphone is available in several models with output levels ranging from minus 85 to 64 db. The specifications state that the upper cut-off begins at 14,000 cycles. All models can be supplied in either low or high output impedance.

Portable P. A. System

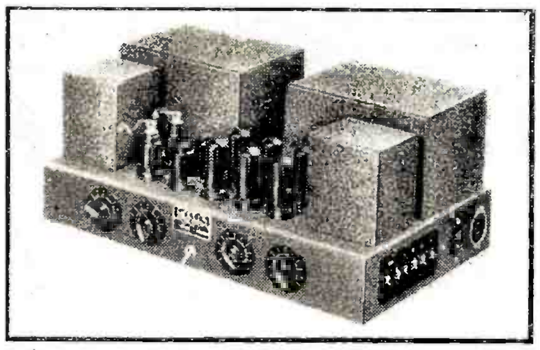
The Operadio model 112 mobile P. A. system operates from a 6 volt storage battery and is designed to deliver up to 20 watts power output, Class A. The dual-speed turntable can play records up to 16 inch size. The amplifier is complete with a crystal, contact-type hand microphone and the circuit is designed to mix microphone and phonograph inputs. If desired the complete unit can be set on the front seat of a motor car alongside of the driver and for this purpose the bottom of the case is adjustable to any angle to maintain a level turntable, regardless of the pitch of the seat itself. With electioneering about to break on all fronts, here is a complete sound reproducing system designed to carry



the message of the candidate with clearness and volume to his audience.

Metal Tube Power Amplifier

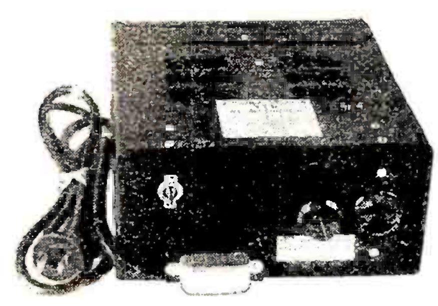
The accompanying illustration shows the new Morlen 38-watt sound amplifier. The tube equipment comprises two 6F5's and two 6C5 triodes in the voltage amplifier,



two 6F6's as "power-drivers" and four 6F6's in the output stage. It is equipped with a two-position input mixing circuit and a universal output of 4, 8, 15 and 500 ohms.

D.C.-A.C. Inverter

The new line of American Television & Radio Company's d.c.-a.c. inverters features long-life vibrators, four-point voltage regulators, quiet operation and built-in filters. Included are 16 different types designed to operate on d.c. input voltages ranging from 6 to 220 volts and to supply a.c. output voltages of 110 or 220 volts.



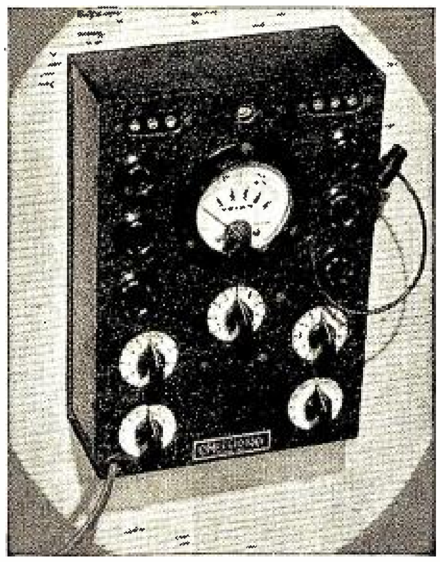
The overall dimensions of the unit shown are 3⅞ by 7¾ by 8 inches.

Personal Receiver

An announcement was recently received from the Pilgrim Electric Corp. of their model 4Z compact table-model receiver designed to operate from either 110 volt a.c. or d.c. line supply. An adapter is available for 220 volt operation. The tubes employed include one 78, one 6C6, one 38 and a type 76. It has a tuning range from 170 to 555 meters. The set is housed in a walnut-finished steel cabinet.

A New Instrument for the Serviceman

Exceptional versatility is featured in the new model TA tube tester and point-to-point analyzer announced by the Million Radio and Television Laboratories. It tests all metal and glass tubes in present-day use and incorporates a neon short-testing circuit, d.c. voltmeter ranges up to 500 volts, ohmmeter ranges of 0-5000 ohms and 0-3 megohms capacity measurement range



of .01 to 3 mfd., and current-measuring ranges of 0-100 ma. and 0-10 amperes.

A.C.-D.C. Superheterodyne

The Emerson model 119 all-wave set features "micro-selector" tuning and is

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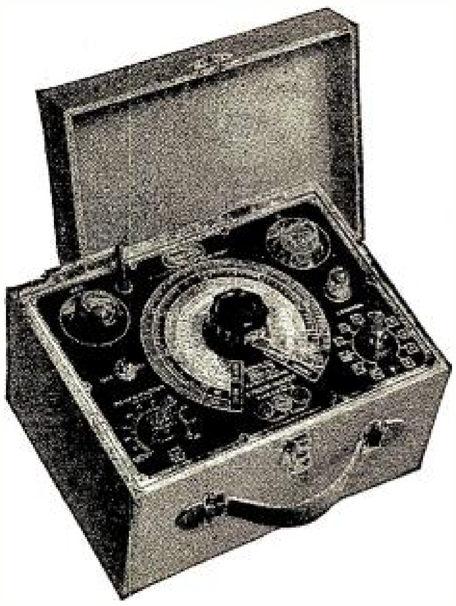
equipped with an 8-inch dynamic type speaker. The tube equipment comprises one 75, one 43, one 25Z5, two metal 6A8's and two metal 6K7's. The set is enclosed in a walnut cabinet measuring 16¾ inches high.

A New Instrument

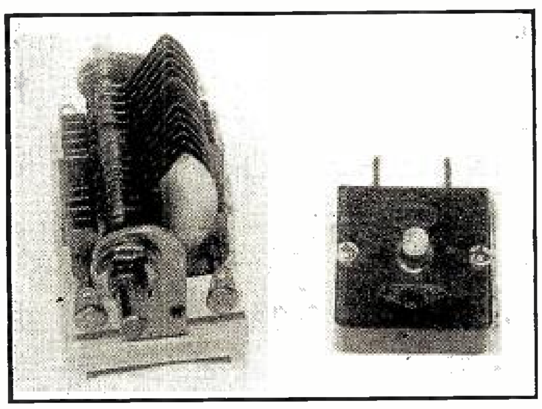
The Solar Manufacturing Corp. introduces a new capacitor-analyzer and resis-



tance-bridge designed to meet the requirements of the engineer as well as the serviceman. All readings are secured direct from a color-coded panel. This unit is available in two models, both of which are housed in wood cabinets with detachable hinged covers.

Two New Parts

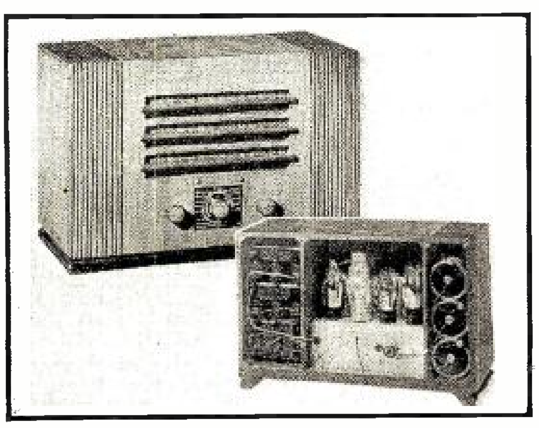
The Bud double-spaced, two-gang midget condenser shown at the left of the illustration has a capacity of 35 mmfd. per section. It is primarily intended for use in trans-



mitters. At the right of the illustration is the Bud crystal holder, recommended for use with crystals covering frequencies from 500 to 7000 kc. Will hold crystals up to 1 1/32 inches square by .25 inch thick. It has an adjusting screw to permit fine pressure adjustment of floating plate to crystal.

Portable Battery Set

In the design of the new International Kadette model 400 receiver the salient point is low battery current drain. Com-



pletely portable with aerial attached and all batteries self-contained, the set weighs approximately 25 pounds. Employing 3 standard 1½ volt dry cells for "A" supply the set is designed to provide approximately 300 hours of battery life. It is a dual wave-band set providing both standard and short-wave programs. The tubes used comprise one 1C6, one 34, one 1B5 and one 950.

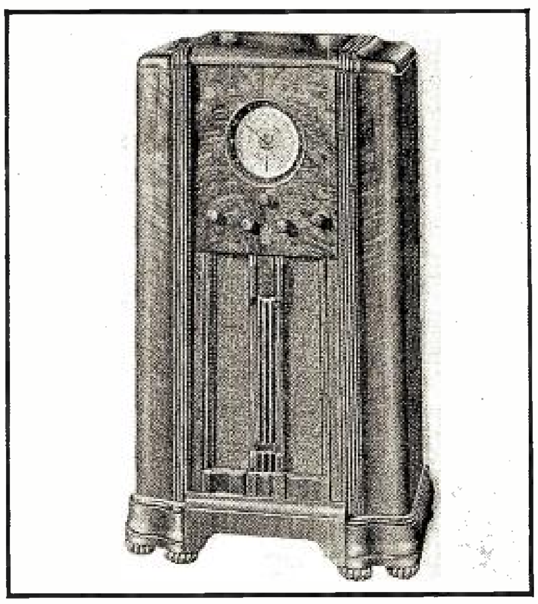
Crystal Microphone

The Turner "Hi-Level Master" model 24 crystal microphone is designed to have a frequency response flat from 500 to 6000 cycles with a rising low frequency characteristic of approximately 5 db. at 50 cycles. The instrument has an output level of minus 54 db. It is especially suited to

broadcast studio use and public-address requirements.

All-Wave Set with Volume Expander

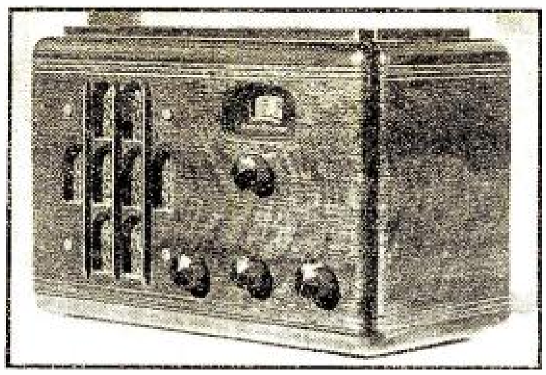
The accompanying photograph shows the new Crosley "Barkentine" console. It



utilizes 11 metal type tubes, covers a frequency range, in 4 bands, from 150 to 19,000 kc. The outstanding feature of this receiver of which there are many, is the "Auto Expressionator", a circuit for reproducing the volume variation of music as it is rendered by the artist. Other features include an automatic bass compensator, live rubber mounted tuning unit, large dial with timelog tuning, and a special sounding board.

5-Tube Table Model

The General Electric model A-54 universal a.c.-d.c., dual wave-band, 5-tube receiver covers a frequency range from 7500 to 540 kilocycles. The metal tubes employed



include the new types 6Q7, 25Z6 rectifier and a 25A6 power amplifier pentode.

Latest Instrument

A frequency modulator-signal generator which employs no motor has just been introduced by the Triumph Manufacturing Company. The "Wobbulator," as it is called, provides a directly calibrated frequency range of 100 kc. to 30 megacycles

with constant 30 kc. band-width frequency modulation. Working in conjunction with a cathode-ray oscillograph, it is especially designed for visual alignment of i.f. and r.f. receiver circuits.

Service Business Becoming More Complex

By Samuel C. Milbourne

The radio service business will become more and more complex as time goes on. In the past few years straight T.R.F. circuits have given way almost totally to the superheterodyne. The latest trend in receivers seems to be towards the perfection of the final detector and audio stages as therein can be found the majority of program distortion. High-fidelity systems are becoming more and more prevalent—testing to the fullest the serviceman's knowledge of his business. The near future will see the cathode-ray tube come into its own through its use in television, test apparatus and control circuits. The average serviceman would even now be hopelessly lost if he could not rely on accurate test instruments for his electrical eyes, ears and nose and standard radio manuals for his memory. A combination of standard test instruments (tube checker, analyzer and signal generator) plus a set of standard radio manuals plus common sense can still render good radio service.

A Telephone Extension in Your Car

A new invention by Dr. Domenico Mastini of Turin, Italy, permits the operation of an automatic telephone from the car of a subscriber. The communication between the car and the home is accomplished by ultra-short waves. The problem has been so worked out with relays, etc. that the car owner operates his dial telephone in the car just like he would handle the one at home. When speaking, the speech travels by radio to his home, from there through the telephone apparatus to the exchange and to the other subscriber. The apparatus also provides for incoming calls. A bell will ring to warn the driver.

The Radio Workshop

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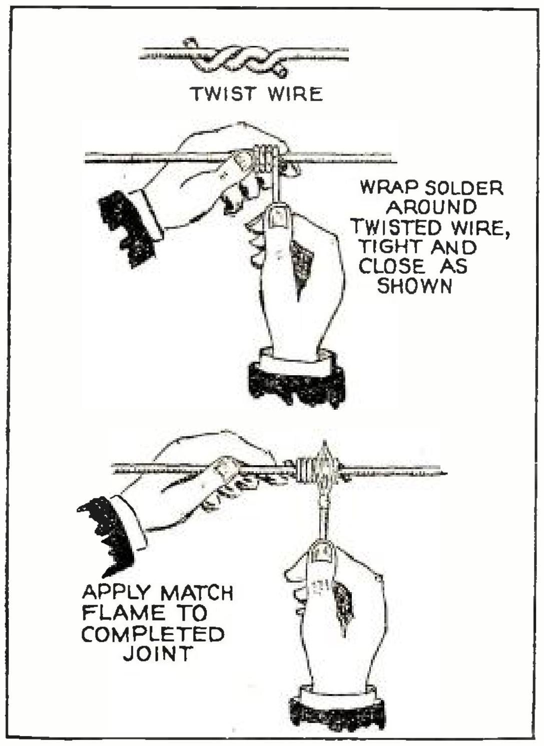
in thickness. The tool is made of hardened steel, punches-out clean round holes, is easy to use and should meet a long-felt want for cutting holes in iron, aluminum or other metal chassis, sub-panels, etc.

Soldering Without an Iron

The following soldering kink makes for a simple and easy soldering job that will really hold and will prove useful for those



occasions where an iron cannot be used or where an alcohol lamp or blow torch is not available. Simply wrap a 3 to 4 inch strip of rosin-core solder around the joint that is to be soldered. It should be wrapped closely and tightly and it must be rosin-core. The heat can be derived from matches or a candle. It does not seem possible that matches will supply sufficient heat to melt the solder and heat the copper joint so that the solder will hold, but I tried it and found that it worked. The new long souvenir matches measuring approximately 4 inches in length provide a larger and longer flame over the standard type size match and made the job that much easier.

W. N. CHELSEY,
Chicago, Ill.

Radio on the Green Diamond

The newest diesel-electric stream-lined train, known as the "Green Diamond" and used on the Illinois Central Line between Chicago and St. Louis, is now equipped with radio. A General Electric 12-tube receiver is located in the diner-lounge while loudspeakers with individual volume controls are located at forward and rear end of each chair and lounge room.

Making Airplane Landings Safe

An automatic radio-controlled steering apparatus, which will land the airplane safely without the aid of the pilot, has been developed by United Air Lines' engineers at the Oakland, Calif. airport. The new "giro-pilot" is operated by radio beams and controls the airplane rudders and ailerons so as to follow a curved beam down to the field. The pilot, when picking up the beam, throttles down to 85 miles per hour and then lets the robot do the rest. The plane will be landed safely regardless of fog or bad weather. This development will eliminate many accidents, it is believed.

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