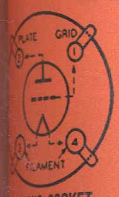
25c [30c in Canada] AUGUST, 1934 $3.00 PER YEAR BY SUBSCRIPTION

RADIO

ESTABLISHED 1917

SHORT-WAVE AND EXPERIMENTAL

BOTTOM VIEWS OF SOCKETS



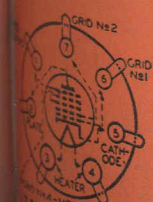
4-PRONG SOCKET
10, 45, 210, 30, 31, ETC.

5-PRONG SOCKET
26-46-47-76-27-37

6-PRONG SOCKET
245-41-42-43

6-PRONG SOCKET
56-606-606-77-78

7-PRONG SOCKET 59



7-PRONG SOCKET

—IN THIS ISSUE—

★

An inexpensive and efficient Oscilloscope

Full Details in This Issue

FEATURE ARTICLES By . . .

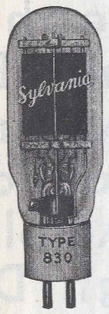
Clayton F. Bane - - D. B. McGown - - E. M. Sargent - - Norris Hawkins
Col. Clair Foster - - I. A. Mitchell - - W. W. Smith - - C. C. Anderson
McMurdo Silver

Individuality . . . Progress!

GRAPHITE ANODE TRANSMITTING TUBES

by

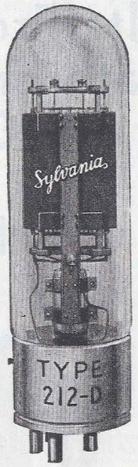
Sylvania

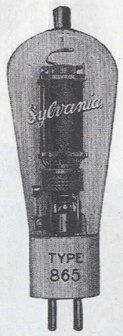


Every single type of SYLVANIA GRAPHITE ANODE transmitting tube represents a complete and exclusive SYLVANIA achievement—not a mere copy of an old conventional design. The eye immediately notes the rugged, clean cut, and original design of these ultra-modern SYLVANIA tubes.

A distinctly improved line of standard transmitting tubes—leading the field—that is SYLVANIA.

Convincing evidence of SYLVANIA engineering progress and transmitting tube superiority is seen in the wide-spread use of SYLVANIA transmitting tubes among broadcast stations. Broadcast engineers, of necessity extremely critical and exacting, now generally concede that SYLVANIA tubes are superior. They are rapidly replacing the old, conventional tubes in broadcast transmitters. Today more than 35% of our American broadcast stations use SYLVANIA transmitting tubes. Stations small and large—from 50 watts to 50 kilowatts—are now using these tubes to the extent shown in the following table:



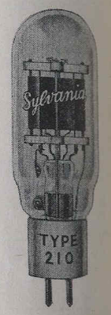


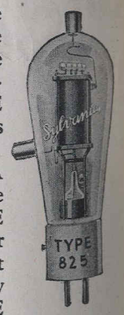
Power Ratings	Number of Existing Stations in each Power Class	Number of Sylvania Equipped Stations in each Power Class
50 Watts	11	3
100 "	196	72
250 "	69	18
500 "	116	56
1,000 "	115	46
2,500 "	25	1
5,000 "	15	5
10,000 "	11	4
25,000 "	5	1
50,000 "	24	5

Amateurs, the world over, are enthusiastic and were among the first to "discover" these tubes. The whole field is talking about SYLVANIA GRAPHITE ANODE tubes—they are saying good things about them.

You, too will be a SYLVANIA enthusiast once you have used these dynamic SYLVANIA GRAPHITE ANODES. Install them in your station now and enjoy the low cost per hour performance that only SYLVANIA GRAPHITE ANODE transmitting tubes can give.

Engineering information may be obtained by writing to the Amateur Radio Division, Electronics Department, Clifton, N. J.





HYGRADE SYLVANIA CORPORATION

HYGRADE LAMPS

FACTORIES:
SALEM, MASS.

AMATEUR RADIO DIVISION
ELECTRONICS DEPARTMENT
CLIFTON, N. J.

EMPORIUM, PA.

ST. MARYS, PA.

SYLVANIA TUBES

CLIFTON, N. J.

HAMMARLUND *Quality* PRODUCTS

Definitely Improve Radio Results

NEXT to engineering knowledge, *experience* is everything in radio. Which is one important reason why Hammarlund's thirty-three years of engineering leadership means definitely assured results for users of Hammarlund Products.

Hammarlund Condensers, Coil Forms, Sockets, Shields, I.F. Transformers, and the superb COMET "PRO" Receiver assure you the highest standards of performance at surprisingly moderate cost. *Mail Coupon for Complete Details.*

Chassis of the World-Renowned **COMET "PRO"** *8 to 550 meter Superheterodyne*

EFFICIENT SHORT-WAVE EQUIPMENT

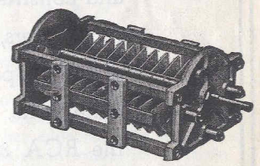
SOCKETS and COIL FORMS

SOCKETS have Isolantite base and perfect spring contacts. Low losses and noiseless. 4, 5, 6 and 7 prongs.

Isolantite Coil Forms for Ultra-short waves. Low losses. No drilling. 4, 5 or 6 prongs for standard or Isolantite sockets.

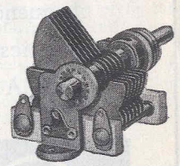
TRANSMITTING CONDENSERS

Electrically and mechanically perfect. Heavy cast aluminum end plates and posts assure rigidity. Isolantite insulation. Widely-spaced plates with rounded edges permit greatly increased voltages. Thirteen capacity ratings from 30 mmf. to 500 mmf. Single and dual models.



MIDGET CONDENSERS

Ideal for short-wave, airplane or automobile receivers, or wherever compactness and freedom from vibration are essential. Soldered brass "Midline" or Semi-circular plates. Sturdy frame. Smooth bearings. Isolantite insulation. Eleven stock sizes from 3 mmf. minimum to 320 mmf. maximum capacity. Single and dual models—also double-spaced.



For Better Radio
Hammarlund
PRECISION
PRODUCTS

NRA MEMBER U.S. WE DO OUR PART

HAMMARLUND MANUFACTURING CO.
424 W. 33rd St., New York

☐ Check here for booklet describing the COMET "PRO" 8 to 550 meter receiver.

☐ Check here for General Parts Catalog "34."

Name .....

Address .....

PR-8

BRANCH OFFICES:
New York City, 253 W. 128th St. Tel. MOnument 2-2812
Boston, J. H. Condon, 6 Marlboro St.
Chicago, C. W. Nelson, 3618 North Bernard St. Los Angeles, Calif. 1455 Glenville Drive. Tel. CRestview 4017

RADIO

ESTABLISHED 1917 Reg. U.S. Pat. Off.

A NATIONAL MAGAZINE - PUBLISHED MONTHLY

Publication Offices—Pacific Building, San Francisco, California

Clayton F. Bane, Editor

H. W. Dickow, Business Manager. Norris Hawkins, Associate Editor.
D. B. McGown, Technical Editor. Frank C. Jones, Ultra-Short-Wave-Engineering Editor.
Clair Foster, Amateur Activity Editor. George B. Hart, Contributing Editor.

25c per copy, $3.00 per year by subscription in the U.S. $4.00 elsewhere. Send subscriptions to the San Francisco office. Entered as second class matter at the Post Office at San Francisco, California, under the Act of March 3rd, 1879.

Vol. 16 AUGUST, 1934 No. 8

RADIOTORIAL COMMENT

Amateur Price Legislation

DURING the 8th annual convention of the Radio Wholesalers Association at Chicago, June 11-13, the Code of Radio Wholesaling was discussed. At the same time a meeting of radio parts jobbers was called to decide whether or not they should join the radio wholesalers. The tube group met first and were about to put through standard provisions for sale to the trade, dealers, and wholesalers or distributors. Not a word had been mentioned about amateurs, and although they are getting dealer's discounts, yet under the definition of a dealer as one selling to the ultimate consumer, the amateur would have to pay list prices. Rex Munger, W9LIP of Lew Bonn Co., St. Paul, first found this defect and very strenuously argued in favor of amateurs continuing to enjoy present prices. Against considerable opposition and misunderstanding, he succeeded in making this exception of amateurs.

Later he brought up the same subject before the entire group of radio parts jobbers, which included such commonly heard names as Allied Radio (Chicago), Wholesale Radio (New York), Burstein-Applebee (K. C.), Walter Ashe (St. Louis), Cameradio (Pittsburgh), Seattle Radio Supply, etc. Of the 50 members present, a committee was appointed to investigate the advisability of joining the RWA, its existing code, and drawing up suggested changes. The amateurs were well represented by Mr. Walter Ashe on this committee, and after discussion it was the consensus of opinion that the committee should give special consideration to amateurs. A unanimous decision was made by the parts distributors to recommend to the RWA code committee that the parts business is a separate and distinct problem, not at all similar to that of the large receiving set wholesalers, and that provision should be made in the code to enable the parts distributors to continue their business the same as in the past. Theoretically, the parts jobbers operate under the blanket RWA-NRA code but they were quite united in permitting present conditions to continue, rather than to place restrictions on their own business.

It is well to point out that radio amateurs enjoy discount privileges unusual to any other type of "hobbyist", including golf, photography or motoring.

Paying list prices for amateur equipment is almost an unknown "art" and approximately 40% discount from old list prices constitutes the amateur selling price, or "effective list" as it might be called.

Millions of dollars are spent by amateurs every year and the continuation of present low prices is of timely importance.

"N" Prefix Progress

FOR about two years certain Naval Reserve amateurs and Fred Schnell, W9UZ, in particular have been working to get the letter N instead of W as a call prefix for amateurs interested in Naval Reserve work so that they quickly recognize each other over the air in emergencies, ordinary routine communication and drills. Progress was slow and Schnell finally was astounded to find that the Executive Committee of the amateur's league was the stumbling block. Knowing where to direct his efforts, he gave this matter wide publicity. The result is now well known . . . the league directors at their annual meeting reversed the decision of the Executive Committee and recommended to the Federal Radio Commission that the plan proceed.

On June 29th the following order was issued by the Commission:

USE OF THE CALL LETTER PREFIX "N" BY AMATEUR LICENSEES WHO ARE COMMISSIONED OR ENLISTED MEMBERS OF THE U. S. NAVAL RESERVE.

Upon the recommendation of the Navy Department the Commission adopted the following rule:

"384A. *In the case of an amateur licensee whose station is licensed to a regularly commissioned or enlisted member of the United States Naval Reserve, the Commandant of the naval district in which such reservist resides may authorize in his discretion the use of the call letter prefix "N" in lieu of the prefix "W" or "K", assigned in the license issued by the Commission, provided that such "N" prefix shall be used only when operating in the frequency bands 1715-2000 KC and 3500-4000 KC in accordance with instructions to be issued by the Navy Department.*

Plans in the 9th Naval District are well under way for the issuing of suitable certificates by the Commandant.

●●●

Here Is a Copy of the Navy Department Instructions Covering Use of Prefix Letter "N"

1. Commandants of naval districts may, in their discretion, authorize members of the naval reserve holding valid amateur radio station licenses, to substitute the prefix letter "N" for the prefix letter "W" or "K" assigned by the Federal Radio Commission subject to provisions of F.R.C. Rule 384a.

* * *

2. Use of prefix "N" shall be effective only during the life of the station license issued by the Federal Radio Commission and further only at the discretion of the commandant of the naval district in which the reservist resides or maintains an amateur radio station.

* * *

3. Amateur frequency bands in which the prefix "N" may be used will be limited to the frequency bands 1715-2000 kc., and 3500-4000 kc.

* * *

4. Amateur stations authorized to use the prefix "N" will be subject to all rules and regulations of the Federal Radio Commission prescribed for amateur radio stations.

* * *

5. The prefix letter "N" when authorized by commandants may be used for general communication between U. S. amateurs, but not with foreign amateurs, and need not be conned to naval reserve drills or naval reserve traffic.

* * *

6. The authority to use the prefix letter "N" by any amateur station, may be revoked at any time by the commandant of the naval district for any violation of the regulations, improper or injudicious use, needless interference or other objectionable use, or as a disciplinary action in connection with the administration, training or drilling of the naval reserve.

* * *

7. Commandants will maintain a record of all persons authorized to use the prefix letter "N" and of all cancellations of authority for its use. Cancellation by a commandant of authority for use of the prefix letter "N" will not affect the validity of the Federal Radio Commission license nor the right of an individual to use prefix "W" or "K."

* * *

8. The monitoring stations of the Federal Radio Commission will make no reports on the use of the prefix "N." If any member of the navy or naval reserve observes use of the prefix "N" by an amateur not authorized to do so, he shall report this fact to the commandant of his district with all details as to time, type of operation, etc. The navy department will bring such operation to the attention of the Federal Radio Commission. Any other violations of the regulations observed by Federal Radio Commission will be taken up directly by that commission with the amateur regardless of whether an "N," "K," or "W" prefix is used.

COL. FOSTER'S COMMENT

READ IT AND WEEP

HAVE you read the official reports of the annual meeting of the ARRL directors?

You get your account of the meeting in two doses, a narrative by K. B. Warner and the "Official Minutes". Both accounts are replete with self-praise, self-righteousness and self-justification.

The narrative says this meeting of 1934 was one of the most important the directors ever held. It was, and for the reason that the directors were called upon to meet three charges of vital importance to all amateurs: (1) That the Secretary-Manager had concealed in his reports to both directors and members the true wording of the new amateur regulations of Madrid. (2) That the Board of Directors had not determined the ARRL's policy of not opposing ratification of those regulations. (3) That the ARRL membership is made up more of commercial radio people and other non-amateurs than of licensed amateurs.

For months prior to the meeting these charges had been hurled at the ARRL headquarters from all parts of the country and directors had been bombarded with them. Now just look through all parts of the published reports of the meeting and see if you can find that even ONE of these charges was met. All you will find is Warner's declaration that the Board spent five hours in examining and discussing the various criticisms and that "It found no justification for any of the charges that have been disturbing members and voted hearty commendation of the Secretary and other officers for their conduct of League affairs."

Just note how the directors did their investigating. When the subject came up the New England director immediately moved a resolution of confidence in Warner and hearty commendation of his conduct of League affairs; AFTER which they spent five hours "investigating". Render the verdict first and "investigate" afterwards!

But the verdict was all foreordained. President Maxim had previously devoted most of his annual report to plastering all those who had dared to question Warner's actions, and to enveloping himself, Warner and the ARRL in general in an aura of righteousness. He had called our criticisms falsehoods, slanderous, lies, and used various other forms of invective. He had used many of the psychological devices for formulating the thoughts of men who are unacquainted with the technic and how to keep from being influenced by it. The devices of shame, fear, command, exhortation, threat, and what not. His report abounds with varying forms of mental influence. I'll give you, direct from Mr. Maxim's report to the directors—which you can get from your director if you care to read the whole of it—some examples:

SHAME—"Decent men and women cannot be expected to remain in an organization composed of persons who stoop to such practices as the leaders of the present agitation".

FEAR—"ARRL must positively be purged of this sort of thing or our end is in sight."

COMMAND—"Your president requests that this Board announce its position as regards its officers in clean-cut and unequivocal language and then take positive steps to prevent a repetition of the present agitation. If there is the slightest doubt on the part of the Board as to the integrity and ability of the officers an unbiased investigation will quickly disclose the truth."

EXHORTATION—"If there be one duty to which the present Board should address itself it is to decide upon the policy and the means of doing this unmasking of those persons who are guilty of falsehood concerning us."

THREAT—"To challenge the honesty, sincerity and loyalty of the officers and headquarters staff is to challenge the honesty, sincerity and loyalty of your president. Your president is not the kind of person to have his integrity challenged when he knows he does not deserve it."

AND so the directors, honest and sincere though they be, came to the meeting with their minds all made up for them. And so that they should not forget how they were expected to vote the New England director makes his motion aforesaid to bring to vivid recollection the pronouncements of Mr. Maxim's annual report. Neat work—of its kind.

Mr. Maxim is a tradition with the ARRL. The League is his child; he brought it into being. For several years after it was born it gave promise of great usefulness. Then it came under an evil influence and fell far from grace. It began life as an association wholly of licensed amateurs. It continued so until a year after Warner took it in charge. Then suddenly it became a league of any old thing that happened to subscribe for QST. It continued to parade as a league of amateurs and does so to this day. But it is not. How the change came about and who profited by it enormously in cold cash we reserve for another story. But the fond parent still cherishes the child as his own and anyone who dares to criticize its failings just isn't fit to associate with "decent" people.

To make the directors feel that their whitewashing of Warner had substantial outside approval, communications endorsing Warner were read to them from two men whose opinions . . . if they were not now in the employ of commercial concerns which pay money to QST for advertising their goods to amateurs—would certainly carry weight.

It is certain that many directors, too, had in their possession communications bearing testimony directly adverse to the two that were read to the Board. For example, the St. Louis Club of Kerr's division had wired him just before the meeting a message demanding the removal of Warner and telling Kerr they wanted that message read to the directors. Kerr had the message right before him at the meeting and yet never mentioned it. So it is a cinch that around that directors' table there was much testimony adverse to Warner and his conduct of League affairs that never emerged from concealment.

Perhaps Kerr was relying upon the letter Warner wrote to certain directors some two years ago in which he gave a new slant to his oft-published assertion that the League has "truly representative government—nothing could be more so—just like the United States Government—the majority rules." If you want the exact wording of the letter get it from your director—if he received one. Not all directors did. I seem to recall that I was a director at the time, and I know I never received it—from headquarters. In this letter Warner indicated that directors should stick by their own individual views rather than those of their constituents because there was no bi-chamber organization in the ARRL corresponding to the House and Senate in the United States government, and so a League director while he should act as a "representative of the people" should at the same time act as a "statesman"; that a League director's higher duty was to look at amateur radio as a whole and then do what was best for the majority; that his higher duty might often demand that the director disregard the mandate of his own division, duly expressed.

And that's just the kind of "representation" most of us ham have been getting—assurance that we are getting real representation while our directors are tipped off from headquarters to give us the run-around. How do you like it? And compare this with Warner's opening statement in his description of the Board meeting: "As every radio amateur knows, this annual meeting of the Board is the high point in amateur affairs of the year, for at this time the policies of the League are gone over in minute examination, responsive to the wishes of the majority of the members, and new plans made for a coming year. With every director present, fully conversant with the wishes of the amateurs in his region, it was possible to make a thoroughly intelligent survey of all the affairs of amateur radio."

What About the Commercial Members?

NOW, all this refers to representation of amateur members of the ARRL. What about the representation of the commercial and non-amateur members? They are the majority owners of the ARRL's property and assets. They assuredly HAVE representation, for no business man has a money interest in ANYTHING unless that interest can be made useful to his business. These commercial members cannot well get their representation directly through the directors, for the directors have very little direct contact with them. You will notice that Warner says each director is "fully conversant with the wishes of the AMATEURS in his region." League officers have frequent contacts with commercial members but directors do not. But it is by action of the directors that the interests of the commercial members are looked after; so there must be liaison between them and the directors. Just who are the intermediaries who carry their wishes to the directors? Obviously it must be the officers of the League. So the advice that directors get from the officers must regard the interests of these majority owners of the ARRL's business and assets; either that or their interests are being ignored. And if you

(Continued on page 34)

A. R. P. A.

THE PURPOSE of the Amateur Radio Protective Association is to provide a medium devoted wholly to the interests and rights of the transmitting amateurs, completely divorced from all commercial influence, either within or from without, and capable of recovering for the amateurs some of their lost rights and frequencies. A body of men so strong that it can secure for the growing ranks of the amateurs frequencies and rights commensurate with expansion. In short, a group of leaders that legitimately can speak vigorously and act aggressively in furthering the interests of **all** amateurs.

A movement that does not meet the foregoing fundamental requirements cannot possibly serve the needs of the licensed amateurs of America today. There are many men in the amateur ranks who are already grouping themselves under the aims of the ARPA into active units in different parts of the United States and Canada.

It Is Not an Organization . . . It Is a Movement

THE ARPA IS NOT an organization in the usual sense. It is loaded with none of the machinery of organization. It has no constitution, no by-laws, no rules and no regulations, no directors no officers, no dues. There is nothing to "join." There is only a set of principles and aims for each amateur to work for. The ARPA is an association of ideas rather than an association of men.

In other words, ARPA is a MOVEMENT. It is a movement to get method and courage and vigor into the process of securing adequate rights for all amateurs. It is a movement to take the safeguarding of amateur rights out of the realm of the haphazard and fortuitous and place it in the position assumed by other large bodies of citizens who take their wishes severally and en masse to Congress. It is a movement to stop accepting resignedly such "privileges" as the commercial corporations permit us from time to time to exercise, and to make direct demands for our right to our share of the air as citizens of the United States. It is a movement of the licensed amateurs to stop having our rights as citizens of the United States determined by a few commercial corporations and a horde of quarreling Europeans. It is a movement to cease permitting any one man to be the sole official mouthpiece for all the licensed amateurs of America and, instead, to have many articulate spokesmen whose interests are wholly amateur—to permit all amateurs to speak directly with the instruments of government instead of depending upon a small but highly centralized "control" to voice their wishes.

It is a movement for the exercise of the right of every citizen of a representative government to carry his wishes directly to his representatives. It is a movement to make known that the 40,000 non-commercial radio stations in the United States are potentially a great asset of the public and the nation, and that the rights of these non-commercial stations shall not be left at the mercy of a few commercials. It is a movement to show that non-commercial radio men are a class of citizens so self-respecting that they may demand and exact the respect of all other users of the air. It is a movement to ensure the voice of amateur radio in the halls of Congress.

Congress Recognizes the Amateur

A PRIME ESSENTIAL of the movement is that the various groups and interested individual amateurs throughout the country shall make it their continuing job to inform their senators and representatives in Congress of the amateur position in any given situation and at all times. All that Congressmen need is that in any specific case they be informed fully and truthfully. The Congress will listen with an open mind to the requests of the licensed amateurs. One of the keenest observers of all movements in the communications field writes us from Washington, *"The few protests you amateurs made against the Madrid treaty created a lively impression on senators who have been most concerned with radio legislation, and Congress is now disposed to give the amateurs everything they ask within reason."*

Why Wait Until 1937?

AND THE TIME to begin speaking is NOW. The day is past for the futile practice of the whole amateur body to sit quietly and inertly awaiting the pleasure of the commercials and foreigners at Cairo in 1937. It is Congress that can decide that great areas of the air now held by commercial corporations but not of use to them shall be devoted to stations—amateur or otherwise—that are disgracefully cramped. And when Cairo finally does come along it is the Congress of the United States that will determine what the non-commercial stations of the United States require to permit them to serve the interest of the public and the nation. One of the chief concerns of the ARPA groups is the recently enacted Communications Bill that sets up a new alignment and control of all communications. The most important item in the Bill is the provision for a special report to be submitted to Congress by February 1, 1935, recommending the new detailed legislation necessary for the proper control of all communications. If the amateurs do not now see that their rights and interests are properly protected in this report then they will have no one to blame but themselves for the amateur restrictions the commercials will surely insert in the new radio law of the United States. It is easy to keep such restrictions out now; it is exceedingly difficult to get them out once they are incorporated in the law. This is infinitely more important and immediately necessary work for the amateurs than hazy speculation on what may or may not "happen" at Cairo in 1937. The various groups of the ARPA will get on their toes now, and not only keep in touch with the progress of this report that will recommend the provisions of the new law, but they will formulate recommendations of their own to be incorporated in it.

That is what the ARPA is, and if you are a live amateur you will enter heartily and energetically into the movement of the intelligent and forthright men who are resolved that the rights and interests of all amateurs shall be properly guarded and promoted.

The ARPA will function independently of existing amateur associations, fraternities and leagues. It will protect the interests of all amateurs, regardless of their present affiliations. It holds malice toward none.

Antennas for City Dwellers

By CLAYTON F. BANE

THE recent craze of antennas 260 feet long (and longer) gives us poor city dwellers the jitters. Our own lot is but 120 feet long and inflexible as the very dickens!

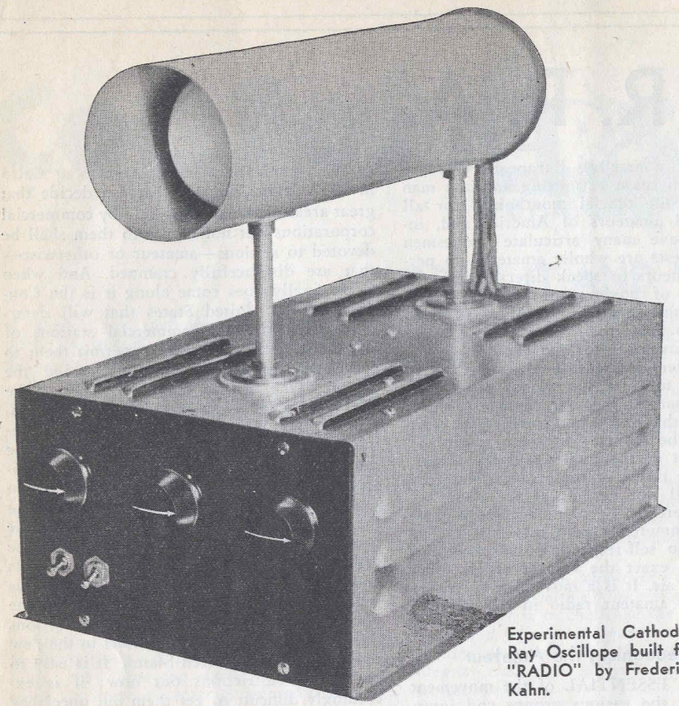
In these days of many stations using plenty of power, the problem of the transmitting antenna does not worry us nearly as much as the receiving antenna. The old adage, "you cannot work that which you cannot hear, etc." still holds good. One factor of utmost concern to ye city dweller is NOISE. We counted 70 autos passing the house in 20 minutes. Power leaks, oil burners, refrigerators and other infernal gadgets exact their awful toll of DX. Driven to a near frenzy by power noises, we decided to see if something couldn't be done to remedy the situation. Doublet antennas long since proved to be fine noise collectors in this location, so here's what we did.

The receiving antenna for 14 MC was a full wave affair and was about 40 feet off the ground at both ends. This antenna was let down and fitted into a convenient stretch of the yard. The height above ground was carefully measured until both ends of the antenna were an exact quarter wave above ground. It happens that a quarter wave is a mere 15 feet, thus you can readily realize that, theory to the contrary, many misgivings were felt as to the probable effectiveness of this low antenna. This may have been somewhat exaggerated in our case because we belong to the old school, "The higher, the better." Anyway, to waive all preliminaries, the effect on the noise was remarkable. Signals that could only be read with difficulty on a higher antenna were now QSA5. Weaker, true—but none-the-less much more readable. Of course, this type of antenna with the ground acting as a reflector is naturally a high-angle affair, and apparently discriminates strongly against the ground wave and other low-angle components. Attesting the soundness of this theory, a great many European signals (DX to us) which had a perfectly solid body on the higher antenna, had that peculiar "shaky" characteristic of signals from the same station coming in from different directions and slightly out of phase, and also of extreme high angle radiation. It should be stated that this hollow effect in no way deterred from the readability of the signals, since the lack of noise more than offset this trouble.

(Continued on page 23)

Cathode Ray Tube Theory and Application

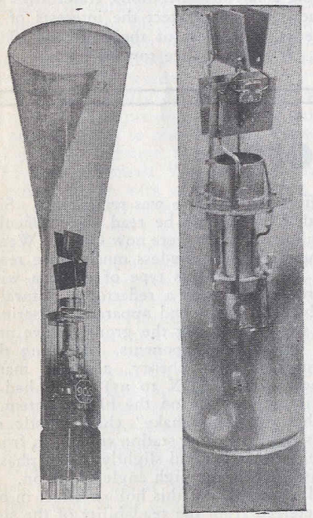
By CLAYTON F. BANE



Experimental Cathode-Ray Oscillope built for "RADIO" by Frederick Kahn.

ALTHOUGH long known by scientific workers and laboratorians, the cathode ray tube has, until recently, remained a mystery to the average amateur. Progress in any line is never possible until the industry, as a whole, has the product available, and at a reasonable price. With many of these tubes now in use, valuable data on refinements and improvements can be gathered collectively, instead of from a small, select group.

The reasonably-priced cathode ray tube gave the needed impetus to place this valuable device in the hands of the technical amateur. There can be no doubt that a cathode ray tube, in conjunction with associated apparatus, will soon become a standard piece of apparatus in all good amateur stations.



Left—The RCA 906 Cathode-Ray Tube. Right—Close-up of Deflector Plates.

When television emerges from the laboratory, those who now acquaint themselves with cathode ray tubes will be among the first to profit.

Much has been written about cathode ray oscilloscopes for determining character of modulation and allied measurements. A rather careful perusal of the various articles has failed to disclose any that gave a careful, elementary explanation of the basic principle of the cathode ray tube. With this fact in mind it is felt a proper understanding of the principles will serve a definite purpose for those who may eventually be called upon to handle similar tubes for television purposes. It goes without saying that the proper understanding is also invaluable to those who will merely use the tubes for their own experiments.

A cathode ray, instead of being something mysterious and technical, is in reality nothing more than a high velocity stream of electrons, traveling from the cathode (or filament) to plate.

In physical characteristics, the average tube has the general shape of a funnel. That portion which would be the neck, in this case, is made considerably larger in diameter, and that portion which would correspond to the mouth is a closed end, slightly convex. It is on this end that the cathode ray comes to focus. A cathode or filament is sealed into the narrow end, this cathode serving as the electron emitter. The grid is between this cathode and the plate. This is the simple, basic type of tube. Many of the present models have an additional grid. The plate has a small aperture through which the electrons from the cathode pass. When the cathode is heated, electrons are given off and if a positive potential is applied to the plate these negative particles will be attracted toward the plate in a continuous stream. As has been mentioned, this plate has a small opening in its center through which some of the electrons may pass through and into the outer portion of the envelope. It can be readily understood that if a varying potential is applied to the grid, the number of electrons passing through the plate can be controlled in much the same manner in which the grid of an ordinary vacuum tube controls the plate current. The application of the grid in the cathode ray tube will be discussed later in this article.

Let us now return to the stream of electrons coming from the opening in the plate. As these electrons travel out into the open portion of the tube, they no longer hold to a narrow stream, but gradually spread out as they get farther away from the plate. Unless the initial velocity is very great, the negatively charged particles begin to exert a repelling force on one another and spread apart. The resulting "cloud" is useless for all practical purposes, so it becomes necessary to resort to some means of obtaining a narrow stream, keeping the beam in focus. There are several ways in which this can be achieved, although admittedly some are much better than others. The first and most practical is to use an extremely high positive potential on the plate, so as to give the electrons such a tremendous initial velocity that the beam does not lose its character. Many of the earlier types of tubes were filled with gas, Argon being generally used. As the negative electrons pass through the gas they cause ionization, with the result that the positive ions collected around the negative electrons (unlike-forces attracting), and tended to "squeeze" or keep them in line, i.e., in focus. Gas filled tubes have the disadvantage in that the impedance across the deflecting plates is not infinite and, consequently, would render certain types of measurement impossible, due to loading of the circuit under measurement. Varying the temperature of the cathode will also cause the beam to focus sharply. A solenoid around the narrow arm of the tube has also been used as a focusing medium. All in all, the high vacuum type of tube using very high plate potentials is considered much more satisfactory than any of the other systems.

Certain chemical substances have the unique property of being fluorescent, i.e., when they are struck by an electrical charge they give off light from the areas exposed to the charge. As an example, Calcium Tungstate will give off a blue light under these conditions, while Zinc Silicate will give off a yellowish-green light. If the large face of a cathode ray tube is coated with such a fluorescent substance, a spot of light will appear on the face of the tube when the cathode ray beam strikes its surface. If we can cause this spot to move in some regulated manner it can be seen that we can reproduce its movement in the form of light on the face of the tube.

If a magnet is placed in proximity to the electrons' beam it will be seen that we can cause the spot to shift into any position on the face of the tube by changing the position of the magnet. This proves that the cathode beam is very sensitive to magnetic effects and suggests a means of controlling the beam. A number of tubes use magnetic deflection by using large coils placed in horizontal and vertical relation to the beam so that by varying the current through the horizontal coils the beam will be made to move across the face of the tube horizontally. Inversely, by changing the current through the vertical coils the spot may, at the same time, move up and down. If, instead of using magnetic coils, we place flat plates within the tube and in the same relative positions with respect to the beam, we can achieve exactly the same result by varying the potentials on the plates. This latter system has the advantage in that the plates offer practically an infinite impedance to any load to which they may be connected and in this way eliminate any loading effect. Obviously, the magnetic coils would offer a very finite impedance to the same load and, consequently, would be unsuited to many types of work entirely feasible with electrostatic deflection.

Having discussed basic principles of operation, we will now take up a specific example of an oscilloscope that has been in operation in our laboratories. Most literature has failed to place enough stress on the fact that such a device is an extremely sensitive instrument. Of course, anyone can hook one up and obtain operation of some sort, but we certainly cannot stress too strongly the fact that correct design is absolutely necessary if the full capabilities of the tube are to be realized.

One prolific source of trouble in the average amateur oscilloscope is AC pick-up, or AC ripple. This may be caused by wrong placement of the transformers and, in this case, it is easily cured by mounting the transformers in such a manner that they have no effect on the beam. Put some flexible leads on the transformer and move it around until the minimum effect is noted. The test for a correct spot is very simple. It should be possible, by manipulation of the focusing and intensity controls, to obtain a perfectly round spot on the screen. For purposes of testing, be careful to avoid having the intensity of this spot any greater than is necessary for good definition. A prolonged holding of a brilliant spot on one place on the screen may destroy the fluorescent material on the screen, and in extreme cases may cause heating of the glass with attendant possibility of puncture. If the spot, when brought up to a size of approximately three-eighths of an inch is perfectly round, or at least has outside edges that are sharply defined, you are indeed lucky and need have no further worry. If, however, the spot, instead of being an even one, has a tendency to show a ragged edge, you have AC. This may also conceivably be due to an incorrect bleeder and filter condenser combination, which would result in the output of the rectifier having considerable ripple; this cannot be tolerated. Ripple and pick-up must be cleared-up before an attempt is made to put voltage on the deflecting plates.

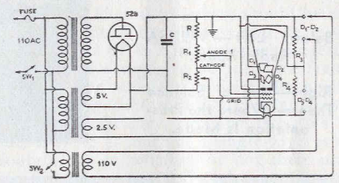
In addition to being very regular and having no ragged edges, the spot must also be capable of being drawn down to a mere point of light without changing its characteristics. It should be mentioned that the 906 tube is capable of producing a round spot, although this may not be true of other makes of tubes, since the shape of the spot is largely dictated by the shape of the emitting surface of the cathode, the spot in some tubes being square!

If the spot when drawn very small shows a halo, this phenomenon may be due to: (a) insufficient bias to focusing electrode. (b) Too-high filament current.

If, when the spot is drawn down in size, it has a tendency to elongate or take a curling shape, it is possible that the beam is being pulled out of shape by some stray field. This field can well be caused by some large mass of metal in the immediate vicinity. If this statement sounds improbable, just take a piece of metal that has possibilities of being magnetic, and hold it close to the tube. Another thing that sounds almost ridiculous, but is none-the-less true, is that the spot will probably be in a different position on the face of the tube, depending upon the time of day! This is simply another way of saying that the beam is affected by the earth's magnetism. An iron or steel shielding tube should cover the cathode ray tube so as to act as a magnetic shield. The shield tube should first be de-magnetized.

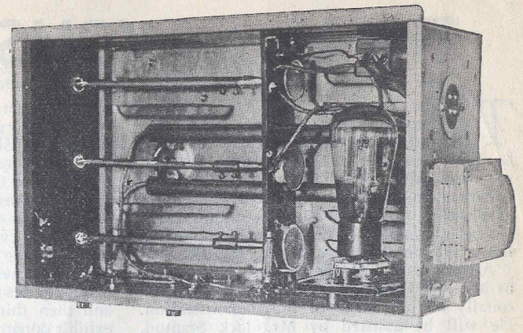
If it is impossible to make the spot go down to a fine point, it is well to look to the voltage on the cathode as the source of trouble, since low voltage on this element will play havoc with the focus. Practically the same effect will be noted if too-high bias is applied to the focusing electrode. The cure in both cases is obvious.

When the spot has been cleared-up to conform to the extent that we have insisted upon,



Circuit diagram used in "RADIO's" Oscilloscope

it is then time to apply some type of sweep circuit to the horizontal deflecting plates so that the spot may be drawn out into a line. For simple applications, a one-to-one ratio transformer can be utilized as a source of sweep voltage. The input of this transformer, of course, is connected to the 110 and the output to one deflecting plate and ground. By varying the control on Anode No. 1 the spot can be drawn-out into a line, and the intensity of the line varied by the grid bias control. The line gives the appearance of standing still, but actually the line effect is caused by the spot moving back and forth across the face of the tube at the frequency of the sweep voltage. The familiar "persistence of vision" takes care of the movement to give the effect of a solid line. If hum, halo, distortion and other troubles have been previously removed, it is possible that the line can be drawn into a sharp, clear affair by manipulation of the focusing controls. Since this line is to be the index line, and since it will remain in the same relative position regardless of the type of sweep used, it is generally considered to make it parallel to the table on which the instrument rests.



Under chassis view of the Oscilloscope. The rectifier tube is a 5Z3. The variable resistors are fitted with long coupling shafts.

Moving the socket that holds the tube is a very easy way of achieving this result. Thus it is wise not to permanently mount the tube socket until one sees the angle of the trace line.

The circuit diagram shown is similar to the one which we are using in our oscilloscope. This circuit is an exact duplicate of the one recommended by RCA in various application bulletins. The output from the high voltage transformer should be approximately 1000 volts, and since the current drawn is extremely small, one of the small transformers used for the better type broadcast sets should prove very suitable. Since the current taken from the condenser is so small, and since the charging of this condenser takes place during a small fraction of the AC cycle, the output from the rectifier is assumed to be equal to the peak voltage of the transformer. Use a small transformer with the entire winding, instead of the center-tap methods, as is usual in the conventional full-wave rectifier. Careful consideration must be given to the selection of the size of bleeder resistor and filter condenser if the value of ripple is to be kept as low as it should be for proper operation. Using common values of bleeder resistance, a 2 microfarad condenser is a very safe value. According to the excellent graph in RCA "Application Notes No. 39" the value of this condenser in conjunction with a one-megohm bleeder would give a value of ripple voltage approximately 0.2 per cent, which is very low. From the same source we find that a 1 mfd. condenser with the same value of bleeder would give about 0.5 per cent ripple.

Again referring to the circuit—the value of R3 and R4 can be anything from 1 to 10 megohms, although we have found that 5 megs apparently makes no difference. One thing that will be seen to differ from usual practice is that the positive high voltage is at ground, and that the cathode (filament) floats. The insulation of the filament transformer must be capable of withstanding the plate voltage if breakdown is to be avoided. At this point, one very serious caution is necessary. Most of us have developed a carelessness when working with low voltages. Remember—don't be deceived by the small size of the transformer used in these oscilloscopes——a thousand volts, aside from inflicting a jolt that will long be remembered, is also capable of inflicting fatal damage under certain conditions! (Confidentially, I have three nice scars on my hand, attesting to the viciousness of "a mere thousand volts").

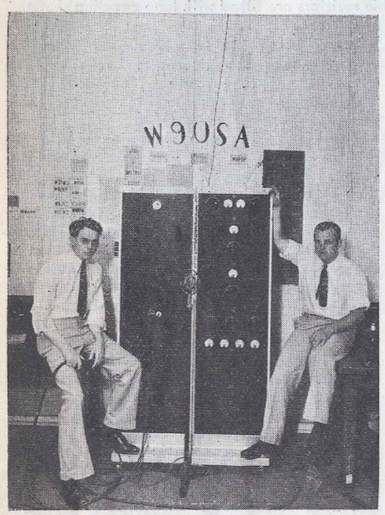
It is hardly within the scope of this paper to go into greater detail as to the various applications of the "Scope". We intend to take up this phase in detail in a subsequent

(Continued on page 17)

The New W9USA at the Chicago Fair

THE Science Theatre at A Century of Progress presents an adventure in the popular branch of present-day Science—Radio. This feature is sponsored through the cooperation of The World's Fair Radio Amateur Council, and you see in the photographs the equipment of a radio station which has been assigned by the Federal Communications Commission the call letters W9USA.

All of this apparatus has been constructed by Mr. Royal Higgins, W9AIO, who will personally be in charge of the demonstration. He will be assisted by Mr. Jack Stanton, W9PSP, who will operate the receiving end of the equipment located on Northerly Island.



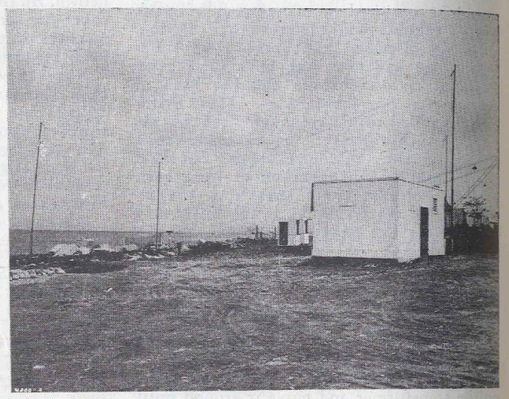
Left—W9AIO and W9PSP at the W9USA transmitter panels

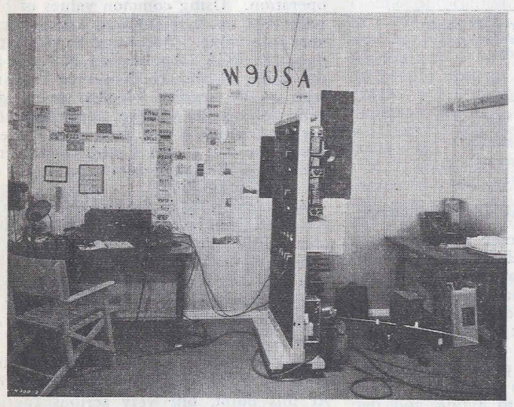
Right—Northerly receiving antenna of W9USA.

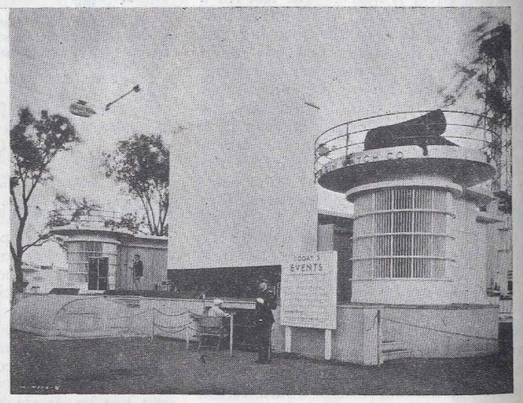
★

Below: Left — W9USA Radio Room.

Right—Hall of Science Theatre Where the Presentation Is Made.







attempt to find some location sufficiently quiet for 14 MC reception. A spot was found on Northerly Island which seemed to fill the bill. It is appropriate at this point to comment on the 100% cooperation given this feature by A Century of Progress. Mr. Farrier, an official in charge of Events, whole-heartedly granted every desire. A small shack was set up on the island and to it were run power and fone lines. Four forty-foot concrete embedded poles were installed, antennae hoisted and then things began to move. The RCA exhibit donated a World Wide antenna which, incidentally, has proved well worth while. At this time the only way a favorable signal to noise ratio can be maintained is to use antennae with directional reflectors. Three receivers are housed in the shack, the output of any one, or all three being fed into the 500 ohm PSC line back to the stage. The shack on the island and the stage are separated by about three-quarters of a mile. This line is split so that input is afforded to the PA system of the Court of the Hall of Science as well as for a pair of headfones for the operator on the stage. Ordinarily no higher level than a minus 6 db. is fed over the fone lines.

The various units comprising the transmitter, after a little preliminary friction with the electrical union, were mounted in the two W.E. racks and testing at the Fair grounds began May 24. The RF section consists of a 59 oscillator with a 7080 KC crystal, a 59 doubler, a '10 buffer, a 211 buffer, followed by the final p.p. 211 Class "C" stage. This stage is modulated Class "B" by two 203A's. The input amplifier working from a double-button carbon microphone is a 56, to p.p. 56's, to p.p. 2A3's all Class "A". Normal input to the Class "C" stage, which feeds a 132-ft. single wire fed Hertz, is 400 watts. Under actual measurement, an output of 212 watts of RF is obtained.

In the first five weeks of operation, the station has worked 44 states, and has been heard in all 48. Confirmation of reception has been received from fifteen foreign countries, and contact has been made with four. It might be of interest to mention that W9USA at the Hall of Science acknowledges all cards. Two different cards are used, one for acknowledging those received from SWL's, the other goes to amateurs in confirmation either of a QSO or a heard report. All cards must have Hall of Science on them to be properly delivered.

W9USA at the Hall of Science—in Chicago, would like to voice genuine appreciation to all amateurs who have made the presentation of Amateur Radio to the public a possibility. What the amateurs are doing in working this station, especially from 5 to 5:30 C.S.T. every day when the transmitter is on the stage for the feature, is a concrete example of the spirit of amateur radio. Exemplary of this spirit, and a fitting example to be followed is the wonderful cooperation given by K4SA.

Other than the 5 to 5:30 C.S.T. period ham phraseology is preferred. But, when W9USA is presented to the public, the conversation should be in English and as non-technical as possible. **"Please—leave out such tomfoolery as diddle de bump de bump . . . (at all times for that matter)"** . . . reads a request from the Fair. This is a "show" given to the public

(Continued on page 32)

Such signals as he receives will be sent to this point over telephone lines.

This equipment has been in contact with forty foreign countries in five continents.

Unfortunately, not all of W9USA is presented to the audience. Should all of the headaches which went into the installation of W9USA at the Hall of Science be known by the audience the presentation would be more appreciated.

The old adage that you can't work what you can't hear was all too apparent when a receiver was set up on the stage. Imagine the QRM from 1,200 electrical gadgets demonstrating electrical phenomenae only 350 feet removed from the receiver. Receivers were lugged all over the Fair grounds in an

The Siamese Exciter

By W. W. SMITH, W6BCX

WITH the influx of amateurs into the 14 megacycle band which began to assume appreciable proportions some two years ago ,and with the growing popularity of the 28 and 56 megacycle bands, some simple, economical means of obtaining excitation to the high-frequency output stage was much in demand.

Fundamental control with a tourmaline crystal ,although the most simple, is far from the most economical. This is especially true when it is desired to operate on more than one frequency within a band, necessitating several tourmalines—one of which is usually beyond the reach of the average amateur's pocketbook. Low frequency quartz crystals are comparatively cheap, a whole flock of them being obtainable for the price of one good tourmaline. The problem resolved itself into the development of high-efficiency frequency multipliers so that the lower-frequency quartz plates could be utilized with a minimum outlay of equipment.

Then someone got the bright idea of modifying the Dow oscillator, whose output circuit is rich in harmonics, so that a quartz crystal could be used in place of the grid coil. Thus evolved the "Tritet" of today. The fundamental circuit, without any trimmings, is shown in Fig. 3. It is usually a very ready oscillator—crystals that can't be persuaded to oscillate at all in the conventional pentode oscillator will oscillate vigorously in the Tritet. In fact, the crystal usually oscillates so hard that unless the exciter is run at very low voltages, there is considerable crystal heating—the harmonic operation aggravating the frequency drift. To keep the crystal current down to as low a value as possible, the cathode coil, L1, should be fairly high-C. For maximum harmonic output, the output coil, L2, should be as low-C as it is possible to make it.

While not performing multiplication of the crystal frequency as well as the tritet when quadrupling, the "Siamese" exciter shown in Fig. 4 will give just as much output as the tritet at twice the crystal frequency, and, when properly adjusted, with less heating of the crystal. There are also fewer parts in the Siamese, one less condenser and one less resistor being required. When used with a 40-meter crystal, it will fully excite a 46 (triode connected) or 59 (tetrode connected) regenerative doubler. The regeneration may be obtained either by using a skimpy by-pass across a cathode resistor, or by a "neutralizing tap" and feedback condenser. The former method works well at frequencies above 14 megacycles, while the latter system is to be preferred at the lower frequencies. Thus, with but two tubes, the 53 used with a 40-meter crystal in a Siamese, and a 46 regenerative doubler working on 28 megacycles, seven or eight watts of precious "ten meter RF" can be obtained. By substituting a graphite anode 841 (high mu 210) for the 46, the input to the doubler stage can be raised to twice the output obtainable from a 46. Some efficiency will be lost, to be sure, but it can be tolerated for the sake of output.

The Siamese will also fully excite another 53, used this time as a "push-push" doubler. The tube is connected as though it were two separate 46's—the same values of circuit constants being correct for the single 53, except that the plate voltage should not run much over 300. To effectively couple from the output of the Siamese into the "push-push" grid tank of the 53, link coupling should be used.

The output of the Siamese may be used to excite a pair of 46's in push-push instead of the single 53, though the output of the Siamese is not really sufficient to drive the grids of the 46 push-pushers to full output at maximum obtainable efficiency. As the two 46's cost almost twice as much as a single 53, it is very doubtful as to whether or not their use is justified when the push-push stage is driven by a Siamese exciter.

A STUDY of Fig. 4 will reveal that the Siamese is basically a high-mu triode oscillator, capacitively coupled to a high-mu triode doubler. The oscillator grid resistor should be either carbon or metallized, and should have a resistance of about 30,000 ohms. If one of the small, sectional wound grid-leak mounting type chokes is used in series with the grid resistor, the resistor may be dropped to around 5,000 ohms with a very slight increase in output. The grid resistor of the doubler section of the Siamese, designated as R3 in Fig. 4, should have a value of between 50,000 and 100,000 ohms, and it also be metallized. There is no advantage in putting an RF choke in series with this resistor. The coupling condenser, C3, may be either a length of twisted hook-up wire, or, better still, a small mica "padding" condenser of the compression type. It is shown as a fixed condenser in the diagram, because when once adjusted it is never touched again.

The coils, L1 and L2, are both wound with No. 22 DCC on one-inch forms. L2 is close wound with what is guessed to be more than the required number of turns, and turns are then removed, one at a time, until the circuit goes into oscillation. C3 at this stage of the tuning-up process should be adjusted to a very low value of capacity, and not over 175 volts should be applied to the circuit until all preliminary tuning-up is first accomplished. After the circuit is oscillating, all further tuning of L2 is done by merely spacing the turns on the form. The capacity of the coupling condenser, C3, is gradually increased, and the spacing of the turns adjusted each time to restore oscillation. If the capacity of C3 is raised beyond a certain value, oscillation will be unstable or may even cease, regardless of the spacing adjustment. The capacity should then be backed-off a bit from that value, or until steady, stable oscillation is had with correct spacing of turns on L2. By heavily loading the oscillator in this manner, the crystal current is kept down to a low value and the drift is negligible.

The tank L1-C1 is low-C and resonates at twice the crystal frequency. The condenser C1 should be just large enough to tune the tank.

When the exciter is completely tuned and working properly, the plate voltage may be raised to 275 or 300 volts. There is no object in using higher voltages, because 250 volts on the oscillator is sufficient to fully excite the doubler ,and also because fairly low voltages are desirable on doubler stages for optimum operation. A doubler stage works best with high bias, lots of excitation, and a fairly low value of load resistance (rather heavily loaded) to favor harmonic generation. And because the efficiency of a doubler is none too high, even at its best, it is impossible to run a doubler at high plate voltages (such as would be desirable for a high-efficiency, neutralized class C stage) and under the aforementioned conditions of operation (heavily loaded and excited) without exceeding the dissipation rating of the tube.

The oscillator plate-resonating coil is not critical in adjustment, and if the circuit is tuned-up with a 7250 KC crystal, either a 7000 KC or 7500 KC crystal may be used without adjusting the spacing of the turns of the oscillator coil. Slight readjustment of C1 is the only retuning required.

If the crystal is removed and if the value of R1 is raised to 50,000 or 100,000 ohms, an excellent "cascade doubler", or quadrupler is the result. The 53 then takes the place of two high-mu triode doublers. A midget condenser similar to C1 is advisable across L2 when using it as a "double doubler" to facilitate the tuning process, as it would be necessary to readjust the spacing of the turns on L2, if no condenser is across it, every time a crystal is changed.

Thus the 53 can be used as an oscillator-doubler, a push-push doubler, or a quadrupler. A larger edition of this tube, possibly with a thoriated filament, would be a SWEET addition to the already overgrown family of tubes on the market. Manufacturers gave us the "50 watt" pentode—now let's hope they come out with an overgrown version of the 53!

And, by the way, the 53 makes a fine push-pull final amplifier for a low-power 10-meter rig . . . IF you have a yen for push-pull.

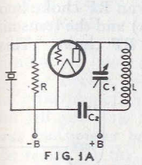


FIG. 1A

CRYSTAL OSCILLATOR, fundamental circuit using triode

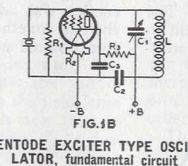


FIG. 1B

PENTODE EXCITER TYPE OSCILLATOR, fundamental circuit
R1—20,000 ohms.
R3—50,000 ohms
C3-C4—.004 mfd.

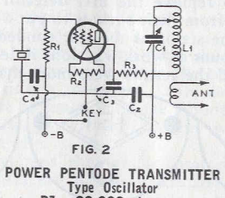


FIG. 2

POWER PENTODE TRANSMITTER
Type Oscillator
R1—20,000 ohms
R3—50,000 ohms
C2-C3-C4—.004 mfd.

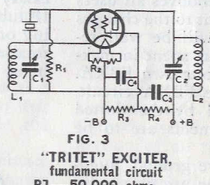


FIG. 3

"TRITET" EXCITER, fundamental circuit
R1—50,000 ohms
R3—10,000 ohms
R4—10,000 ohms
C3-C4—.004 mfd.

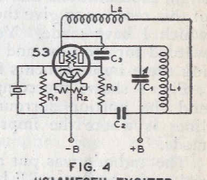


FIG. 4

"SIAMESE" EXCITER, fundamental circuit
C2—.004 mfd.
For values of other constants see text

Getting More Out of the FBXA

By C. C. ANDERSON, W6FFP

Some practical suggestions for improving the performance of the receiver and a new wrinkle on an antenna system which has given exceptionally good results.

MANY users of the FBXA have been bothered with Old-Bugaboo Image from high-power commercial stations. Some of us cannot afford a preselector. The suggestion that a regenerative detector be used to reduce image interference, as well as to increase the sensitivity of the receiver, did not appeal to me. Various other methods were given consideration. The electron-coupled circuit of Lieut. J. B. Dow was finally chosen as the best solution of the problem. It is so simple and so easy to improve the overall performance of the FBXA with a few slight modifications that it behooves all users of this receiver to give thought to the changes which I have made. You will be well rewarded for the time and effort spent in making these improvements in your own FBXA.

Fig. 1 shows the complete FBXA circuit, and the portion surrounded by the dotted lines is where the improvements are to be made.

The cathode was put above ground potential with respect to RF by the use of a radio frequency choke between the cathode and suppressor grid of the 57, with a variable cathode resistor hooked to the suppressor grid. A variable resistor was added to vary the screen potential. It was beginning to sound like a lot of knobs to twist again, for the ole regeneration control has been a missing motion; in fact it seemed absurd to just sit and copy without having both hands on the receiver, even on a nice crystal signal. But a preselector knob would have been just as bad to my way of thinking. However, that is slightly ahead of the story.

The next thing to do is to mount the resistors. The two switches on the front were very seldom used, in fact the one cutting the plate voltage (SW-2), seemed more than useless, but in this case it was nice to have the hole there. The BFO switch was moved to the rear, it being necessary to drill a hole there for it. This left two nice holes in the front for mounting the two 50,000 ohm variable resistors. The battery switch (SW-2) was taken out of the circuit and a drop of solder substituted for it, thus gaining about seven inches of wire to continue the job. Moving the BFO switch (SW-1) also helped considerably. Now to supply the electron coupling.

It was observed that there was an extra prong on the coils to bring out the tap, but this looked like work to me. Being a normal ham, an easier method was discovered. The band spread tap on the 7 and 14 MC coils was just the right place to put the cathode tap for electron coupling, and since this tap eventually arrived at the tuning condenser it was placed on the stator of the rear gang. To get it there was slightly puzzling, but National must have foreseen something like this coming up and conveniently provided two holes in the subpanel at the rear of the two gang condenser (Fig. 3) and these holes are within one inch of the cathode lug on the first detector tube socket. By using a stiff wire, insulated with spaghetti, the coupling condenser, .002, was mounted. It was necessary to remove the first detector and first IF tubes from their sockets to put a soldering lug on the stator of the rear condenser. The total amount of work was done in less than an hour, and the results were more than gratifying. Signal strength doubled, so did the sensitivity, although the ear was the only means of telling this. Signals were heard that were never heard before, and on contact with these signals it was learned that they had always been there, and had called me several times with no result.

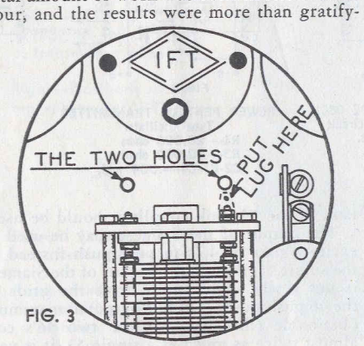
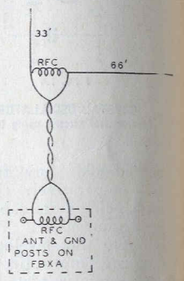


FIG. 3

But the story does not end here. The revamped receiver was tried out on the 7 MC band. In one of my weaker moments I had built Louis X Hubers' weird tuned doublet receiving system, and had a 7 MC tuned coil up in the air. Being somewhat lazy (I am still a normal ham) I hated to take the antenna down every time I wanted to listen on other bands. An inside antenna was tried, and it seemed impossible to stop the regeneration and squawking of the first detector. Having had considerable experience with "21 circuit balance tests", it seemed only natural to believe that the antenna circuit was not properly "terminated" by the impedance of the small indoor antenna. Still being too lazy to put the 20-meter coils in the doublet of the renowned Huber, a brilliant idea occurred . . . to use an RF choke between the antenna and ground posts on the set. This worked like a million. The regeneration was again under control, and the signals jumped-up about ten db. The rig even worked slightly on 7 MC with this indoor antenna, and at this point occurred the peak of my "brilliance." It seems and sounds insane, but it solved my receiving antenna problem. The doublet was lowered, spliced together . . . making a 66-foot flat top. A vertical 33-foot section was added with an RF choke hooking the two together (Fig. 4) and the transmission line hooked across the RF choke. This set-up did wonders, and still does, on all bands; at least it proved to be the best that had ever been tried.

Left—FIG. 3. Correct Method for Bringing Out the Tap.

Right—FIG. 4. An innovation in Antenna Systems. It Has Given Exceptionally Good Results With the FBXA



The next thing was to try the receiver on 3.5 MC. The regeneration could not be controlled there, nor on 1.7, for the reason that the band spread tap used for the cathode feedback was too far up the coil. It was a case of either making the rig normal, or try something else. The easiest way out was to put a switch in series with the electron coupling and cut it off on these two bands. SW-2 was recalled, another hole drilled on the right hand side of the cabinet, and it was so placed. The only precaution necessary is to keep the wires to the switch well separated and in the clear, to cut down the series capacity with the condenser. The variable resistors were enough to cause regeneration on 3.5 and 1.7 MC bands. Aussies and Zedders came in better than they did

(Continued on page 32)

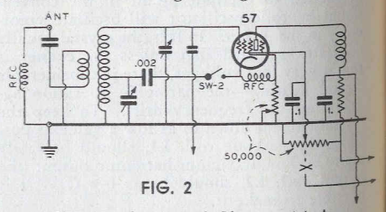


FIG. 2

Showing the Actual Changes Made

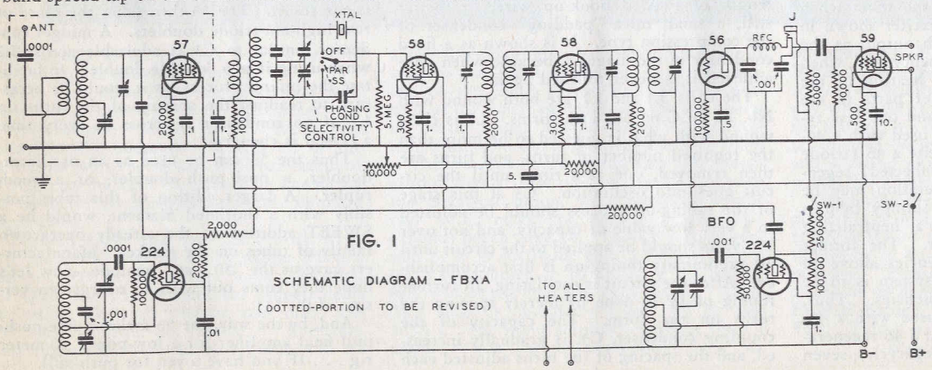
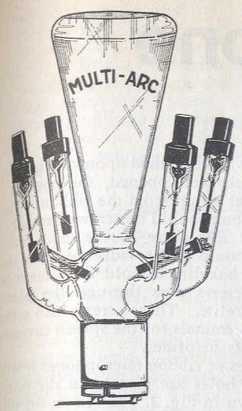


FIG. 1

SCHEMATIC DIAGRAM – FBXA

(DOTTED-PORTION TO BE REVISED)



The Multi-Arc Rectifier

A Self-Starting, 15,000 Volt, 10 Ampere Rectifier, Developed by a Radio Amateur. Air Cooled . . . 10 Inches High . . . Silent in Operation. It Solves Many of the Problems of High-Voltage Rectification.

By GEORGE A. BECKER*

EDITOR'S NOTE—The Multi-Arc is a new adaptation of an old principle. It is another of amateur radio's contributions to the art, and its introduction will be welcomed by many who have long sought the solution to high power rectification at low cost. The inventor, Mr. George A. Becker, here presents the fundamental principles of the Arc. In the next issue he will tell you how to use this new tube in amateur transmitter power supplies. The Arc will be ready for the market within 30 days; production is already under way.

★ ★ ★ ★

THE Mercury Arc Rectifier is a natural outgrowth of the invention of the Mer-Vapor Lamp by Peter Cooper-Hewitt about 35 years ago. The rectifying properties of the Vapor Lamp, discovered early in its development, were expanded rapidly during the next few years and by 1905 Rectifiers were produced which have only been improved slightly in all the intervening years.

The Mercury Arc takes its place between Tungar Bulbs and Kenotrons, being less efficient than Tungars at low voltages, but offering good efficiency from about 100 volts to 5000 or 6000 volts output. Kenotrons follow, up to 200 KV or better, although as much as 40,000 volts has been successfully rectified by Mercury Arcs. Their chief advantage lies in the amount of current that can be rectified, even in small size Rectifiers.

Due to the neutralization of the space charge effect of the electrons by the positive mercury ions of the mercury vapor, the voltage drop through the tube is very low, usually around 15 or 20 volts. It varies somewhat with the design of the tubes. The electrons in the first place, are produced in a very unique manner from the mercury cathode and originate in the Cathode Spot, which is the bright spot that "skitters around" over the surface of the mercury pool.

This spot is maintained by the passage of the arc current itself and there seems to be no limit to the number of electrons that can be obtained. Since this spot is the source of electrons there can be no current through the tube until the spot is established. Once established, however, the current flow will maintain it, provided the current is in the neighborhood of 3 or 4 amps. If the current is interrupted, even for a split second, the spot goes out and must be re-established before the tube will again operate. The spot can be established by breaking a separate current circuit at the surface of the mercury pool, either by rocking the tube or moving an electrode in the tube so as to break contact with the mercury surface, thus creating a small arc which immediately develops into the Cathode Spot.

We see, therefore, that there must always be a current flowing through the tube in order to maintain the spot. This means that there must be more than one Anode, so that one is always carrying current while the others are idle.

This explains the fundamental difference between Mercury Arc Rectifiers and Tungars or Kenotrons. First, there is no filament or heated cathode to supply the electrons, since they are obtained from the Cathode Spot on the Mercury Pool and, second, more than one Anode is necessary; third, there is no limit to the number of Anodes that can be used inside the same bulb.

They do not interfere with each other in any way. A space-charge of positive ions builds up around a negative electrode and effectively shields it.

Since a current of about 3 or 4 amps must always flow through a Mercury Arc to maintain the Cathode Spot, a natural addition to lightly loaded or intermittently operated tubes is a pair of small Anodes operating at low voltage and carrying enough current to maintain the spot. This current flows in an impedance circuit and is wasted. Its sole purpose is to maintain the spot when the other Anodes are idle or when they are carrying less than 3 or 4 amps.

This represents a loss of efficiency, but the wasted power can be held down to about 150 watts, which is not much greater than the filament consumption of Hot Cathode Type Rectifiers.

Since we can have any number of Anodes, and since they will not interfere with each other, it follows that we can use one tube for rectifying several different sources of AC simultaneously. Of course, the Mercury Cathode is the COMMON POSITIVE connection of all the supplies, but the NEGATIVES are distinct and separate terminals. In addition we can secure multi-phase rectification by the same process. This will be described more fully in a later article.

Summing up the advantages of the Mercury Arc Rectifier for amateurs we have:

First—No filament to burn out or lose its emission, therefore extremely long life at top efficiency.

Second—Good rectification right in the range desired by amateurs, without cumbersome or expensive equipment.

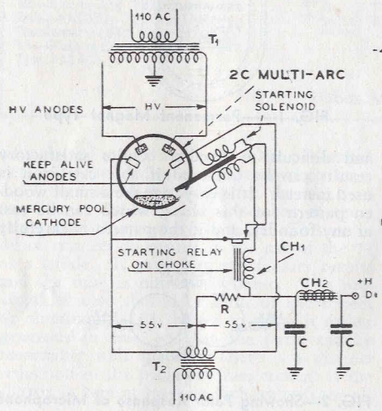
Third—Large current capacity; no such thing as overloading in amateur circuits.

Fourth—Several separate power supplies can be rectified in ONE TUBE, simultaneously.

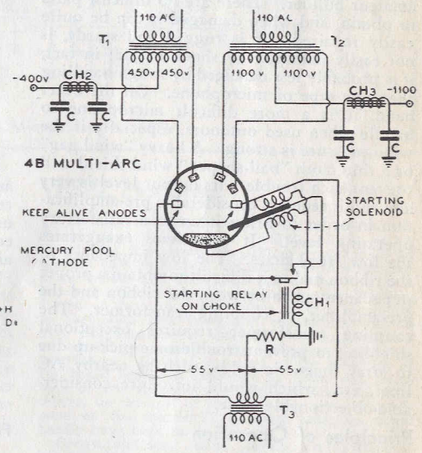
Fifth—Multi-phase Rectification in ONE TUBE, resulting in better DC with less ripple to filter.

Sixth—Simple circuits with common garden variety equipment.

In the next issue the details of this new adaptation of an old system will be fully described—with the information on the new Multi-Arc Tube that opened this field to the amateur.



2C MULTI-ARC



4B MULTI-ARC

* EX-6BIP, 2445 Telegraph Ave., Oakland, Calif.

The Velocity Microphone

By D. B. McGOWN, Technical Editor

THE ribbon or velocity microphone is one of the most desirable types of audio pick-up devices available at the present time. Ordinary diaphragm microphones such as the condenser type are almost non-directional, and as a result they are sensitive to sounds coming from all directions; thus all extraneous noises and sounds will be heard as well as the sound it is desired to pick up. The ribbon microphone has a marked directional effect, and while this is a disadvantage for some types of work, if this property is used to advantage it will result in very desirable operating features under proper conditions. The directional characteristic of a ribbon microphone permits its use in rooms or enclosures with poor acoustics, because the ribbon may be placed so that the reverberation coming from the side walls may be reduced by proper microphone placement. The ribbon microphone has very good frequency characteristics and is capable of high-quality speech reproduction. It is a low impedance device which permits it to be located at almost any convenient distance from the pre-amplifier. It is simple and easy to build and is relatively inexpensive; there are no close tolerances in its construction and it lends itself well to the amateur builder. There are no difficult parts to obtain, and when damaged it can be quite easily repaired. It is rugged and sturdy, is not easily damaged by shock or jar; in fact, it is probably less damaged by rough handling than any type of microphone. On the other hand, it is a more difficult microphone to handle when used outdoors, especially if the wind pressure is strong. A heavy "wind gag" or a thin cloth "ball-shaped" wind shield will prevent such trouble. Its output level is very low and it requires considerable pre-amplification in order to bring it up to a satisfactory operating level. It sometimes exaggerates the low frequencies. The low impedance of the ribbon makes it difficult to obtain a proper impedance match between the ribbon and the pre-amplifier, or coupling transformer. The coupling transformer requires exceptional shielding to prevent troublesome pick-up due to stray magnetic fields, such as nearby AC lines, etc., which would introduce considerable objectionable noise.

Principles of Operation

THE principle of the ribbon microphone is very old, and is also very simple; the operation depends on the electrical law that a conductor moving in a magnetic field has an electromotive force induced in it by its action in cutting the magnetic lines of force in the field. The magnitude of the electromotive force thus produced is equal to the rate of change of the flux through the circuit. This is exactly the same action that makes possible the operation of electrical generators and other similar devices. Obviously, the higher the flux the greater the current generated, and therefore it is desirable that a high flux be available in the ribbon microphone, through which the ribbon may move. Furthermore, because the actual movement of the ribbon is small, the higher the flux the more current will be supplied to the output.

Construction

A RIBBON microphone can be made by taking a thin aluminum alloy ribbon (duralumin) about a half mil. in thickness, .00035 to .0005 inch, and about $\frac{5}{16}$-in. wide. The ribbon is then corrugated by running it through a pair of gears, about 10 to 16 teeth per inch, the entire ribbon strip being about 2½-in. long. The ribbon is suspended between the pole pieces of a powerful magnet. This may be in the form of an electro-magnet or a permanent magnet. Fig. 1 shows the general construction. The permanent magnet from an old magneto may be picked up in almost any automobile wrecker's place for a small sum. If the magnet is weak it can be re-magnetized at a magneto service station. These magnets usually have holes drilled in their sides, and this makes the rest of the unit easy to mount. The soft iron pole pieces should be made of soft Norway iron, but it is sometimes hard to obtain

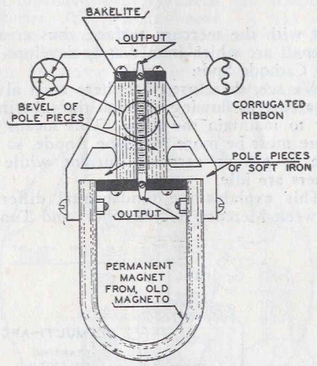


FIG. 1—Permanent Magnet Type

and difficult to handle. Quite satisfactory results can be obtained if soft cast iron is used instead. It is easy to make a small wooden pattern for this work, which can be cast at any foundry, and if the pattern is carefully

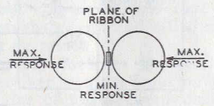


FIG. 1

FIG. 2—Showing Palor Response of Microphone

made the finishing can be done with a file and emery cloth, thus avoiding machine work. An electro magnet may also be used (see Fig. 2), where the general arrangement is the same. Field excitation must be pure, unvarying direct current; otherwise every change in the supply will be heard in the speech output. Battery supply is best, although well-filtered rectified AC is sometimes satisfactory. Commercial direct current is entirely satisfactory, provided a good filter is used, as shown in Fig. 4. The commercial supply is not always free from commutator ripples, etc. A very good supply would be well filtered DC obtained from a 25Z5 or similar tube, for which no transformer would be necessary, and which would give plenty of current for the purpose.

The Ribbon

THE aluminum ribbon must be floated between the poles at very low tension, so that the frequency of the ribbon is below audible range. Generally the ribbon will hang slightly "limp", but care should be taken that it does not hang too freely. It should hang in such a position that it will vibrate easily when breathed upon very gently, with the mouth well opened, the speaker's lips being about a foot from the ribbon. The ends of the ribbon should be screwed to bakelite or rubber insulating blocks, and small metal plates should be provided between the screw and the bakelite to hold the ribbon in place. The screws pass through the plate, ribbon and bakelite. These screws also serve as the output terminals for the speech currents to the output transformer.

In some types of ribbon microphones it will be found that holes are pierced in the poles pieces, as shown in Fig. 2. The reason for this is that these pole pieces act as a baffle, similar to the baffle on a dynamic cone loudspeaker, and the shorter the path between the front and the back, the higher the frequency response. This distance should be about ½ the wavelength of the highest frequency. If the frequency is 15,000 cycles, it will be desirable to have this distance about .44 inches, which is a half wavelength at 15,000 cycles. In ordinary work, this extreme high frequency response is hardly necessary, and it is usually not necessary to pierce the poles.

Since the impedance of the ribbon is very low, usually from 0.2 to 0.5 ohms, it is very easy to insulate the ribbon, and stray moisture or temperature changes will have no effect on the ribbon. It makes it quite difficult, however, to match this impedance with a proper transformer. Transformers can be obtained commercially which will give a proper im-

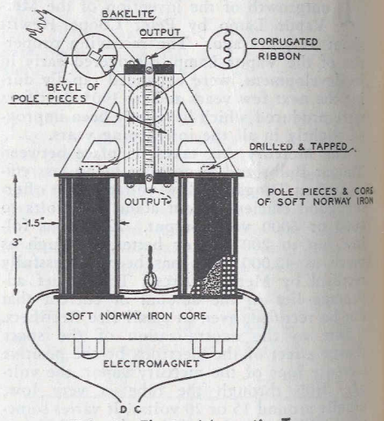


FIG. 3—Electro-Magnetic Type

The cores are 1½ by 3 inches, with following windings: 6 v. DC, No. 19 enameled wire. 12 v. DC, No. 22 enameled wire. 110 v. DC, No. 35 enameled wire. 220 v. DC, No. 38 enameled wire

pedance match and it is usually better practice to use transformers with output impedances of 200 or 500 ohms, which can then be fed into a line, or, if desired, into another transformer which serves as the input of the pre-amplifier. Transformers are available which will match directly from the ribbon to the grid of the tube, and either type, in several popular makes, can be obtained from any supply house.

Response

THE response of the ribbon microphone will cover the entire audio frequency range, up to about 15,000 cycles. Usually there is a slight loss at the high frequencies, starting at about 1500 to 2000 cycles, and

gradually dropping until at 15,000 cycles the average microphone is down about 6 d.b. This condition is with the sound coming from directly in front of the microphone, and from a reasonable distance, the distance being great enough so that the sound waves present a practically uniform or "flat" field to the ribbon. When the microphone is moved up close to the source, the frequency characteristics change considerably. See Fig. 5. At 1-foot distance the low frequency response increases considerably, and decreases rapidly as the distance is increased. The microphone should not be placed closer than about three feet to a person who is singing or speaking, as in public address work.

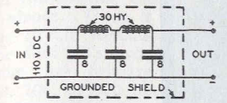


FIG. 4—Filter for DC Field Supply

For amateur use this is not a very serious objection, and the low frequency response can be eliminated by using a "high pass" filter with about 100 cycle cut-off, as is done in commercial microphones, or by using not-too-flat audio frequency transformers for the pre-amplifier. The cheaper types cut off at about this frequency. The common types sold for replacement in broadcast sets are suitable for this purpose.

Pre-Amplifier

A PRE-AMPLIFIER is absolutely necessary with the ribbon microphone, and usually about two stages will be required. The output of the microphone is about 70 to 100 d.b. below a reference level of 6 milliwatts, and the output should be about minus 30 to 40 d.b. The output can then go to either a mixer, a volume control pad, or directly into the final amplifier. Obviously, the pre-amplifier should have an output transformer which matches the impedance of the final amplifier, 200 or 500 ohms.

Heater type tubes are best to use for such a pre-amplifier. They can be battery operated, or operated from a step-down transformer. Battery operation is easier and simpler, and is by all means advised in experimental set-ups. AC operation can be substituted later. The plate supply for such an amplifier should be well filtered and shielded. It is good practice to mount the power supply, including the rectifier and filter, and filament heater supply in a steel

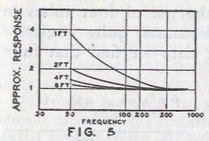
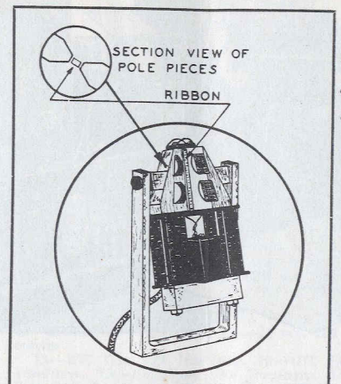


FIG. 5

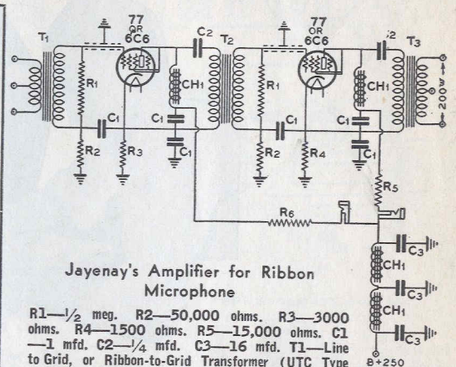
FIG. 5—Response at Various Distances from in Front (or back) of Microphone

or iron shielded box, and place it some distance from the pre-amplifier, so that there will be no stray fields to set up hum.

An amplifier suitable for a ribbon microphone is shown in the diagram, Fig. 6. Here the input is led from the ribbon to an impedance matching transformer, and thence through a 200 or 500 ohm line to the input of the pre-amplifier. It is best to mount the first transformer as close to the ribbon as possible, even mounting it in the bottom of the microphone itself. It is very important that this transformer is very well shielded from magnetic fields, such as from AC lines and equipment. This transformer will prove a fertile source of bad AC hum if it is not properly shielded and a ground connection



The Olson Ribbon Microphone



Jayenay's Amplifier for Ribbon Microphone

R1—½ meg. R2—50,000 ohms. R3—3000 ohms. R4—1500 ohms. R5—15,000 ohms. C1—.1 mfd. C2—¼ mfd. C3—16 mfd. T1—Line to Grid, or Ribbon-to-Grid Transformer (UTC Type PA135 or PA142). T2—Plate-to-Grid Transformer (UTC Type PA136). T3—Plate-to-Line Transformer (UTC Type PA140). CH1—Audio Choke, 250 H., at 15 MA (UTC Type PA45).

C1—½ mfd. C2—¼ mfd. R1—50,000 ohms. R2—500,000 ahms. R3—5000 ohms. R4—30,000 ohms. R5—1500 ohms. R6—15,000 ahms. T1—Mike-to-Line Transformer (UTC Type PA143). T2—Line-to-Grid Transformer (UTC Type PA135). T3—Interstage Transformer (UTC Type PA133). T4—Plate-to-Line Transformer (UTC Type PA140).

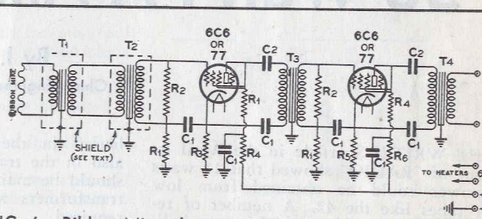


FIG. 6. Ribbon Microphone Amplifier

be mounted in, and as a part of the pre-amplifier, and grounded to the common chassis.

77 type tubes were selected for the pre-amplifier. The shields and screens of these tubes were connected to the plate. This method of connection results in the use of the 77 as a triode. It gave very satisfactory results and the tube is non-microphonic. The pre-amplifier case should be built of sheet steel or aluminum. It is better to make it rather generous in size, so that the parts can be reasonably well spaced. There is a distinct reduction in the probable hum content if the chassis is kept at least an inch away from all

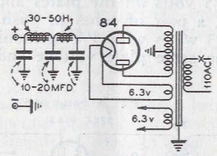


FIG. 7—Power Supply for Pre-Amplifier

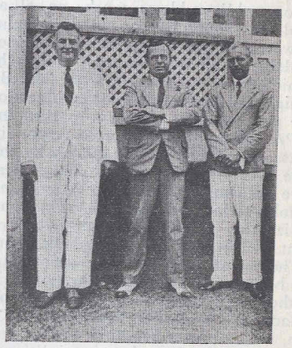
parts. Ventilation may be desirable in the case of long continued use, and holes can be drilled or punched at suitable places in the chassis.

The mounting of the microphone and the amplifier is left to the individual builder. It is difficult to offer suggestions that will be of help, because individual problems differ so greatly. The microphone can be mounted either with the ribbon at the top or at the bottom, the first corresponding to a desk or floor stand type mounting, and the other to a suspension hanger. The microphone may also be hung from a counter-balanced cord and weight system. Owing to the rather great weight, it is inadvisable to try to hold the microphone in the hand while using it, because this brings it rather close to the speaker. Mountings should be rigid and sturdy, and at the same time arranged so that vibration and shock are not transmitted through them. Padding with felt or soft rubber shock-proof pads or mounts will prove beneficial.

VP5PZ Honored

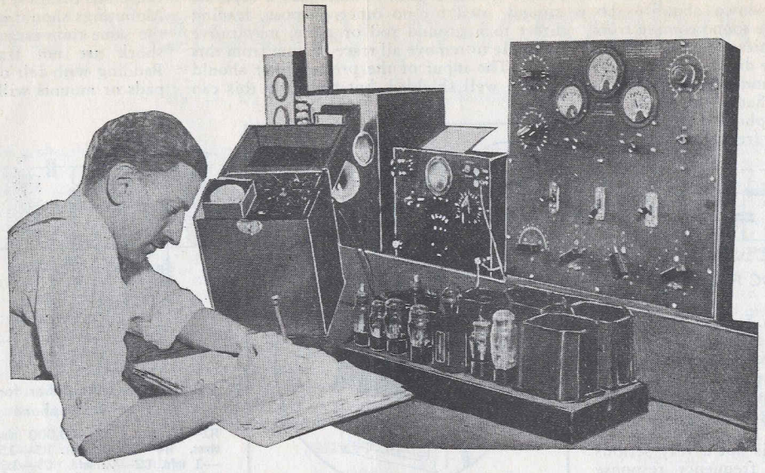
IT IS a pleasure to present a photograph of our old friend, John Grinan, VP5PZ, and two of his associates. This is not an ordinary photograph of a social ham gathering, but something a great deal more serious and dignified. Mr. Grinan has been honored with an appointment on the new Wireless Board of Jamaica. The duties of this board are to formulate new laws and regulations and to give examinations to ascertain the qualifications of candidates applying for Wireless Operators' certificates. General approval of the selection of the board has been expressed by prominent members of the wireless world in Jamacia and elsewhere, on account of the long and varied experience of the members; a better selection could hardly have been made.

Congratulations, John! Again, an amateur is appointed to a position of dignity and responsibility in the Governmental field!



NEW WIRELESS BOARD

(Center): Mr. T. J. Guilfoyle, chairman, Government Wireless Telegraph Inspector;; (left): Mr. J. F. Grinan, member Institute of Radio Engineers; (right): Mr. Edward Mockett, Chief Wireless Engineer, Direct West India Cable Co. in Jamaica.



A 38 Watt PA Amplifier Using '45 Tubes

By I. A. MITCHELL
Chief Engineer, United Transformer Corp.

THE WRITER'S article in the April issue of "RADIO" showed that 15 watts power could be obtained from low power tubes like the 42. A number of requests were received by the writer to indicate what could be done with other tubes in the same line. The information given below was obtained after considerable research on the characteristics of the 45 tube under various conditions of operation.

Due to its excellent fidelity and low harmonic content, the 45 tube has been very popular in both the radio and PA fields for many years, where low power was required. However, few people realize that properly used in push pull connection, a pair of these tubes can deliver from 12 to 19 watts with only 5% distortion and operating with only 275 volts on the plate. While some attempts were made in the past to increase the power output from 45 tubes, the tubes were invariably operated above the manufacturers' maxnmum plate voltage rating (275 volts), so that the tube life was appreciably shortened.

For public address work, an all-around amplifier should have a power output over 25 watts. While many class B amplifiers are available with this rating, the high harmonic distortion inherent with class B tubes at high and low levels is often objectionable. The past year has shown a marked increase in PA competition, and a corresponding increase in the demand for quality by the ultimate user of PA systems. Many men who were accustomed to taking a large number of jobs at low prices are now beginning to realize that a few jobs with quality equipment will bring the same amount of income.

The word "quality" in audio amplifiers can be covered by four major points insofar as the ear is concerned. These are low frequency discrimination, low harmonic distortion, ample power-handling ability, and low hum level. The first of these qualities is controlled almost entirely by the transformers used in the amplifier. Good transformers are available; one grade on the market today having a response from 30 to 15,000 cycles. The second factor, harmonic distortion, is inherent in the amplifier construction, and also in the transformers used. Proper bias should be maintained on all the tubes, and transformers with negligible saturation are required.

IT IS FOOLISH to make a general statement such that an amplifier has 20 watts power output. In many cases the less reputable amplifier manufacturer rates his power output in watts at the maximum saturated output. An amplifier rated at 20 watts in this way would probably be throttled down to 10 watts in use, so that the harmonics would not be objectionable.

Everything considered, anyone who has worked with vacuum tubes realizes that there is nothing superior to class A tube operation for low harmonic content. Class A prime has this same characteristic of low harmonic content plus high power output. The 45 tube lends itself very well to A prime operation. Using 275 volts on the plates and 56 volts self bias, a pair of tubes in push pull will deliver 13 watts with 5% harmonic content. Using the same plate voltage and 70 volts fixed bias, 19 watts can be obtained with 5% distortion. This should be bright news to those of you who want to revamp your old 45 jobs. It should be noted, however, that some power is required to drive the 45 tubes and that the input and output transformers must be special. 56 tubes in push-pull make a perfect driver. The input transformer is the same whether fixed or self bias is used, and has a slight stepdown ratio. The United Transformer Corp. has made available a type UA233 transformer for this purpose. If self bias is used, the plate to plate load should be 6000 ohms (the same as that for class B 46's). If fixed bias is used, the plate to plate load should be 3500 ohms. A special output type PA245 has also been released for these tubes. Figs. 1 and 2 show self and fixed bias circuits for a pair of 45's used in this manner.

Inasmuch as the 45 tube is quite inexpensive, the use of four tubes in push pull parallel becomes quite logical. Examining the above data we find that four tubes will

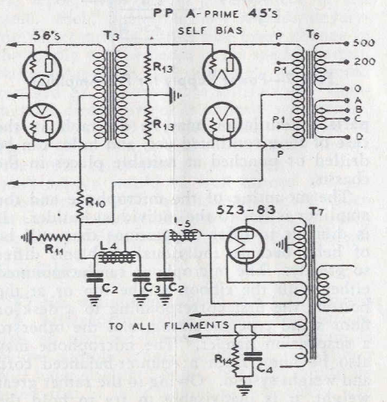


FIG. 1

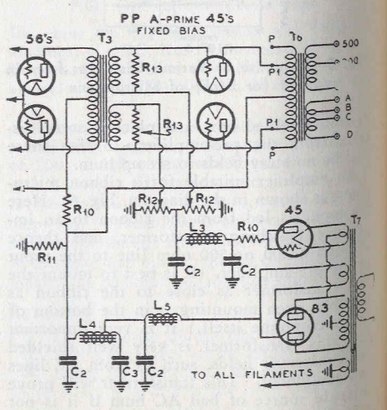


FIG. 2

give us with fixed bias 38 watts, and with self bias 26 watts. These power outputs considering the non-objectionable harmonic content of 5 to 7 per cent are ideal for the medium and large PA job.

FIG 3 ILLUSTRATES the schematic circuit diagram of a three-stage triple push-pull amplifier using self bias and having a power output of 26 watts. The unusual simplicity of construction and wiring is apparent at a glance. There is nothing tricky in the entire circuit. Resistors R3 and R4 stabilize the four 45's excellently. The input transformer has primary terminations to match 50, 200, or 500 ohm lines, single or double button mike, or low impedance pick-up. This transformer is coupled to the two grids of the 57 tube triode connected in push pull. The 57 tubes have the unusually good amplification factor of 20. These tubes are again transformer coupled to the 56's. The input transformer from the 56's to the four 45's is of a special type designed specifically for the purpose. If a transformer of standard nature is used, the normal power output may be cut 80 per cent. The output transformer is also somewhat critical and should be the exact impedance to match the tubes. The transformer shown has two primary impedances, so that it can be used with four 45's having either fixed or self bias. If fixed bias is available the lower primary impedance should be used. This transformer will handle 50-watt peaks. If fixed bias is desired, the output circuit is Fig. 4 should be used. Here the filament center tap is grounded and the bias obtained through a separate 45 tube rectifier, as described in April "RADIO."

THE HUM LEVEL is maintained negligible through good filtering. The output tubes obtain their voltage after the first choke and condenser, so that the plate supply regulation is good. Following this a tuned filter is used having extremely high efficiency. This is augmented by a resistance-capacitance filter in the plate circuit of the first stage. Push pull tube operation has two great advantages in producing high audio quality. The direct current is balanced out of the transformers, allowing good low response, and both filament and plate hums are neutralized.

The output trnsformer from the 45's has terminations for a 200 or 500 ohm line and also for up to 20 voice coils. The voice coil impedances are 1.5, 3, 5, 8, 16 ohms. The

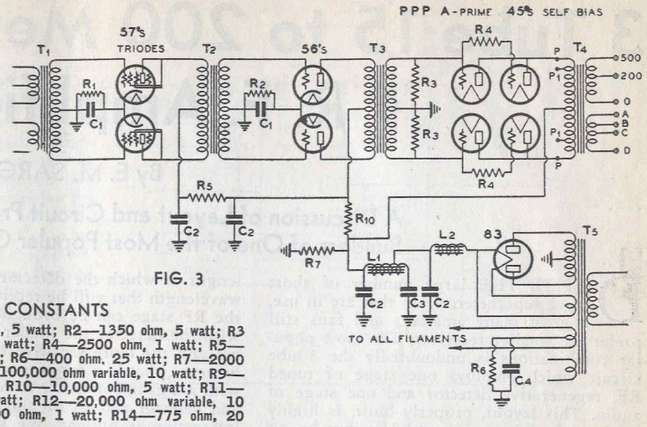


FIG. 3

CONSTANTS

R1—15,000 ohm, 5 watt; R2—1350 ohm, 5 watt; R3—100,000 ohm, 1 watt; R4—2500 ohm, 1 watt; R5—30,000 ohm, 5 watt; R6—400 ohm. 25 watt; R7—2000 ohm, 10 watt; R8—100,000 ohm variable, 10 watt; R9—5000 ohm, 5 watt; R10—10,000 ohm, 5 watt; R11—40,000 ohm, 15 watt; R12—20,000 ohm variable, 10 watt; R13—250,000 ohm, 1 watt; R14—775 ohm, 20 watt.

C1—1 mfd. 200 v.; C2—8 mfd. 500 v. electrolytic; C3—1 mfd. 500 v. electrolytic; C4—25 mfd. 100 v. electrolytic.

T1—UTC Type 135 Transformer. T2—UTC Type 133 Transformer. T3—UTC Type 233 Transformer. T4—UTC Type 445 Transformer. T5—UTC Type 425 Transformer. T6—UTC Type PA-245. T7—UTC Type PA-22.

L1—UTC Type 102. L2—UTC Type 103. L3—UTC Type 45. L4—UTC Type PA-100. L5—UTC Type PA-101.

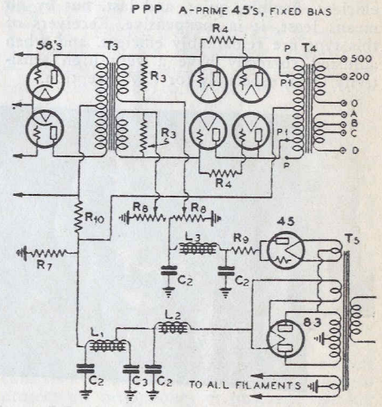


FIG. 4

plate to plate load impedance for push pull parallel 45's A prime self bias is 3000 ohms; for fixed bias 1750 ohms.

If we summarize the actual important factors in this amplifier, they may be noted as follows:

High gain—90 db. suitable for all PA applications.
Low distortion—less than 5 per cent at ALL levels below 26 watts self bias or 38 watts fixed bias.
True class A prime operation
High power output.
Plate supply having good regulation.
Low hum level.
Unusual simplicity of construction.
Inexpensive tubes, and economical operation, low cost of components.

All in all, it is apparent that the 45 tubes in A prime lend themselves very well to the construction of a high quality PA amplifier. With proper precautions in the amplifier construction and the choice of good transformers, together with quiet resistors and non-leaky condensers, an amplifier of this type will be found foolproof for any PA work.

Special output transformers are also available now for use with two or four 45's in A prime for modulation purposes. These tre types PA201 and PA401, respectively.

Cathode Ray Tube Theory

(Continued from page 9)

article in which we hope to describe our sawtooth sweep oscillator. For the many who must certainly be confused by some of the articles on the interpretation of the trapazoidal figures obtained by connecting one set of plates to the modulating carrier and the other set to the modulating voltage, we would like to offer a suggestion. A good article, with appropriate illustrations, was published in "RADIO" for October, 1933. It is felt that since this article was so far in advance of the advent of popular priced cathode ray tubes, it may have well been overlooked. If so, the fifteen illustrations will interpret almost all of the possible troubles that may arise. It is regrettable that no back copies of this issue are available but if demand warrants we may re-print it at some future date.

To recapitulate, one of the most important considerations in designing a "Scope" is to avoid stray fields and pick-up. Be certain that the transformers are out of the field of the tube and mount them, preferably,in or on the rear of the housing. Use an iron or steel, non-magnetic shield around the cathode ray tube. By all means, keep the outfit away from the transmitter when measuring modulation. Determine carefully the correct value of bleeder and filter condenser to avoid disastrous ripple. Ground the metal case of the instrument with a good external ground. It is also good practice to provide some type of filter in the 110 input. This condenser can be a .01 mica from either side of the line to ground. Avoid allowing a bright spot to remain in one place on the face of the tube for any length of time, in order to prevent destruction of the fluorescent material on the tube.

It is our hope that this paper will prove of some value to those who desire a more complete understanding of the theory and operation of cathode ray tubes. Those desiring additional information are referred to an excellent series on the subject by Arthur H. Halloran, a noted authority, whose articles appeared in several issues of "RADIO" last year. The application bulletins of RCA RADIOTRON are particularly fine and cover special phases in a thorough manner. The bulletins published by Allen B. Dumont Laboratories are also highly informative.

There can be no doubt that the introduction of the type 906 has opened an entirely new field for the amateur. "Thanks, Mr. RCA."

CALLS HEARD AT W1CNU STAMFORD, CONN.

June 17 to July 15—20 Meters

G2DI, G2DL, G2DV, G2GF, G2IM, G2KI, G2KT, G2KZ, G2MA, G2OD, G2PN, G2QH, G2XA, G2XU, G2ZJ, G5BD, G5CH, G5JU, G5LB, G5MQ, G5NF, G5NI, G5QA, G5QU, G5QY, G5SR, G5UF, G5VM, G5WY, G5YH. Heard on fone: G5CV. Heard on fone and CW: G5BJ, G6DL, G6HB, G6IR, G6JG, G6JU, G6KI, G6LI, G6LK, G6NJ, G6PY, G6QC, G6QX, G6UF, G6US, G6VP, G6WM, GI5QX, F8GG, F8JJ, F8RJ, FM8BG, D4BCK, D4BGT, D4BHH, D4BIU, D4BKK, D4BTU, EA2AD, EA3EG, EA4AV, EA5BD, PA0AZ, PA0CE, PA0HM, PA0LL, PA0QL, PA0XF, PA0XG, PY1AW, PY5AD, HB9AQ, HB9Y, HC1EG (fone), I1TKM, LY1J, LU1EP, OE1FH, OZ4LM, VO8Z, VP2GP, VP5JB, VP5PZ, VU2BQ, maybe this is a foney as he was R7 RAC at 6 p.m. EST on about 14375 KC. OA4Z, K5AA, K5AF, K5AZ, K6GUA. X1H. Heard on fone: X1G.

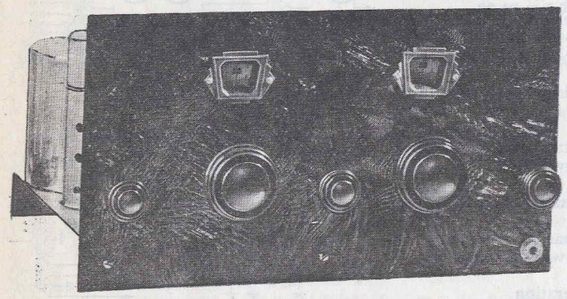
Conditions very poor here this month and the noise level higher than usual. I understand the boys from down under are coming through on 20 from about 11 p.m. EST on. Heard one Saturday night 7-14 at about 12 midnight about R2 VK3HM, not quite sure if the H was an H or an S. Will be on 14376 every Saturday night from 11 p.m. EST till 1 a.m. EST trying to hook VK and ZL.

3 Tube 15 to 200 Meter Receiver With R. F. Amplifier Stage

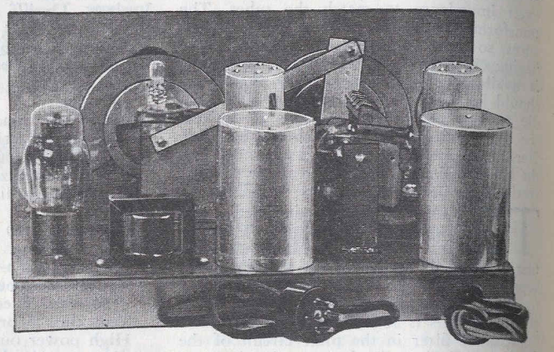
By E. M. SARGENT

A Discussion of Layout and Circuit Problems, and Helpful Hints for Builders of One of the Most Popular Circuits Used for Short Waves

DESPITE THE large number of short wave superheterodynes that are in use, a great many amateurs and fans still prefer the smaller receivers. The most popular combinations is undoubtedly the 3-tube circuit which employs one stage of tuned RF, regenerative detector and one stage of audio. This layout, properly built, is highly efficient, flexible, quiet, and last, but by no means least, it is inexpensive. Receivers of this type are remarkably efficient, and when adjusted correctly have a very high sensitivity level, especially for CW reception.



Front panel view of Sargent 3 tube R.F. receiver with stage of R.F. Amplification



Rear view, showing mechanical band-spreader and 3 inch coil shield cans

In reviewing this type of circuit, it is necessary for the sake of clarity to refer to a specific receiver and circuit. For this purpose the 3-tube "AMATEUR SPECIAL," designed by the writer, is here illustrated and the circuit wiring reproduced. However, the considerations apply to any receiver of this general style, and the intent of this article is to give practical hints to those who own, or those who contemplate building one.

ONE OF THE most important considerations in the layout and wiring of a receiver of this kind is to make provision for complete isolation between the RF stage and the regenerative detector. Even a small amount of interaction is very undesirable. A regenerative detector, in itself is a none-too-satble proposition. Add to this an RF stage which affects both the regeneration and the tuning adjustment of the detector, and an electrical engineer will be needed to operate it. In addition to complicating the operation, interaction also makes is practically impossible to log the receiver. It is therefore highly important that interaction be reduced to a minimum.

Fortunately, with a little care, it is not difficult to do this. Interaction is caused by coupling between exposed parts of the detector and RF circuits. This coupling usually takes place between coils, variable condenser stators, and grid or plate leads. However, it can also occur in the heater wiring, power supply, or even in the shielding if it is not properly designed. The ideal receiver would have coupling only in the one-way action of the RF amplifier tube to the detector, and there would be no reverse coupling of any kind. In the normal operation of the receiver, the detector, because of its regeneration, is the controlling circuit, and the wavelength to which the detector is tuned is the wavelength that will be received. The closer the RF stage can be brought into resonance with the detector the louder will be the signal and the more sensitive the set. Suppose, however, that in a receiver wired as in Fig. 1, with a 2-gang condenser to tune the RF stage and detector and an RF stage trimmer, some interaction is present. We will assume that it is desired to tune in a certain station, KDKA, for example, on 49 meters. The 2-gang tuning condenser is rotated until KDKA is heard. Then, to get maximum sensitivity and best signal, the RF trimmer must be adjusted. This trimmer adjustment, because of the interaction, detunes the detector circuit. The detector controls the wavelength that is received, and when detuned in this way cuts out the signal. Then the main tuning condenser must be readjusted to bring the signal in again, the trimmer must be readjusted, and the whole process repeated a number of times until the loudest signal is obtained. With present-day knowledge of circuit design this complication is no longer necessary. If there is no interaction, the adjustment of the RF trimmer will have practically no effect on the detector adjustment. Thus, as the detector is the controlling circuit in the tuning, a single adjustment of the tuning condenser will suffice, after which the RF trimmer may be adjusted for maximum volume without changing the wavelength of the entire receiver.

The most troublesome medium of intercoupling is the power supply, particularly if it is of the rectified AC varietv. This type of power supply, which is in general use, has a high impedance which has a tendency to couple all circuits that are fed from it. Perhaps the only way to prevent the power supply from coupling the receiver circuits is to use large isolation resistors in all screen and plate leads to the RF and detector tubes. They must then be bypassed by a fairly large condenser to a single-point ground for each set of circuits.

"Single-Point" Ground

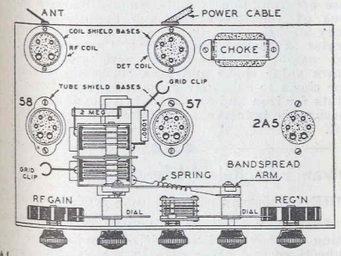
MANY EXPERIMENTERS are careless when it comes to the grounding of circuits, the impression prevailing that any connection to the chassis is a "ground" and that it makes no difference where this connection is made. This is far from fact. The word "**circuit**" implies a complete ring, or circle. A DC circuit, as everyone knows, must be a complete, uninterrupted conductor of electricity, and if part of it runs through the ground, the ground is always taken into consideration as being a part of the circuit. A radio frequency circuit must therefore be considered as a complete circle through which the current oscillates, instead of flowing in a single direction.

Before reading further, look at the illustration that shows the rear view of the receiver, and note the relative positions of the two coil shields, tube shields, and the 2-gang tuning condenser. The coil and tube to the extreme right are part of the RF stage, while those in the center are the detector circuit. Suppose that in hooking up the parts, the careless method of grounding is used. To do this we will put a grounding lug for the coils under the rear of each coil shield. We will also place a grounding lug under each tube socket for circuits that can be conveniently grounded at these points, and we will let the condenser take care of itself, with both sections going to ground through the rotor shaft to the front panel. Now look at the wiring diagram, and see the possibilities. Disregarding the antenna, which may be a doublet and therefore not grounded, the first circuit with which we are concerned is the input to the RF stage. This circuit consists of the secondary of the RF coil, the tuning condenser, the trimmer, and the grid and cathode of the 58. For simplicity, consider the current flow for half a cycle only, and follow the circuit as if it were DC. Start with the top of the secondary coil. Leaving this point the current flows into the stators of the tuning condenser. thence to ground, also to the grid of the tube. Continuing, it leaves the tube via the cathode and there it will divide into two branches, depending upon the iimpedance ratio of the two. Part of it will go through the cathode resistor and the variable 10,000-ohm resistor to ground. The rest will flow to ground through the .01 mfd. by-pass condenser. If a good, noninductive by-pass is used, the impedance at 30 meters will be less than 2 ohms, as against 400 through the resistor, so we may assume that for practical purposes all of the current goes the condenser path. As a matter of fact, one-half of one per cent goes through the resistor at this frequency.

We therefore have the current arriving at ground at the point at which the .01 condenser is grounded, which we will say is at the tube socket. We have more current arriving at ground through the tuning condenser rotor shaft to the front panel, and a lesser amount, depending on the ratio of the tuning and trimmer capacities, at the center of the front panel where the trimmer is located. To complete the circuit, we must trace the radio frequency paths that this current is likely to follow in returning to the starting point at the top of the RF coil. The current from the .01 by-pass will go back via the chassis to the coil grounding lug at the rear. The current from the tuning condenser and trimmer will probably run diagonally down the panel, then flow across the chassis back to the grounding lug for the coil, then up through the coil to the starting point.

NOW COMES a very important point. Radio frequency current does not take the most direct path. It has a tendency to spread, to follow the outside, whether it is flowing through a wire or over a piece of flat metal, such as a chassis. Therefore these currents will spread and will be found at all parts of the chassis. Suppose we are equally careless with the wiring of the detector circuit. We then have RF and detector circuit currents spread over the entire receiving set. There is a resistance drop in a chassis the same as in a piece of wire, only more so. The voltage built up across this resistance is a COUPLING voltage. Enough of that. If you get the point, the seed has been planted. Look over some of the sets you are using, make the changes her indicated, and get ready for some real surprises!

Reurning to the 3-tube set, it is now obvious that we should do all of our pronding at a single point, at least for a given set of circuits. In the case of the RF stage we cannot quite do this, because unless we go to unnecessary bother to insulate the trimmer from the panel we will have at least two grounding points at the panel. The rear section of the gang condenser is used for the detector and the front for the RF stage. The most practical arrangement is to run all RF stage grounds to a lug where the panel joins the chassis, right under the condenser shaft. The detector leads can go to a lug at the rear of the tuning condenser. Circuits belonging to the RF stage should also include the plate of the 58, and its return by-pass.



Above chassis layout, showing proper placing and spacing of essential parts.

IN THIS PARTICULAR 3-tube receiver, the plug-in coils are furnished with individual shields. They are large enough to reduce coil losses to a point where they are not serious, and they are well spaced so as to avoid intercoupling from the currents induced in the coil shields from the coils. This is important. The mere fact that a coil is completely shielded means little. It still requires isolation, and should be treated almost as if it had no shield. True, the coil itself is shielded, but the shield is alive with current induced by the coil, and this can cause plenty of trouble in the right place.

Heater wiring often causes unsuspected interstage coupling, especially below 30 meters. The inductance of the heater wires, plus the capacity to ground through the tubes, forms a resonant circuit that is not affected by center-tapping to ground and which can cause a 60 or 120-cycle hum in the set. This hum can be eliminated by the use of a non-inductive by-pass to ground from each side of the heater at either the RF or detector tube. These by-passes can be of small values.

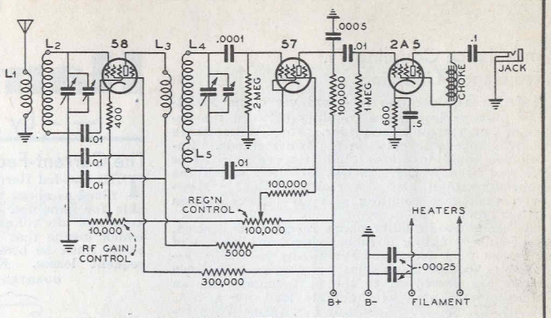
Coupling between exposed grid and plate leads can only be prevented by proper arrangement. In short wave sets of the tuned RF variety, like this receiver herein described, it is impossible to use shielded wire for grid and plate leads without loss of efficiency. Grid and plate wires should be kept as short as possible and located where they will not be near any live parts of other circuits.

The Band-Spread System

THE SYSTEM OF band-spreading used in this receiver is similar to that described in RADIO for July, 1933, in an article by this writer. It is a mechanically-operated band-spreader, different from any other known system. The rear photo of the 3-tube set shows the main working parts of this band-spreader. The tuning condenser, instead of being rigidly mounted to the panel as is usually the case, is held securely in a swivel or cradle mounting. The cradle mounting is extended upward as shown. At the top a coupling arm fastens to it. The other end of the coupling arm connects to a small cam which is operated by the bandspread dial (left, in the photo). Obviously, rotating this dial will turn the cam and impart a small amount of back-and-forth motion to the coupling arm. This motion is transferred to the cradle mounting, and swivels the condenser STATOR over a small angle. The other dial turns the condenser ROTOR. The stator swivel angle is adjustable, and if the coupling arm is attached to the cradle at a lower point, the angle will be greater. Thus it may be adjusted to give any desired spread on any band. In these days of popularity for pre-selectors, etc., band spreading is becoming a real problem. It is just as easy to bandspread a 4-gang condenser as a single condenser when this method is used.

FIG. 1

Circuit diagram of the new Sargent 3-tube receiver. Those desiring more detailed information are invited to write Mr. Sargent, care of this magazine. Additional copies of coil-winding charts can be secured free of charge by addressing the Technical Editor of "RADIO." The chart is of value to all builders of small short-wave sets because the coil constants are unusually good and can be used in designing many other types of 2 and 3 tube receivers.



SARGEANT 3 TUBE AMATEUR SPECIAL

Regeneration

FOR THOSE INTERESTED in an unusually stable regenerator, the writer recommends without qualification the circuit shown. By confining the feedback to the screen, the plate is left free of RF com- of the proper size can be used. This improves the tone quality, also the stability, and makes it possible to go right into a stage of resistance coupled audio without any locking-up. Furthermore, this regeneration circuit is very good ahead of a superhet, for those who like such a combination. Operation of the regeneration control does not affect the adjustment of the IF transformer when used in that manner. The control is unusually smooth, there being almost complete freedom from squawking and spililng over.

The audio system for this 3-tube receiver consists of a single 2A5 with plate choke to protect the headphones or magnetic speaker from damage. The receiver is fully capable of operating a speaker on U. S. short wave broadcasting and on amateur phone and police calls. For the benefit of those who like to build their own, all values of resistance and capacity are given. Number of turns on the coils, etc., depend on the size and type of coil form used. The coil shield should be at least twice the coil diameter and twice its length. Secondaries of the RF and detector coils should be identical. On the detector coil the secondary should be in the middle, the primary on top, next to the grid end of the secondary, and the tickler below. Turns-ratio between secondary and tickler, although best determined by experiment, should be about 6 to 1 for 40 meters and up, about 4 to 1 for 25 to 40 meters, and about 1½ to 1 below 40 meters. On the waevlengths around 20 meters and below, it may be necessary to interwind part of the tickler with the secondary in order to get oscillation. The primary coil for coupling the RF stage to the detector should be two-thirds the size of the secondary, and spaced about ¼ inch from the secondary.

For the CW man who is not interested in single-signal reception, there is perhaps no better set than one of this type. It is an old friend, well known in amateur circles, and also a most popular receiver for all-around short wave reception.

●●●

A good way to check the linearity of a grid modulated stage is to plot different bias voltages against RF output. This can easily be done by varying the C bias either side of the working value (modulator disconnected) and checking against antenna current. If the C bias is varied in 22½ volt steps, the different values of antenna current should be essentially linear when plotted on graph paper. If they are not, the transmitter certainly cannot be expected to have good quality on the air.

Impedance Coupling Vs. Resistance Coupling

MANY regenerative receivers use either resistance or impedance coupling between the detector and the audio amplifier. For CW use there is little to choose between the two methods. Impedance coupling allows slightly more gain to be realized because there is less DC drop across the impedance than across a resistance load. However, resistance coupling gives less trouble from fringe howl.

If really good quality phone reception is desired, impedance coupling is taboo when working out of a screen grid detector. Practically no audio frequencies below 200 cycles or above about 3000 cycles are passed on to the next stage when an impedance is used as the plate load for a 24A, 32, 35, 57, 58, 77, 78, 6C6 or 6D6 tube. Thus resistance coupling becomes necessary.

However, if a triode is used as the detector, the use of the impedance is highly recommended. While impedance coupling, strictly speaking, is not capable of as good fidelity as resistance coupling; when used with triode tubes, the difference in fidelity is only noticeable below 20 cycles per second or above 25,000 cycles, both of which are out of the audible range. In general, impedance coupling gives better fidelity than transformer coupling, although certain manufacturers make audio transformers that give flat fidelity from 30 to well above 10,000 cycles. However, these transformers cost real money and it is often cheaper to add another stage, using impedance coupling, than to get equivalent gain through transformer coupling step-up.

●●●

Whence Came the Ten-Volt Filament In Common Transmitting Tubes?

THE ten-volt filament, as used in the 03A, 211, 852 and others, came from the days of Tungsten filaments. A Tungsten filament, for best efficiency, must preserve a definite ratio of length to diameter. Thus in the old 203 tube the dimensions of the tube and its filament made ten volts the ideal voltage. When the Tungsten filament was replaced by the thoriated type the ten-volt rating was maintained, so that the 203 could be directly replaced with the 203A with as little inconvenience as possible. However, the ten-volt filament for tubes in the 100 dissipation class is not particularly satisfactory when thoriated wire is used as the filament material. A study of all the compromises involved calls for either 5 or 6 volts as more nearly the ideal. The lower voltage has two important operating advantages. First, the hum level is reduced 75%, when the voltage is reduced from ten volts to five volts. Second, it is possible to realize a much higher mutual conductance with the lower voltage because the ideal of a uni-potential cathode is more nearly realized.

●●●

Crystal Oscillator Tubes

AFTER many months of experience with practically every type of pentode tube, I have come to the conclusion that indirectly heated cathodes must be improved before they are genuinely satisfactory in transmitting circuits. The 59 and the 2A5 are particularly bad actors in that a good deal of the active oxide material from the cathode leaves the cathode and travels over to the control grid where it starts primary emitting. This makes for very unstable operation and is one big cause of the parasitics which characterize the 59 when used as a doubler. This brings us back to the old reliable 47 as the crystal oscillator. We have used it successfully as a tritet oscillator with the filament grounded and the screen above ground (to RF) but while it seems to give somewhat better results than a 59 I still cannot recommend it because the oscillator portion of the tube is still nothing but a triode, which I don't like for best stability and long crystal life. The old and proven pentode oscillator circuit still does the best job. By the way, I might mention that of all the tubes with indirectly heated cathods the 53 has about the huskiest structure. It gives much longer life than the 59s and 2A5s, although it is not as good as the 47, according to my experience with oscillators.

●●●

Sylvania Announces 12A7 Tube

THE Sylvania 12A7 type—a combination power pentode and rectifier tube designed especially for use in small AC-DC receivers where space is at a premium—is announced by the Hygrade Sylvania Corporation of Emporium, Pa. There is a 6.3 volt heater for each unit, the heaters being connected in series internally, thus making the rated heater 12.6 volts. Separate connections are brought out for the pentode-cathode, screen grid, and plate. The suppressor grid of the pentode section is connected internally to the pentode-cathode. The rated power output from the pentode is 0.55 watt, and the maximum DC load current of the rectifier section is 80 milliamperes.

Ham Hints

— — By JAYENAY —

The Current-Fed End-Fed Antenna

THE end-fed Hertz antenna has long been recognized as about the simplest arrangement available for ham use. However, 99% of all end-fed antennas use voltage feed to the antenna proper, which means that the hottest portion of the antenna must be brought into the shack, with consequent losses. Fig. 1 shows the current-fed

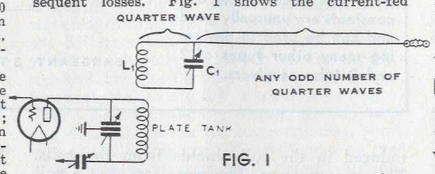


FIG. 1

edition which has materially lower losses than the voltage-fed type, although this type is practically unknown among amateurs. The antenna proper consists of any odd number of quarter waves and the coupling tank, which consists of a coil and a condenser shunted across it, also has a quarter wave across it. If the antenna is rather long, it is important to check the tuning of the coupling tank. The best test is made with a neon bulb to determine that there is very little RF voltage at the point where the coil and the antenna connect, although the other end of the tank should be quite hot.

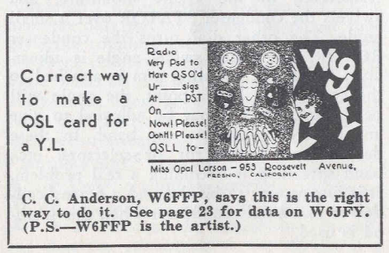
●●●

Push-Push Doubling With a Single Tube

THE OPERATION of a Push-Push doubler is quite similar to the action of a Wunderlich detector tube. However, until such time as some tube manufacturer makes available a Wunderlich tube with a plate dissipation around fifteen or twenty watts, we will either have to use two tubes in the conventional push-push circuit or else use a single double-grid tube in the unbalanced circuit shown in Fig. 2. The circuit is, in effect, a split-stator input circuit with the common condenser lead grounded. However, an ordinary split stator condenser is not suitable because the two capacities are not equal. Thus we use two

FIG. 2.

separate condensers, C1 and C2. This capacity unbalance allows us to compensate for the difference in the amplification factors of the two grids in the 46. Grid No. 1 being closest to the filament has the highest mu, so it receives less voltage than grid No. 2, which has a lower mu, and therefore requires more driving voltage to have an equivalent effect on the plate current of the tube. Thus we must adjust C1 and C2 so that the RF ground is closer to the end that feeds grid No. 1 so that the excitation voltage divides in accordance with the relative mus of the two grids. This adjustment is not critical and is made by increasing one condenser and decreasing the other condenser, until the plate current dips to the lowest possible value, meanwhile restoring resonance after each adjustment. While the same value of grid bias gives good results, the operation of the doubler can be improved slightly by using shunt-feed for the bias supply and then using separate and adjustable grid leaks for the two grids. In this case, grid No. 2 requires the greater amount of bias. If series-feed is used, the RF choke shown is quite important.



C. C. Anderson, W6FFP, says this is the right way to do it. See page 23 for data on W6JFY. (P.S.—W6FFP is the artist.)

Improving Impedance-Coupled Circuits

PENTODE TUBES have a tendency to peak at approximately the center of the audio spectrum, i.e., 2500 cycles. Because impedance coupling is widely used in circuits employing pentode tubes, the peak effect can be further exaggerated by the resonant effect of the impedance itself. This objectionable effect can be largely overcome by shunting a fixed resistance of about 250,000 ohms across the terminals of the impedance, and in this way broadening its resonant characteristics. This method will also effectively eliminate fringe howl, thus making for greater sensitivity by permitting the detector to oscillate at the threshold of oscillation, where greatest gain is secured. The objectionable hiss is also reduced.

●●●

Filter Fundamentals

NO PORTION of the average Ham transmitter is subject to more of the hazards of guesswork than the power supply filter network which is supposed to by-pass the ripple voltage to ground, so that all that reaches the plates of the amplifiers is "adequately filtered DC."

Dellenbaugh and others have presented some fine material on how to forecast filter performance, but the complexity of the whole subject has made it difficult for the average Ham to practice what is preached, especially when so few manufacturers observe any standard basis for filter choke ratings.

However, it is possible in few words to show a rule-of-thumb that allows the operator to make a fairly-usable guess as to whether or not a given filter set-up will do the job.

The first thing to keep in mind is that the filtering EFFECTIVENESS of a condenser increases directly with the capacity but, what is more important, it also increases as the SQUARE of the applied DC voltage. Likewise, a filter choke's filtering EFFECTIVENESS increases directly as the inductance is increased and as the SQUARE of the DC current through it. Expressing it another way, we reach the interesting conclusion that the POWER being filtered has more to do with determining filter costs than the amplitude of the voltage.

For 60 cycle, full wave rectification (120 cycle ripple) the product of the inductance in henries and the capacity in microfarads should equal 20, if 10 per cent ripple is allowable. This amount of ripple is currently being found on some final amplifiers for CW use, although the Federal Radio Commission has not defined just what it meant by "adequately filtered DC." However this amount of ripple is definitely noticeable and should not be used on the oscillator or buffer stages as it is amplified in all following stages. It is unsuitable for phone use. The maximum permissible ripple is 1 per cent for phone use and broadcast practice requires that the ripple be kept below .1 per cent. To obtain 1 per cent ripple the product of the inductance and capacity in the filter should exceed 200. Thus 20 henries of inductance and 10 microfarads of capacity will do the job. By the same token the operator could use 50 henries and 4 mikes to get the same result. The inductance and capacity can be divided in any convenient way, such as 5 mikes, 20 henries and 5 mikes or possibly 2 mikes, 25 henries, 1 mike, 25 henries and 1 mike. Add all the capacities, then all the inductances separately, then multiply the total capacity by the total inductance.

This method is not exact but will give fairly close accuracy and is quite simple. Be very suspicious of your choke ratings because many 30 henry chokes actually measure less than fifteen henries at their rated current. Compare the size and weight of your choke with an equivalent known value choke and then revise the rating of your choke to suit your purpose. There is no substitute for iron and copper and, if possible, actually measure the inductance, WITH RATED DC FLOWING.

●●●

Sylvania Technical Manual

THE wide array of radio tube types now available is reduced to a logical ready-reference listing of characteristics, circuit application, base connections and other data in the Sylvania Technical Manual just issued by the Hygrade Sylvania Corporation of Emporium, Pa. The manual contains 104 pages. It is of convenient pocket size, bound in durable black cartridge paper. Aside from the data on all types of receiving tubes in current use, the manual presents sections on fundamental properties of vacuum tubes, amplifier classifications, definitions, general tube and circuit information, shielding, filtering, heater voltage supplies, volume control considerations, tube and base diagram symbols, and typical receiver circuits in current use. The manual is available to anyone sending 10 cents, in stamps or coin.

The RK-20
In a Broadcast Quality Phone

By McMURDO SILVER

TWO things are outstanding in amateur radio telephony—the small number of phones in operation as compared to telegraph transmitters, and the all but unintelligible hash called modulation put out by many of these amateur phones.

The primary reason for both these conditions is cost . . . many amateurs would prefer to communicate by voice rather than by code.

This whole picture is now completely changed, thanks to the genius of Dr. Paul T. Weeks of the Raytheon Company, and it is not only possible to build an amateur phone boasting good broadcast station modulation quality, but such a transmitter can be built at a cost equal to or lower than that previously possible for a telegraph transmitter of equal power.

This is made possible by suppressor grid modulation in the new RK20 Raytheon Screen Grid RF Pentode. Previous articles have described this tube and its functions, which may be summarized by stating that less than one watt of audio power is required to modulate 100% its 100 to 120 watts plate input with quality equal to that of the best broadcast stations. This is made possible by variation of suppressor grid voltage, variation of which gives a linear control of RF power output.

The transmitter illustrated in Figures 1 and 2, and the diagram, Fig. 3, employs one RK20 in a crystal controlled Tritet electron-coupled oscillator circuit and deliveries 100 to 120 watts RF power on any amateur band, for C.W. telegraphy or 25 watts carrier with 100% modulation capability, which gives a peak power output of 100 watts. Modulation is effected through a simple two-tube three-stage audio modulator and microphone.

The transmitter consists of three units mounted on three standard 19-in. Crystaline black ⅜-in. thick aluminum relay rack panels, having a combined height of only 17½-in. The lower unit is the RF power supply, the next is the 100 watt crystal oscillator, amplifier and antenna tuner, and the top unit is the modulator.

Starting with the RF unit, one of the new RK20's is used as an electron coupled (Tritet) crystal oscillator and amplifier. The crystal is connected between grid and filament, and the oscillator "Plate" tank circuit between filament and grounded screen, thus making up the triode oscillator circuit. Despite the power developed, the crystal is subject to less strain than in the ordinary low powered crystal oscillator due to the high mutual conductance of the RK20—so high that as an RF amplifier, it requires less than a watt of RF driv-

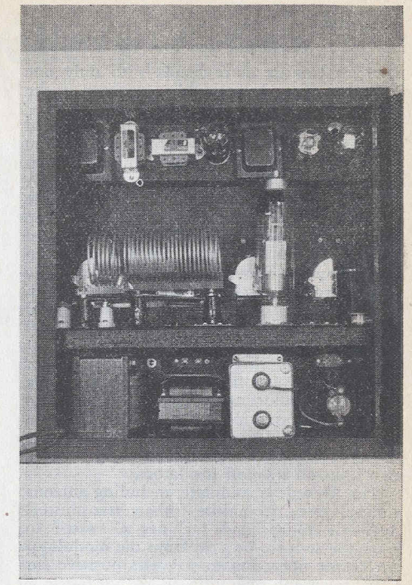


FIG. 2.

ing power. The "plate" circuit of the oscillator consists of two coils effectively in parallel, tuned by a 365 mmf. Cardwell Midway condenser. Since the RK20 is a filament tube and since the filament of an E.C. oscillator must be above ground, these two coils are included one in each side of the filament circuit, and serve both as RF chokes and as oscillator "plate" inductances. They are wound on a plug-in form to permit interchanging for quick shift to operation on 10, 20, 40, 80 or 160 meter amateur bands.

Oscillator operation is checked by a "plate current" jack in the screen circuit, which is by-passed to ground for RF currents.

Because of the effective screening and isolation of the oscillator grid and plate circuits from the plate circuit of the RK20, it is possible to operate the oscillator and output circuits on the same frequency, or where opera-

(Continued on page 22)

CONSTANTS FOR RK-20 PHONE

C-C2—Cardwell Midway, 365 mmf. C-3—Cardwell Midway, 150 mmf. C4—Cardwell 365 mmf. C5-C6—.003. C7-C8-C9—.002. C10—Two Dubiliers, TD-50-40. C11-C12—¼ mfd. C13—0.1. C14—4 mfd. C15—½ mfd. C16—0.1 mfd. C17—.01. C18—20 mfd. low voltage. C19—12 mfd. C20—8 mfd. C21—4 mfd. R1-R2—25,000 ohm, 100 watt Ohmite, set at 350 v. R3—(in osc.) 1100 ohm Red Devil. R3—(in speech) 0.1 meg. R4—10,000 ohm Red Devil. R5—5 meg. R6—0.1 meg. R7—¼ meg. R9—0.3 meg. R10—1 meg. R11—¼ meg. R12—.06 meg. R13—1 meg. R14—500 ohms. R15—10,000 ohms. R16—50 ohms. R17—5,000 ohm Red Devil. Special Chokes: L7—Silver #1485. L8-L9—Silver #1003 Chokes. T1—Silver AC31 Trans. T2—Silver HC-29. T3—Silver P2646 (L3 and L6 are National RF chokes).

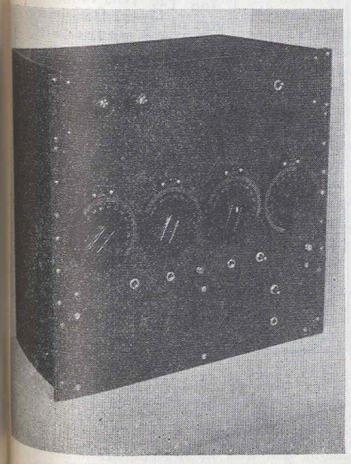


FIG. 1.

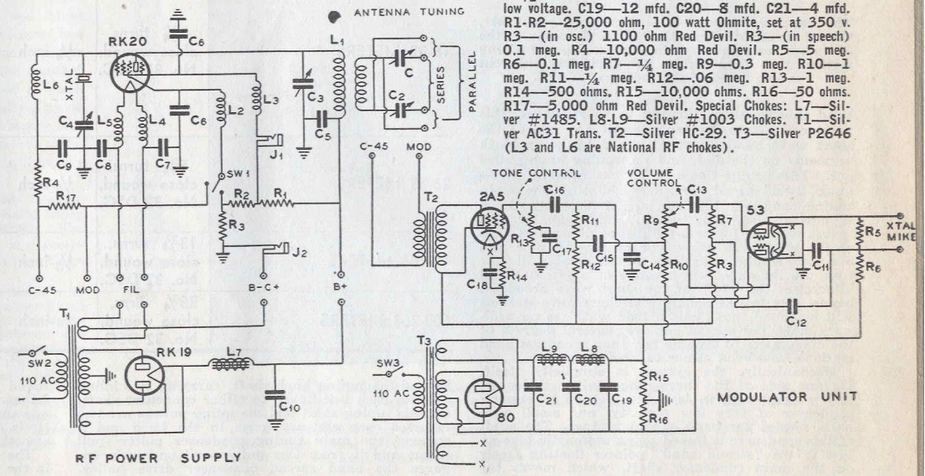


FIG. 3.

RIC-20

(Continued from page 21)

tion on two or more bands with only one crystal is desired, to double frequency in the plate circuit.

The output plate circuit is the standard low C of RF amplifier practice, using a 150 mmf. tuning condenser with plug-in inductance wound with ⅛-in. copper tubing. A jack is provided in the RF unit negative plate return lead for plate current check. To keep this jack at ground potential a meter plugged into this jack reads both plate and screen current, so to determine plate current alone it is merely necessary to subtract the previously measured screen current from the total plate current reading to determine the actual plate current of the RK20.

Antenna coupling is by means of a copper tubing antenna coil with variable coupling to the plate inductance. Two 365 mmfd. condensers are provided for series antenna tuning, while both may be connected across the feeders for parallel tuning by simply shifting two links on standoff insulators.

The RF unit is complete, including antenna tuning circuits, unlike other transmitters available today, and includes a switch to shift the suppressor grid from the modulator for phone operation to 45 volts positive for C.W. telegraph operation.

Frequency stability is what is to be expected—crystal controlled-modulation causing no appreciable frequency shift. Operation and tuning up is childishly simply with the aid of a single 0-150 MA milliammeter. Power output with one RK20 is safely, 100 watts on crystal fundamental, but can be pushed up to 120 watts. It is about 60 to 70 watts on crystal second harmonic, on all bands. One pair of plug-in coils allows operation on the 80 and 160 meter amateur bands, and a second pair of coils permits operation on the 20 and 40 meter bands.

The RF power supply is simplicity itself—one large power transformer providing all filament and plate voltage, on RK19 high vacuum, low voltage drop rectifier tube, a high inductance, lo wresistance filter choke, and 8 mfd. of 1500 volt Pyranol oil capacity. The filter is choke input for good voltage regulation and long rectifier tube life. The power unit is provided with an on-off switch and jack for telegraph key, which must be short-circuited (or plug pulled out) for telegraph operation. This power supply develops 1400 volts at 150 MA which, while slightly above the maker's rating for the RK20, is quite safe, and allows 100 to 120 watts of C.W. power output to be had from a single tube, or 25 watts of phone carrier power, running up to 100 watts or more on 100% modulation peaks.

The Modulator

THE modulator is nothing more than a simple three-stage audio amplifier having its power supply mounted in the same unit. It employs one 53 (dual high-mu triode) in two stages of resistance coupled amplification, developing a voltage gain of over 700 times. This two stage amplifier operates out of one of the new Astatic Crystal Microphones (or out of a carbon or other microphone by addition of a mike-to-grid transformer). The resistance-coupled amplifier then feeds a 2A5 pentode developing 3 watts undistorted output, which is applied to the suppressor grid through a suitable coupling transformer incorporated in the amplifier. The modulator has input and output terminals, a volume or gain control, an on-off switch, and a tone control. The latter is supplied in order to attenuate the modulator's excellent high frequency response in the event that the proposed regulation limiting amateur phones to 3000 cycle modulation bands goes into effect.

The gain and power output of the modulator is more than sufficient to modulate the RK20—in fact, the gain control must be turned down to the point of no plate circuit kick during modulation to prevent overmodulation. The frequency response is flat to 4 db. from 40 to 8000 cycles—response which is better quality than the average high-power broadcast station.

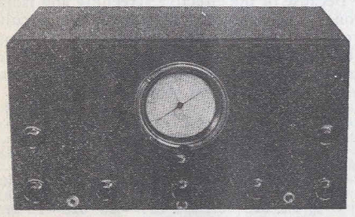
Such, then, is a crystal controlled amateur phone and C. W. Transmitter for operation in, or quick change to, the 10, 20, 40, 80 and 160 meter bands, capable of 100 to 120 watts peak power output, with modulation quality equal to the best American broadcast stations. Yet all this is available, including everything but antenna and 110 voltage power source, at a cost of less than $160—less than $1.60 per watt of useful antenna power!

In a future issue will be described a linear amplifier to boost the power to the maximum one kilowatt input allowed.

New McMurdo-Silver Band-Spreader

A NEW band-spread system is provided in the new McMurdo-Silver receivers by the new "Watch" dial—a single airplane dial having four 180 degree scales accurately calibrated in megacycles (thousands of kilocycles) which is read with the large "minute hand" pointer, and two more 0-100 degree scales read by the "second hand" pointer.

In operation, the tuning knob is pushed in and the "minute hand" pointer used for broadcast band tuning, then, turning to short waves, this pointer is set to the top edge of any one of the short wave bands clearly marked by heavy black segments on the dial, and the tuning knob pulled out. This brings the separate low capacity three-gang band spread condenser shunting the main tuning condenser into use, and if the tuning knob is now turned, the "second hand" pointer will travel over the inside 0-100 degree dial scales. The entire 180-degree movement of this pointer and ovr four revolutions of the tuning knob will now tune the set only over a range of a few hundred kilocycles—the width of the short wave broadcast bands. On this secondary dial short wave stations will be found, not "half a hair wide" as on ordinary dials, but spread out over several degrees of the dial, easier to tune by far, than broadcast band stations, and even easier to read apart.



The improved Silver 5-B single signal super het, the 5C (available Sept. 1, 1934) is the same as the 5B except for a new and simpler band spread tuning method and dial, higher RF gain, less inherent noise, and includes optional A.V.C.

Mechanically, the system is simplicity itself. On one side of the three-gang tuning condenser, and integral with it, is built a second three-gang condenser of very low capacity, and small size, as is needed for band spread tuning. The shaft of this condenser is linked by an automatic take-up belt to the "second hand" pointer floating freely on the main condenser shaft, which moves the main "minute hand" pointer. Below the dial is located the tuning knob shaft, carrying two idling pulleys, each belt-linked to either condenser shaft. On this tuning shaft and the idling pulleys are two reversed cone clutches—push in the knob and it engages the main tuning condenser pulley—pull it out and it frees this pulley and positively engages the band spread condenser drive pulley. This system is known as a "cone clutch", and is found in the most expensive American precision lathes. Its principles and application have been known for years, and it is so simple as to be entirely trouble-free as well as beautifully sweet and smooth to operate.

The tuning dial with its two pointers is shown in the illustration. Condensers and new McMurdo-Silver dial, $6.60 net.

COIL WINDING TABLE FOR SARGENT 3-TUBE RF RECEIVER

Note—These specifications are for coils on 1½" O.T. forms, shielded by a 3" dia. aluminum shield can

R.F. COILS 4-PRONG FORMS	"A" (Primary)	"B" Spacing between coils	"C" (Secondary)
15-32 METERS	2¾ turns, close wound, No. 32 DSC.	Spacing ⅛-inch between "A" and "C".	4¼ turns, No. 24 DSC, space wound, ⅛-inch between turns.
26-53 METERS	4¾ turns, close wound, No. 32 DSC.	Spacing ⅛-inch between "A" and "C".	9¼ turns, No. 24 DSC, space wound, ⅛-inch between turns.
49-106 METERS	7¾ turns, close wound, No. 32 DSC.	Spacing ⅛-inch between "A" and "C".	18¼ turns, close wound, No. 24 DSC.
100-208 METERS	10¾ turns, close wound, No. 32 DSC.	Spacing ⅛-inch between "A" and "C".	41¼ turns, close wound, No. 28 DSC.

DETECTOR COILS 5-PRONG FORMS	"A" (Primary)	"B" Spacing between A & C	"C" (Secondary)	"D" Spacing between C & E	"E" (Tickler)
15-32 METERS	3¾ turns, close wound, No. 32 DSC.	⅛-inch	4¼ turns, No. 24 DSC space wound, ⅛-in. spacing between turns.	Top 1⅔ turns of "E" are interwound with bottom 2 turns of "C"	(See "D") 1⅔ turns, No. 32 DSC interwound with "C", and 2 turns wound separately. Total 3⅔ turns on "E".
26-53 METERS	5¾ turns, close wound, No. 32 DSC.	⅛-inch	9¼ turns, No. 24 DSC space wound, ⅛-in. spacing between turns.	⅛-inch	4⅔ turns, close wound, No. 32 DSC.
49-106 METERS	13¾ turns, close wound, No. 32 DSC.	⅛-inch	18¼ turns, close wound, No. 24 DSC.	⅛-inch	3⅔ turns, close wound, No. 32 DSC.
100-208 METERS	35¾ turns, close wound, No. 32 DSC.	⅛-inch	41¼ turns, close wound, No. 28 DSC.	⅛-inch	5⅔ turns, close wound, No. 32 DSC.

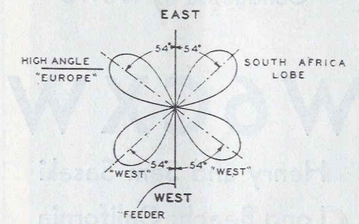
Antennas for City Dwellers

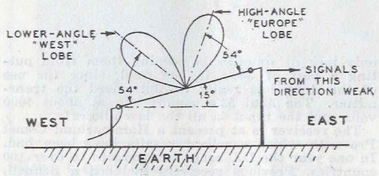
(Continued from page 7)

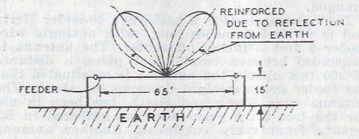
We are told that the decided directional effect of certain antennas tends to reduce the strength of signals in directions other than those in which the antenna is directed. This, of course, is true, but again we are reminded that the prohibitive length of such antennas makes them unavailable to us. Let's see if we can't arrive at a more simple substitute.

Take the case of a full wave antenna (65 feet), working on 14 MC. Let us say that the direction from which we wish especially desire to receive is north-north east. Let us so situate this antenna that it points east and west (approximately, as we will see later). Now if the high end of the antenna is toward the east and the low end toward the west, we naturally would consider the antenna directional to the west, which it is. However, one must remember that a full wave antenna does not have its maximum directivity at right angles to the direction of the wire, as does a half wave, but instead it has two loops in the form of an "X", these being at an angle of 54 degrees to the direction in which the antenna points. If the angle of slope of the antenna is not too acute, it will be readily apparent that we may get very definite signals from directions 54 degrees north of the point, and also the same number of degrees to the south. We are disregarding the other lobes to the west, since they do not enter into the discussion. If the direction of the antenna is fixed so that one of the lobes is on a great circle bearing with the desired direction, we are certain to get strong signals from that locality. Rather obviously, if the tilt of the antenna is made too great the pattern will be in an almost vertical plane, consequently useless. Angles of tilt of 15 or 20 degrees are generally as great as is permissable. Back to our original example.

In our case, the antenna is pointing approximately due east and slopes to the west with an 18-degree tilt. All east-coast U. S. signals are discriminated against, while at the same time signals from Europe are exceptionally fine. In this way, QRM from the U. S. eastern and southern stations is greatly reduced. We have been able to hear European stations with this antenna which were absolutely inaudible on our regular east antenna.







Since the antenna is tilted to the west, signals in this direction are also excellent, so we have in reality almost the uni-directional antenna. By using a little judgment as to the directions most desired, and obtaining great circle bearings on these directions, a compromise can be affected so that really strong signals can be obtained from at least one direction and very creditable signals from two of the others. Of course, such performance is only possible with a full wave antenna. A half wave antenna can be tilted to obtain directivity in one of the directions that would ordinarily be dead, but in this case the direction opposite the tilt will be a complete blank. In the case of longer antennas the loops make a smaller angle to the direction of the antenna as the length is increased, so that even with a tilt, signals will still be strong in either direction. Of course, signals at right angles to such an antenna will be correspondingly weaker as the length is increased for a given frequency.

One very obvious fault of the system outlined is the fact that it comes close to being a one-band antenna, since on 7 MC, for example, our fine full wave 14 MC antenna becomes a half wave affair and "blotto" goes the east direction. Conversely the full wave, 7 MC antenna becomes two full waves, with attendant drawbacks, as previously stated. Such an antenna might well be the ideal compromise, since it would seem probable that a balance could be found where the antenna would radiate in at least two desirable directions on both bands, with the tilt adding still a third direction. Yes, the more we think of it the more we are convinced that this is the ideal antenna for the city dweller—but darn it all—our lot isn't big enough!

Fresno Hamdom's Sweetheart, W6JFY

A YEAR ago while other YLs were studying for a different kind of license, Miss Opal Larson, 953 Roosevelt avenue, Fresno, Calif., was studying for her ham license, and passed. The call of W6JFY was assigned to her and soon she was on the air with about three watts, limited to local QSOs. She soon yearned for out-of-town contacts, and the low power expert, W6FFP, was hired at $50 per hour with the result that she soon had a special "FFP" 16-watt '45 transmitter on the air. Her first out-of-state QSO was with another YL, W7NH, who honestly (?) gave her a much better report than FFP got while standing by to arrange the QSO. Then she gained confidence and many good QSOs followed. Yet she was not satisfied, for everyone gave her better reports than she could give them.

A new receiver was needed and old "Gainer Bane", W6WB, was prevailed upon to build her a custom "Gainer." Opal is a very active YL. She is secretary of the Valley Radio Club, and secretary of the 1934 Pacific Division Convention Committee.

She has captured the hearts of all the hams who know her; in fact when she is visited by other hams all they can seem to do is operate her set. Imagine the embarrassment of some of her contacts, she was probably siting by, bored to death, being too much of a lady to suggest that the visiting ham take her to a dance, a show, or at least let her run her own rig.

We predict many shattered hearts at the coming convention for after all, there is only one Opal.

She is a good operator, has a very precise "fist", both for the key and for those who get too chummy. Ask FFP!

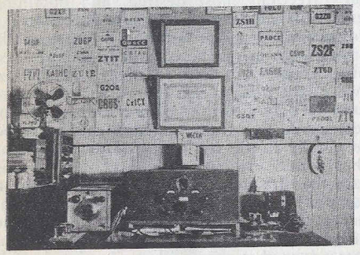
No foto is available of her transmitter. Who cares about that?

She has a nice QSLcard,likes to receive QQSL's, and is always the first to QSL you.

All in all, W6JFY is a real ham. At her ham set her interest is all radio. While sitting under a full moon, with a soft spring breeze blowing . . . well, what does a YL ham think about, anyhow?

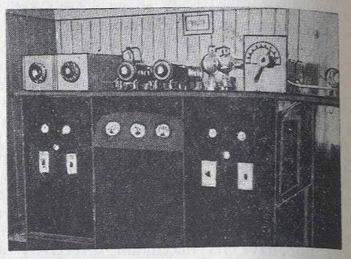
Globe Girdlers

Conducted by W6WB



W6CXW

Henry and Sam Sasaki
Long Beach, California



W6CXW IS LOCATED approximately nine miles north of the city of Long Beach, California, at least a half mile from the main boulevard and no high-power lines or BCL's to disrupt the peace of mind of the operators. Not a bad location, any way one looks at it!

The station is jointly owned and operated by two brothers, Henry (HY) and Sam Sasaki. They ask me to mention that the name is **not Russian,** they are Japanese. Hi! We have the pleasure of knowing both personally and, confidentially, they are as fine a pair of chaps as you would ever care to meet and both are **real** operators!

The first station license was acquired in May, 1929, and shortly after another rock-crushing RAC hit the air. A 210 was responsible—however, their stay on the air was brought to a sudden and rather disastrous close . . . the complete transmitter was stolen! With this and one other exception (when the station was moved to the present QRA), W6CXW has been on the air constantly. After their initial venture, an 852 was installed with 100 watts input (No, we didn't forget to add that other zero)! This same 52 is still in use and is getting better with age. Hi!

The operators were among the early users of crystal control, and as "Hy" says, ". . . days when the more back wave one had, the more certain he was to receive that highly-valued report of 'xtal-control'." The old QRA did not live up to expectations as it was impossible to raise Europe for a WAC, although some 39 DX countries were worked, so that the station was moved to the present QRA in '32. In less than a month, the WAC was established. In seems funny for the boys to recall those early-day struggles because since that time WAC has been worked over 150 times!

For some time, the transmitter consisted of a 47-46-852-852. On 14 MC one of the 52's was used as a doubler-amplifier. Hy and Sam say that disgusting results during the 1934 DX tests prompted the present instalaltion consisting of 47 oscillator, 800 doubler, HK354 buffer and 2-852's in the final. For 14 MC the only change is the use of the 354 as a doubler. They say that only lack of finances is keeping them from putting a pair of 354's in the final, since the use of this tube has really revolutionized the transmitter. The final 52's usually run at about 4000 volts and the input is all the law allows!

The receiver is at present a Hammarlund Comet Pro with which excellent results have been had. In one year the DX heard has mountd to over 100 countries. Previous receivers included a Schnell, Super Wasp and SW3, these receivers having become obsolete as conditions in the amateur bands changed.

The antenna used is a half-wave 40-meter Hertz and is 65 feet 4 inches long, with a single wire feeder 9 feet 5 inches off center. The antenna is suspended between two 70-foot poles, a distance of 200 feet apart; the antenna is so situated that the feeder drops straight down to the shack. The antenna runs North and South, has been in use for the last three years and has gathered in R9 reports from every continent. Another antenna of the same length and height, but running Northeast by Southwest, works out better for Europe, but has been very disappointing in other directions, notably East Coast, U. C., and VK-ZL. It is planned to do some experimental work with directional antennas "as per RADIO" but we can tell you that from the way we hear CXW knocking over the Europeans this "experimental" work is going to be postponed. Hi! Incidentally, there is space aavilable on the east and south sides of the shack up to 1700 feet. Oh!

Activities include membership in A.R.R.L., J.A.R.L., R.S.G.B., IRF, WAC, WBE, and WCA. Most of these organizations are familiar to everyone but the last mentioned, namely WCA, is perhaps not so well known. The initials (WCA) stand for World Contact Association, the membership of which is made up of a small but select group of local amateurs, who are devoted exclusively to DX and to furthering good fellowship among the amateurs of the world. The membership includes W6ADP, W6BIF, W6CVZ, W6EXQ, W6ENV, W6FAL, W6FKC, W6FZY and both ops at W6CXW. All are WAC, WBE and have worked at least 60 countries. The combined European QSO's of the club this year totals well over 500!

DX has always been the chief source of enjoyment at CXW but those who have listened to the W5ATF-W6CXW chats for over a year and a half know that a good rag chew is always welcomed. In addition, a sked has been kept with W2CC for over four years!

DX includes 82 countries (78 not counting Chatham Island, Aelutian Islands, Cocos Island and Galapagos Island) in all continents. We regret that space does not permit a listing of all the wonderful DX worked by this station, but a list of some of the DX follows:

North America—Alaska, Canada, U.S.A., Mexico, Salvador, Spanish Honduras, British Honduras, Panama, Canal Zone, Trinidad, Antigua, Martinique, Costa Rica, Haiti, Dominican Republic, Cuba, Jamaica, Virgin Islands, Porto Rico, Newfoundland, Nicaragua. **Oceanica**—Australia, Tasmania, New Zealand, Fiji Islands, Ellice Island, Ocean Islands, Hawaii, Philippines, Java, Dutch Borneo, Sumatra, Sarawak, Guam, Tahiti. **Europe** — Scotland, England, Spain, Germany, Italy, Russia, Netherlands, Poland, Norway, Finland, Hungary, Austria, Belgium, France, Lithuania. **Africa**—Mozambique, South Africa, South Rhodesia, Nigeria, Egypt, Canary Islands, Algeria. **South America**—Venezuela, Brazil, Argentina, Peru, Chile, Colombia, Ecuador, British Guiana, Bolivia, Uruguay. **Asia**—Japan, Korea, Manchuria, China, Hong Kong, Straits Settlements, Federated Malay States, Unfederated Malay States, India, Siberia. Cocos Islands, Chatham Islands, Galapagos Islands, Aleutian Islands.

We asked who does most of the operating and the answer was that the fellow who was lucky enough to get at the key first. They modestly state that the possible reason for their DX record is the fact that there are two operators at the key.

Both men have been to Japan and can certainly tell some great tales about their "J" brothers. They have visited J1, 2, 3, 4, 5 and J6 districts. They mention, in passing, that it is a pity that more U. S. amateurs do not get the opportunity to visit Japan because those chaps are spdendid hosts and the visitor is always assured of a wonderful time.

Well, you have heard the story of the brothers Sasaki; drop in some time and meet two real amateurs.

THIS 'N THAT—By W6WB

AT last, that much-discussed individual, O. M. Reid, ZS2A, comes to the fore and answers many of the questions which have been so widely discussed. We take the liberty of quoting part of his fine letter: ". . . I would like to settle that lil' argument with regard to the final stage used here. During the contest I was using a single type 210 with about 1250 volts at 40 to 50 mills, which gives me about 45 watts, average input. Total contacts were 244, with all W districts and two VE. Was able to exchange numbers with all stations both ways, making 8052 points if all the chappies send in their results . . . about old ZS2F . . . He (so he says), was only using 10 watts maximum all the time he was on and raised 600 points. Not bad, eh? ZS6B, ZS1C, ZS1H and, I think, ZT5R were using 50 watts. ZU1E had more power, I presume, although I am not certain. ZS1H parked himself on 14 MC and the rest were all on 7 MC. . . You cannot guess what one day's mail was 'ere, I'll bet . . . 65 letter and cards to be precise! Yes, and have been rather a long time answering them, and had to QSL via the Bureau . . . WID best 73s to all the mob over there, Thine,

'PYE', Radio ZS2A."

DON'T FORGET THE MELBOURNE CENTENARY DX CONTEST TO BE HELD IN OCTOBER THIS YEAR! See back issues of "RADIO" for full details of the contest. Now is the time to get those great circle bearings on VK and get the antenna functioning so that you can raise plenty of the gang from "Down Under." East-coast and middle-west stations will have the opportunity of a lifetime to snaffle off a bunch of those elusive Australian stations.

●●●

AND now for a dip into the pages of that very excellent journal, **"The T & R Bulletin"**, for DX news from the British Empire.

Mr. R. E. Erle advises that amateurs in the Strait Settlements will operate under the call VS8 instead of VS1. As far as he knows, this change does not extend to amateurs located in the Federated and Unfederated Malay States.

Malta stations are now officially licensed and up to May 19 the following have been registered: VP3C becomes VP3A, VP3H is VP3B, ex G2AZ is now VP3C.

The months of June and the early part of July saw a great increase of European DX on 14 MC. On the west coast, G, F, ON, and D were commonplace. Such extremely rare DX as PAO, LY, OE, HAF, I, OH, SP, HB and SU1 were heard and worked by many of the W6-W7 gang. Bearing out the theory of the effect of the moon on DX, we were able to predict the exact night on which European DX would be heard. Really worthwhile!

W7BB says he cracked W6CUH's record of 21 VK and ZLs in one morning! Well, here's the answer from W6QD himself: ". . . we think nothing of working 21 . . . upon checking our log we find that during our best night we worked 27 VK and ZLs with 7 Js, 4 KAs, 3 VSs and 2 ACs, also 2 PKs thrown in for good measure." Well, well, what can you say in answer to that, Ed? If this column does nothing else, it certainly brings the boys out of the old hole to refute statements that others make. Hi!

●●●

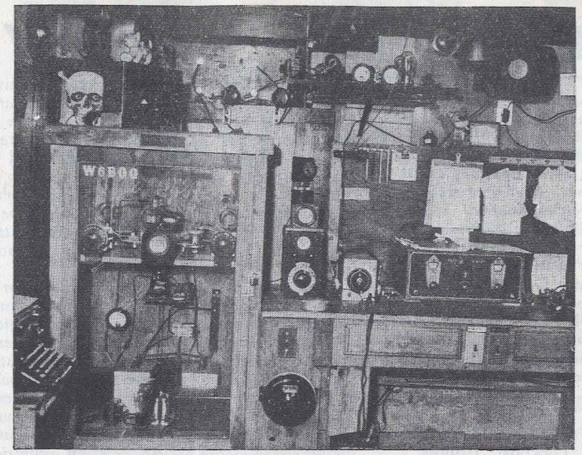
ATTENTION, WEST COAST AMATEURS! The Federation of Radio Clubs will have its biggest session of the year at Santa Barbara on September 1, 2 and 3. This gathering will assume the aspects of a regular convention and no one within a reasonable distance should fail to attend. Maybe see you there.

I. R. F. NEWS (Formerly I.T.K.)

The Amateur's Legion of Honor

This department is edited by the President of the International Radio Fraternity, J. Richard Meloan (Jo) radio W6CGM-W6ZZGB, KERN.

All communications concerning the International Radio Fraternity, as well as inquiries from any amateur as to the Requirements for Membership, should be addressed to I.R.F. Headquarters, either to the Secretary-Treasurer, Kenneth M. Isbell, W6AMR-W6BOQ, 5143 So. 6th Ave., Los Angeles, or to the President, J. R. Meloan, W6CGM-W6ZZGM, 1411-9th St., Bakersfield, California.



W6BOQ

Station of Kenneth M. Isbell, Secretary-Treasurer of I. R. F.

Second Honor Degree Awarded

FOR distinguished or heroic radio service in the field of communication this fraternity awards its highest degree, the Honor Degree, to members who are deserving of it. Only one has been awarded to date, although several brothers are eligible and will receive the award in due time. Usually only through friends of the deserving person do the real facts become known, such is their modesty. Too frequently is the radio operator belittled rather than praised. Too often have the heroic efforts of radio operators been doomed to oblivion or submerged in the praise of others not directly responsible for the beneficial action, even though "the lightning jerker" may have made the supreme sacrifice.

Many amateurs have become so sufficiently skilled at their hobby that they are also professional radio operators or engineers. The fact that professional men are paid for routine duties does not discount their service when their actions are no longer routine.

Los Angeles, Calif.,
June 13, 1934.

Secretary,
Int. Radio Fraternity,
Los Angeles, Calif.

Dear Sir:

Here is a report of my services in connection with the San Felipe hurricane:

San Felipe Hurricane Sept. 1928, commonly called Porto Rico Hurricane, started in British West Indies, passing over Porto Rico, Haiti, Cuba and Florida. 1,000 lives lost in Porto Rico. Damage 100 million dollars. Wind velocity over 150 m.p.h. for 2 days. Storm broke Thursday a.m. Vessel to which I was assigned was off north coast Haiti, relaying storm warnings. That a.m. no communication to be had with Island. Bull S.S. Co. vessel "Edith" torn from anchor in secluded harbor of San Juan, dashed aground at entrance to harbor. Next day my vessel made port. Quoting P. R. "Progress" of Sept. 25, 1928: "Every man for himself—Friday, Saturday and Sunday". RCA short wave point to point station out. NAU, Navy station out, WPR out. No amateurs on. No power for 5 days, then only emergency power for hospitals and police from steam engines. Saturday messengers afoot and on horseback sent into interior to get news; all phones and telegraphs down. Whole cities of 10,000 wiped out, never again rebuilt. Humacao, P. R., is one of these. One week after storm struck people were digging in mud for food, milk selling for 75c a quart. Gov. Towner, of P. R., did not know extent of damage and did not act for 72 hours. Sept. 22, 1928, first vessel arrived from States with Red Cross supplies.

As a radio operator I handled all traffic for 4 days in and out of San Juan. Messages received from States given to local Cable companies and Navy. Messages handled were U. S. Weather Bureau and bank code (10 letter groups—no rpts), War Dept., Bull Steamship Line, N. Y. Porto Rico Line, S. P. R. Sugar Co., British Government at St. Kitts. For 5 days only two or three hours sleep nightly. I had cooperation of Local Harbor Master and all agencies named above, except U. S. Navy. Receipts on hand for messages to Dept. of Interior of P. R., Bureau of Insular Telegraph and French Cable Co. Refer to N. Y. "Daily News"—Sept. 1928; N. Y. American and P. R. "Progress" Sept. 1928 issues. It has been officially stated in Washington that if I had not relayed this traffic, even though I violated Radio Laws by Port operation, that hundreds of deaths would have resulted from neglect. Red Cross would have sent an insufficient amount of food, blankets and medicine. Receipts, and official communications on hand for inspection of anyone.

Respectfully,
(Signed) JOSEPH DOCKENDORF,
W6JTC.

West Coast Division Chief Elected

RONNIE MARTIN, W6ZF-KUP, popular amateur leader, is chosen to head the important West Coast Division in which IRF has almost 200 crack operators and engineers, truly the "cream of the crop". This Division includes Arizona, California, Nevada, Hawaii and the Philippines. W6BPO, Jack Smyser of Las Vegas, is State Chief of Nevada at present with an election in progress for State Chief of California with W6LN, W6SM and W6GHD as nominees. SC's for Arizona, Hawaii and P. I. are yet to be chosen with several excellent men under consideration.

Mr. Martin will represent IRF in this Division and supervise the operation of the State organizations in his charge. Through his State Chiefs he will supervise the organization and functioning of all Chapters and he will direct traffic and communications in conjunction with the IRF western network.

W9HVN, Gene Poteet of St. Louis, government radio operator in the U. S. Engineers service on the Mississippi, has been appointed State Chief of Missouri. Members should henceforth make their monthly reports through him and lend their cooperation to his efforts. Other State Chiefs for this Central Division are about to be appointed for Nebraska, North and South Dakotas. Inasmuch as few IRF members in these states have the necessary time available because of occupational pursuits, these several openings present excellent opportunity for prominent amateur leaders resident therein who are qualified for IRF membership. Such amateurs who have not yet received formal invitation to IRF brotherhood should communicate with headquarters at once.

IRF Silver Cup Contest

TO choose the "Best Amateur Station in North America" each annum, open to all amateurs, is the purpose of this contest. Robert S. Kruse, prominent radio engineer and short wave pioneer, is tentative chairman of the Judges Committee. Other noted engineers from IRF ranks will be chosen from various sectors of North America to complete the board of judges. The contest will be unique and it will present an entirely new angle on amateur achievement. Every amateur will have an equal opportunity to compete. Application of modern short wave knowledge to amateur equipment, versatility of operation, facilities for emergency operation, past record, individual ingenuity, coupled with new ideas in action, will all be featured in this contest, together with other phases yet to be outlined.

The first cup winner will be chosen for this year, 1934. Watch for complete details and photo of the handsome silver IRF trophy.

Ten Meter Contest

FOR the purpose of the advancement of radio communication on the 28 mgc. band and the encouragement of portable activity during the vacation season, the Ten Meter Contest began July 15th and continues to September 15th. All members entered in this contest should submit detailed reports on their accomplishments immediately at the conclusion of the contest. The prize will be awarded with respect to the general purpose of the contest and your general activities on 28 mgc. Frank C. Jones, IRF brother and noted authority on the ultra-high frequencies, has been asked to judge the contest.

W6DTJ, Russell Bennett of Stockton, Calif., won the low power contest, using a single 230 tube. His score was over 7000 points. The prize has been awarded.

W6LN, Thorius LaCroix, took honors in the QSO contests and won the prize, a Munzig brass ribbon-wound adjustable antenna coil.

Attention, All Amateurs!

So desirable has it become to be an IRF brother, and so enthusiastic are the amateurs about the ITK-IRF plan, that headquarters has been besieged with countless letters requesting that we create a junior membership so that every worthwhile man can have an opportunity to cooperate in IRF's sound program of a great unselfish fraternity sponsoring a New Deal for the amateur with fair and honest administration. Taking cognizance of this demand, the large Southern California Chapter submitted a resolution to headquarters for vote of the general membership to wit: (1) That every worthy **licensed amateur** be permitted to join IRF, independent of the present requirements, and by merely making application. (2) That all **of the present IRF members become brothers by** reason of careful choice, formal invitation and the meeting of rigid requirements and that this membership shall be known as the ITK section (Order of ITK) of the International Radio Fraternity. (3) That the requirements remain unchanged for this ITK classification, with the possible addition of a 21-year age limit. (4) That ITK men shall retain their former degrees, exclusive of those admitted to "Junior Membership". All members of IRF, including the degree section of ITK, shall have direct voice on all IRF affairs, including voting privilege.

Further functions included in this resolution would probably be that radio clubs could as a whole become IRF clubs with their present officers, set-up remaining undisturbed. Such clubs are to be independent of ITK Chapters. While qualified amateurs could gain brotherhood in the Order of ITK (Degree Men) directly as formerly, amateurs not so qualified can join IRF and look forward to the day when their merits are such that they can become ITK candidates. The whole organization structure therefore would be known as The International Radio Fraternity, having an upper classification of Degree Men, known as ITK (not I Tappa Kee).

The above-mentioned plan effecting all licensed amateurs has been in a process of vote for the past month. **Because this is the first time such a plan has been outlined publicly IRF Headquarters wishes an expression from all amateurs as to their reaction.**

D-X NEWS

By W6WB

Proposed New D-X Country-Classification

IT is with great pleasure that we here reproduce a letter received from Mr. O. M. Carter, W9ADN, together with his proposed list of DX Country Classification. "The Carter System", as we rightfully call it, was complied after much intelligent study of the matter of country classification. In Mr. Carter's letter you will find many interesting views of this rather-complicated situation. His proposed list has been sent to members of the Official Country Committee so that they may use it as a basis for their considerations. In the event that the Committee decides to adopt this new classification, the DX amateurs are indebted to Mr. Carter for his valuable and timely contribution to the art.

1010 Madison St.,
Lockport, Illinois.
June 28, 1934.

"RADIO",
Pacific Building,
San Francisco, California.
Gentlemen:

A note in a recent issue of "RADIO" states that you are undertaking a study similar to one I started about three years ago, the establishment of a list of countries of the world to be used as a standard or "yardstick" by all of us in computing the number of "countries heard", or "countries worked". I started to prepare such a list because I found that in comparing DX coverage with others there was so much disagreement in what was a "country" and what was not. I had, in fact, become irked at having someone say that he had worked so many countries (invariably more than I had, of course), and then discover that he had counted Yukon Territory, or Scotland, or some other such place as a separate country.

When I started my "study" I had no idea that I was to spend the equivalent of weeks of work on it. I had expected to find a list already prepared for me, but such was not my good fortune. But perhaps it was really fortunate that I did not find a list ready made for I was forced, before I got through, to look up many places, or countries, about which I had previously had a very imperfect idea as to their location, climate, people, etc. Which brings to mind again the suggestion which someone once made: . . . that we would all learn much more, find our hobby much more interesting, and instructive, too, if we would familiarize ourselves with the land, people, and so on, of the DX stations to which we so glibly say, "Geom, R8, QRU, 73, Gb."

In establishing our "yardstick", we should endeavor to have it confirm to our needs and also agree with modern ideas of those accustomed to world geography, commerce and communication. An example of what we should not use is the suggestion once made that all minor subdivisions of all the countries should be counted, as well as 48 states, all provinces of Canada, Australia, South Africa, Brazil, Mexico, all islands, etc. There are a number of objections to such a system. (1) The preparation of a standard list of such divisions would be no mean undertaking and would correspond to multiplying this list I am submitting by, perhaps, 20 times. (2) It would be necessary for each amateur to have quite a good set of maps to check the locality of such small subdivisions. (3) Such a system would be preposterous to use in telling our DX accomplishments to our friends, our bosses, etc., acquainted with international geography. Our yardstick should be so arranged that a person in one locality has no unreasonable advantage over a person in another locality, as would be the case if each island in the world were to be counted as a separate country. Think what an advantage a person in Japan would have if he got a friend to take a portable transmitter in a boat and land at each of the 1000 and more islands in the Japanese group!

After one has studied the problem for a short time and made a start on a list he finds that there are apparently only two logical reasons for classifying localities as "countries", and that neither of these, alone, is quite satisfactory, either. The two ways are on the basis of geography, and on the basis of government. The geographical basis is ruled out, however, because of the immense number of islands, and similar considerations. At the start, a division on the basis of government looks to be comparatively satisfactory. If we were to use this rigidly, however, we would have to delete from our list such island groups as the Cape Verde Islands, Madeira Islands, and the Canary Islands, as they are governed just as though they were a part of the mainland countries of Europe to whom they belong, and so would reduce the total possible number of DX countries for us to communicate with, when such a reduction does not seem necessary considering the great geographical separation. The same thing is true of certain of the countries of northern Africa, which unquestionably we have every justification to consider as separate countries.

In view of these difficulties I was at a loss as to how to prepare a list of countries that would satisfy the requirements previously mentioned. I consulted several professors of history, and political science and they were able to suggest no simple formula for our use. The suggestion was made, however, and the more one studies the situation the more one realizes that something of the sort must be done, to combine the two methods of division on the basis of government and geography.

The method used was to prepare a list of all geographical localities listed in the U. S. Postal Guide. Then each locality was looked up in the Encyclopedia Brittanica to determine its political status. The division was then first made on the basis of government and then special cases made to agree with great geographical separation. An arbitrary decision was made to list as a separate country all islands more than 300 miles distant from the governing country. Independent units such as the United States, Great Britain, Dominions and Crown Colonies of the British Empire, colonies of other countries than those of Great Britain not called Crown Colonies but administered in about the same way, are listed as "countries" in all cases. Groups of islands, such as the Bahamas, Dutch West Indies, Dutch East Indies, Gilbert and Ellice Islands colony are listed as one country and each island in the group is not listed as a separate country. In the case of islands that are governed as independent units, such as Trinidad and Martinique, each independent unit is listed as a separate country. The Virgin Islands of the British Empire and of the United States are counted as two countries, and so on. In other words, whenever a colony is administered direct by the mother country, or protecting country as the case may be, the island is listed as a separate country. If an island has a Resident Officer who in turn reports to a Resident-General for a group of islands, then only the group is listed.

Due to the smallness of some islands and the fact that they are practically uninhibited at the present time, and also to the fact that some of the maps available, particularly those of the western Pacific, were not suitable to measure distances as small as 300 miles, they have been included with the governing country. If these places later have stations, and subsequent investigation warrants it, they can be separated and listed as a country.

As a whole, the listing and classification of localities has been done slowly and carefully. However, it is my suggestion that each country that has island possessions, protectorates, etc., be given an opportunity to study the list before a final OK is put on it. It is possible that an occasional error has been made, or that some omission has been made in the condensed final list. Considering the immense number of localities looked up over such a long interval of time and the absence of anyone to check over my work, it would be a bit of luck if the list were perfect as it stands. However, before any appreciable changes are made, the person or persons recommending them should study the problem in its entirety so that the list will be consistent throughout and so that they will not be misled by any unintentional feelings of nationalism.

Yours very truly,
(Signed) O. M. CARTER,
W9ADN.

1 Aden
2 Afghanistan
3 Alaska, including Aleutian Islands, Pribilof Islands, St. Lawrence Islands
4 Albania
5 Algeria
6 Andora
7 Anglo-Egyptian Sudan
8 Ascension Island
9 Australia, including Norfolk Island, New Britain Archipelago, Admiralty Islands, New Ireland, New Britain, Solomon Islands, Santa Cruz Islands, Australia mandated territory of New Guinea
10 Austria
11 Azores
12 Bahamas, including Little and Great Abaco, Great Bahama, Eleuthera, Cat, Wattling, Rum Cay, New Providence, the Exuma chain, Long Island, Andros, Crooked Islands, Mayaguana, Inagua
13 Barbados
14 Basutoland
15 Bechuanaland Protectorate
16 Belgian Congo
17 Belgium
18 Bermudas
19 Bismarck Archipelago
20 British Honduras
21 British Somaliland
22 British Guiana
23 Canal Zone (Panama Canal Zone)
24 Cape Verde Islands
25 Ceylon
26 Costa Rica
27 Cuba
28 Cyprus
29 Danzig
30 Denmark
31 Dominican Republic
32 Dutch (Netherlands) East Indies, including

New D-X Country Classification

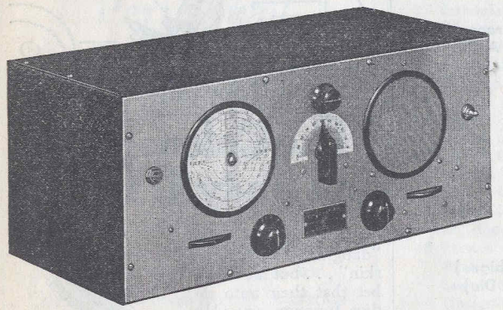
(Continued from page 26)

Bali, Banka, Billiton, Dutch Borneo, Celebes, Java, Dutch New Guinea, Sumatra, etc.
33 Dutch Guiana
34 Dutch (Netherlands) West Indies, including Aruba, Bonaire, St. Eustatius, Saba, Dutch part of St. Martin
35 Egypt
36 Eritrea
37 Esthonia
38 Ethiopia
39 Falkland Islands
40 Faroe Islands
41 Fernando Po and Spanish Guinea
42 France (including Corsica)
43 French Cameroons
44 French Equatorial Africa
45 French Guiana
46 French Indo-China, including Annam, Cambodia, Cochin-China, Laos, Tonkin
47 French India—Chendernagore, Karikal, Mahe, Pondichery, Yanaon, Calicut
48 French Settlements in Oceania—Gambier Archipelago, Marquesas Islands, Tuamotu, Leeward Islands (French) Society Islands (including Tahiti), Tubuai
49 French Somaliland
50 French West Africa, including Senegal, French Guinea, the Ivory Coast, Dahomey, the French Sudan, Haute-Volta, Mauretania, Niger, French Togoland
51 Gambia
52 Gibraltar
53 Gilbert and Ellice Islands—Indl. Line Islands, Palmyra, Washington, Fanning, Christmas Islands
54 Gold Coast Colony, including Ashanti and Northern Territories
55 Great Britain and Northern Ireland, including England, Scotland, Wales, and Northern Ireland
56 Greece, including Crete
57 Greenland
58 Guadeloupe, including La Desirade, Les Saintes, Marie Galute, Basse-Terre, Grande-Terre, St. Bartholomew, French part of St. Martins
59 Guam
60 Guatemala
61 Haiti
62 Hejaz, Nejd and Dependencies
63 Honduras
64 Hongkong, including Kowloon
65 Hungary
66 Iceland
67 India, including Burma, Bhutan, N.W. Frontier Prov., Brit. Baluchistan, Andaman, Nicobar, Laccadive, and Maldive Islands
68 Nepal
69 Iraq
70 Irish Free State
71 Italian Somaliland
72 Italy
73 Jamaica, including Cayman Islands, Turks, Caicos Islands
74 Japan
75 Kenya
76 Latvia
77 Leeward Islands, including Anguilla, Antigue, Barbuda, Dominica, Montserrat, Nevis, Redonda, St. Ketts, Virgin Island (British part)
79 Liberia
80 Liechtenstein
81 Lithuania
82 Luxembourg
83 Macao
84 Madagascar and Dependencies (Ste. Marie-de-Madagascar, Nossi-Be, Comoro Islands)
85 Madeira Islands
86 Malay States
87 Malta
88 Marianas or Ledrones, Marshall and Caroline Islands
89 Martinique
90 Mauritius
91 Mexico

(Continued on following page)

92 Morocco (French)
93 Morocco (Spanish)
94 Morocco (British)
95 Netherlands
96 New Caledonia
97 Newfoundland, including Labrador
98 New Hebrides, including Banks and Torres Islands
99 New Zealand, including Nauru
100 Nicaragua
101 Nigeria, including British Cameroons, Lagos
102 Norway, including Spitzbergen Arch.
103 Nyasaland Protectorate
104 Palestine
105 Panama
106 Paraguay
107 Persia
108 Peru
109 Philippine Islands
110 Pitcairn Island
111 Poland
112 Porto Rico
113 Portugal
114 Portuguese East Africa (Mozambique)
115 Portuguese India (Goa, Daman, Diu)
116 Portuguese Timor
117 Portuguese Guinea
118 Portuguese West Africa (Angola)
119 Reunion (Bourbon) Island
120 Rhodesia, Northern
121 Rhodesia, Southern
122 Rumania
123 St. Helena
124 St. Pierre and Miquelon
125 St. Tome and Principe, including Sarame
126 Saar Territory
127 Salvador
128 San Marino
129 Serbs, Croats and Slovenes, Kingdom of (Czechoslovakia)
130 Seychelles, including Admirantes, Cosmoledo, Aldabra
131 Siam
132 Sierra Leone
133 Spain
134 Swaziland
135 Sweden
136 Switzerland
137 Syria, including Lebanon, Alaouites
138 Tanginyika Territory
139 Tonga (Friendly) Islands
140 Trans-Jordan
141 Trinidad, including Tobago
142 Tunisia
143 Turkey (Asian and European)
144 Uganda
145 U.S.S.R., including Moldavia, Bashkir, Tartar, Kirghiz, Dagestan, Crimea, Vakutsk, Karilian, German Volga Settlements, Buriat (Caucasus) Mts., Georgia, Azerbaiken, Armenia
146 Union of South Africa, including Cape Province, Natal, Zululand, Amatongaland, Orange Free State, Transvaal, British Bechuanaland, Tristan Da Cuba, South West Africa
147 Uruguay
148 Venezuela
149 Windward Islands, St. Lucian, St. Vincent, Grenada, Grenadines
150 Zanzibar and Pemba

A Ham Receiver Lacking These Features is Antiquated!



Actual Fractional Microvolt Sensitivity
Built-In Monitor Calibrated Dial
Co-Axial Coils with Non-Failing Switch
Continuous Band Spread
Built-In Power Pack and Speaker
—you get them all in the SKYRIDER

The old spark coil, the loose coupler and the "three piece" receiver with an arm load of plug-in coils have a warm spot in my heart. I used them—in the early days. But, like 2-cylinder cars and corsets they belong buried in the past!

Yet, because the manufacturer long neglected the ham, thousands of amateurs have had to lumber along with antiquated equipment. So, we built the SKYRIDER — a thoroughly MODERN Amateur Receiver, with everything to fit today's requirements, including a fair price.

The SKYRIDER
The MODERN Ham Receiver

Pioneer W9RA Enthusiastic

George E. Joyce, President Chicago Radio Apparatus Co., a distinguished ham of pioneer days, W9RA established in 1909, says: "If a signal is on the air, the SKYRIDER gets it. Cuts through static—actually seems to thrive on this nuisance! I get a new thrill everyday from my SKYRIDER—more thrill than from any set I've ever owned, due to the extreme ease of locating stations and its extraordinary sensitivity. It's the best buy on the market. Congratulations!"

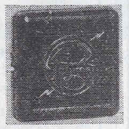
SEND for BOOK: I can't cover half the features of the SKYRIDER here — ask your Jobber for the SKYRIDER Book or request it of me. It's free.

the hallicrafters, inc.
W. J. Halligan, President
417 North State Street Chicago, U. S. A.

Behind the POLYMET Trade Mark

Polymet TRADE MARK — QUALITY SERVICE DEPENDABILITY

This midget size mica condenser is extremely popular where space limitation is a factor — Polymet fabricates seven different types of mica condensers from .000005 mfd to .03 mfd capacities.



Hi-Frequency Condensers

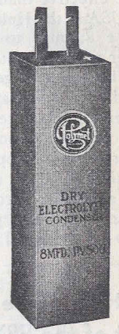
These condensers are designed to eliminate the common faults of ordinary condensers such as poor power factor and inductance. Because of their low loss characteristics Polymet's new Hi-frequency line is particularly recommended for use in short wave receivers.

POLYMET PRODUCTS

Are recognized by many of the leading manufacturers in both the radio and electrical industries for that HIGH QUALITY so essential to dependability. THEIR ENGINEERS DO NOT GUESS—THEY KNOW. The successful service man, experimenter, or amateur does not guess, he knows that the use of POLYMET products in his work is his GUARANTEE OF SATISFACTION.

Polymet Condensers

ELECTROLYTIC—Wet and Dry Types
PAPER—Tubular and all can types
MICA—All Types, Midget Sides with lugs & leads
TRANSMITTING OIL CONDENSERS
CONDENSER for all PURPOSES



POLYMET STANDARD WET ELECTROLYTIC
This type wet electrolytic condenser type is most popularly used throughout the entire world because of its established reputation for quality and durability.

PETITE CONDENSER
A new POLYMET Tubular paper condenser in greatly increasing demand by radio manufacturers. Its compactness and low cost effect many economies in radio.

POLYMET DRY ELECTROLYTIC CONDENSERS
Exceptionally popular in the leading AC-DC receiving sets. Furnished in many combination dual and triple units. Supplied in either cardboard or metal containers.

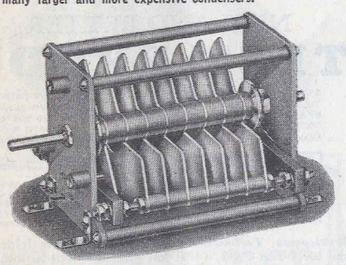
We Also Manufacture TRANSFORMERS and WIRE WOUND RESISTORS

Polymet Manufacturing Corporation
831 E. 134th ST. NEW YORK, N. Y., U. S. A.
Write for New 1934 Catalog

NEW! JOHNSON TYPE "D" TRANSMITTING CONDENSERS

Single and Dual-Section (split-stator) Models

JOHNSON Type "D" Transmitting Condensers achieve capacity values and high voltage ratings in the most compact assemblies ever constructed. Though small in size and low in cost, they are equivalent in performance to many larger and more expensive condensers.



A few of the exclusive features: ● *Sturdy, rigid, polished plates, .051" thick. Corners rounded and polished for high flash-over voltage.* ● *MYCALEX Low-Loss high-frequency insulation* standard. ● *Integral, laminated low-resistance phosphor-bronze contacts.* ● *Bi-Metallic cone bearings front and rear; adjustabe.* ● *Large diameter ⅝" spacers.*

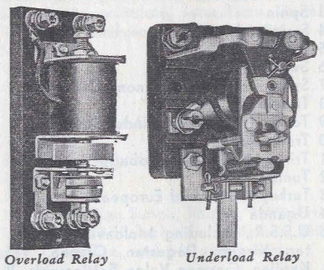
A *full* range of capacity values, in both *Single* and *Dual-Section* (split-stator) types. Voltage ratings, per section: 3500 RMS. (.080" spacing) and 7000 RMS. (.175" spacing).

Two of the popular Dual-Section models:

	3500 Volt Rating Per Section	
No.	*Cap. Per Section*	*List Price*
100DD35	100	$12.50
200DD35	200	18.50

For Full Details Get BULLETIN 200 From Any AUTHORIZED JOHNSON DISTRIBUTOR

E. F. JOHNSON COMPANY
Manufacturers of Radio Transmitting Equipment
Waseca, Minnesota, U. S. A.



Overload Relay *Underload Relay*

New Ward Leonard Relays

OVERLOAD RELAY

WARD LEONARD Midget Overload Relays are specially designed for use in transmitter circuits of amateur radio stations to provide protection to the tube against overload or current surges. These overloads may occur while tuning the transmitter or if resistance bias is used on the power amplifier, the tube may become overloaded should loss of excitation occur.

The normally closed relay contacts are connected in series with the primary of the plate rectifier transformer. The relay overload coil is connected in the negative return lead from the rectifier so as to operate at low potential.

When a current surge occurs the relay armature pulls in, opening the contacts in the rectifier circuit and protects the tube from damage. The contacts are held in the open position by a mechanical latch until the operator trips the latching device, thereby closing the contacts and reconnecting the tube in the circuit.

The relay is adjusted for operation in the vertical position. Operating current 200 or 250 MA. List Price..... **$8.50**

UNDERLOAD RELAY

WARD LEONARD Midget Underload Relays are designed for use in transmitter circuits of amateur radio stations to provide protection to class "B" modulator tubes and possible breakdown of secondary of class "B" modulator transformers should the class "C" tubes fail to hold the load due to loss of excitation.

The normally open relay contacts are connected between the center tap of the class "B" transformer and ground. The relay coil is connected between the center tap of the class "C" transformer and ground. When the transmitter is set in operation the coil is energized and the plunger closes the contacts, completing the class "B" modulator circuit. When the class "C" circuit drops the load, the relay coil is de-energized, the relay plunger drops out, opening the contacts and preventing possible damage to the class "B" transformers or to the tubes due to sudden increase of voltage.

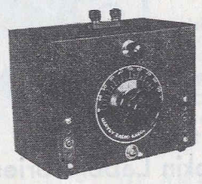
The "pick-up" may be adjusted by turning the screw at the top of the relay coil. 100-200 or 200-400 MA.
List Price **$10.00**

SHORT-WAVE MANUAL

120 page 6x9 book for newcomers in amateur and short-wave field. Profusely illustrated. $1.00 per copy.

"RADIO," Pacific Bldg., San Francisco, Cal.

TRANSCEIVERS



6-VOLT MODEL—ideal for plane, auto or wherever 6-volt source is available.
Price $17.95
Tubes 1.68

2-VOLT MODEL for portable or field work. Employs smallest size batteries.
Price $18.75
Tubes 2.04

2-VOLT MODEL in carrying case, ready to operate including all accessories.
Price $49.50

5-10 METER TRANSMITTERS mounted on black crackle chassis-class B circuit with five tubes including a stage of speech amplification-outputs of 3-10 watts. Price including tested tubes..... $29.50

Power supply for the above..... $26.50

RK-20 POWER AMPLIFIER employing two of the new suppressor-grid tubes in push-pull, permitting 100 watts CW output on four bands and 30 watts output when modulated. Price including two tested tubes $65.00.

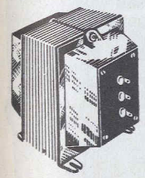
●●●

Write for new bulletin describing the above apparatus in detail. It will be sent free upon request.

●●●

Harvey Radio Laboratories
12 Boylston Street Brookline, Mass.

QUALITY
at a Price You Can Afford to Pay!



FRANKLIN Transformers

Very conservative ratings on Transformers and Chokes for every Amateur Station.
"MOST SOCK PER DOLLAR"
Write for Catalogs

FRANKLIN TRANSFORMER MFG. CO.
607-609 22 Ave. N.E., Minneapolis, Minn.

LEICHNER CAPACITORS

Built up to a Standard—Not Down to a Price

You will be money ahead by using LEICHNER CAPACITORS in any RF circuit of the transmitting. Both by their low initial cost, and greatly increased efficiency.

LEICHNER CAPACITORS embody the following outstanding features—

1. Dielectric, finest quality Flint Glass.
2. No change in capacity due to heating.
3. High current carrying capacity.
4. GUARANTEED FOR ONE YEAR.

Manufacturers' inquiries solicited

Your dealer can supply you—or write us for prices

MANUFACTURED BY
Leichner Electric Company
FORT WAYNE, INDIANA

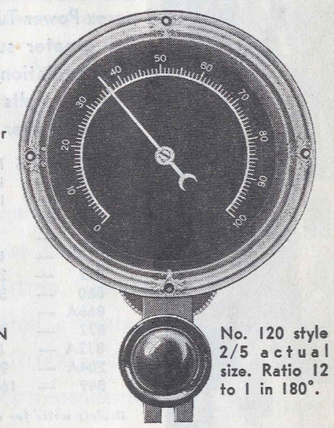
TUNING CONTROLS

FOR RADIO SET MANUFACTURERS

New Airplane Type
in Ten Styles

More Than 50 Kinds Shown in Our Catalogs
Also Escutcheons, Cabinets, Name Plates and Other Specialties

Write for Catalog



No. 120 style 2/5 actual size. Ratio 12 to 1 in 180°.

REMOTE CONTROLS FOR AUTO RADIOS

EXPORT ORDERS RECEIVE SPECIAL ATTENTION
Cable Address—CROWNAME CHICAGO

Jobbers and Dealers Find Our Line Profitable

CROWE NAME PLATE & MFG. CO.
1755 GRACE STREET *Established 35 Years* CHICAGO, ILL., U. S. A.
Pacific Coast Representative, W. BERT KNIGHT, INC.

NOTICE! You can get the next 4 issues of "RADIO" for only $1.00. Subscribe now.

W9USA—"At the Hall of Science Theatre—in Chicago"

(Continued from page 10)

to demonstrate the marvel of high-frequency transmission and reception. You'd be surprised to notice the favorable impression created.

Undoubtedly, the presentation could be more effective than it is, but before defaming W9USA at the Hall of Science too strenuously please attempt to appreciate the handicaps under which the station is operated.

Whether it is generally realized or not, it should be quite apparent that through this presentation amateurs are offered that once in a lifetime opportunity to demonstrate to a heretofore unappreciative audience the intriguing thrill of the art that is our hobby. The amateurs, through the medium of their transmitters, are putting the show across. Keep up the good work.

●●●

Getting More Out of the FBXA

(Continued from page 12)

before. Because the main bands used are the 7 and 14 MC, the work seemed well worth while. Nine-tenths of the images disappeared, and those that were left were quite weak.

A word should be said about the variable resistor that controls the screen grid voltage. This should be of a fairly high wattage rating; it is connected across the total voltage of the power pack. The .1 mfd. condenser which was removed from the original cathode resistor was placed on the arm of this potentiometer. The wire that originally went to this screen was cut out of the circuit, and the voltage was picked up at the resistor leading to the primary of the xtal IF stage. No condenser was found necessary across the variable cathode potentiometer. Also, these potentiometers need be set but once for each band.

While it is true that the noise increased with the signal strength, it was well worth it, because the terrific volume of the BFO noise drowned it out. If someone will come forth with some dope on how to kill this terrible background noise which is always R5 to 6 when the BFO is turned on, I believe that the information will be welcomed by many.

Col. Foster's Comment

(Continued from page 6)

think that any business man with a vested interest permits that interest to be ignored then you just don't know commercial people.

Since it is the only way the League directors may keep themselves informed of the wishes of all members the liaison officer learns the desires of the commercial members and carries them to the directors. In 1931 Liaison Officer Warner learned that the commercial members wanted the amateur members to ask for no more frequencies at Madrid. He wrote the directors putting this up to them and calling for a mail vote on the question. At that time the Canadian government itself was planning to demand more frequencies at Madrid for its amateurs. Warner indicated to the ARRL directors that they should vote to ask for no more frequencies. They so voted.

The commercial members had long desired to stop the amateur members from transmitting third-party messages across the Pacific. There was no way of accomplishing this by law in the United States but there was a way of doing it at the Madrid convention—by getting the wording of the international regulations changed and then getting the United States Senate to ratify the new regulations. With the acquiescence of Liaison Officer Warner they got the wording changed. They got it changed without either knowledge or approval of the ARRL Board. The commercial members wanted the new amateur regulations ratified. Whether the directors would have voted to oppose ratification is a question; that Liaison Officer Warner failed to convey to them the new wording of the regulations is a fact. In this case the Liaison Officer took it upon himself to pass upon this question; he sided with the commercial members. From then on he acted in accordance with their wishes and worked tooth and nail for ratification.

A record of the Circuit Court of Appeals of the District of Columbia says that up to February 23, 1927, the amateurs were entitled to all waves from 200 meters downward but that at various national conferences they had, "through their authorized representatives offered to relinquish most of their frequencies for commercial development". The commercial members of the ARRL wanted this territory of the amateur members and made their wishes known. Just who were the amateurs' "authorized representatives" I don't know. Liaison Officer Warner was one—if not the only—authorized representative of the ARRL. And I don't know if the relinquishment of nearly all of the amateur territory was authorized by the ARRL Board; but I do know that the commercial members of the League had their wishes well taken care of by the ARRL.

Besides these instances of the ARRL's looking after the interests of its commercial members there are numerous others; but these three will illustrate the point. So let no one hold the false notion that the ARRL may, or does, work for the interests of its amateur members and ignore those of its commercial members. The amateur members make a thousand and one demands upon the ARRL, and the directors and officers accede to a few of their wishes. The commercial members make few demands but of great consequence, and ALL of their demands are met.

The ARRL headquarters claim that the directors are elected mostly by the votes of the amateur members and that there is therefore no danger of the League's being influenced by the commercial members. From the foregoing illustrations you may see the shallowness of this claim.

It is a sorry contretemps, however one looks at it. But it is a mess that one is sure to make when one tries to mix amateurism and commercialism in the same association. That has never succeeded and NEVER WILL. The man who was responsible in 1920 for infringing the property rights of the then owners of the ARRL—the licensed amateurs—by arbitrarily making co-owners of all QST subscribers did a horrible injury to amateur radio. He started an irritation that developed into a suppurating sore. In all these 14 years nothing has been done to heal it. Occasionally a layer of thin guaze has been laid over it to hide it from view but the sore has gone on eating into the flesh and bone of amateur radio until now it can no longer be hidden, and nothing but a major operation for extirpating the whole infected area will give it a chance to heal from the bottom.

Vice Directors

IT SEEMS from the minutes we are now to have a flock of "vice directors". President Maxim suggested, "without objection", that the General Counsel prepare the wording for a motion to bring this about. Just whose vices these 14 new officials are supposed to direct I don't know, but at any rate henceforth each division will be required to carry a spare. And each vice director will be nominated and voted for just as in the case of directors. That should make elections doubly interesting—and doubly irritating. And should keep the hams so busy with internal squabbling that they will have less time to keep a wary eye on headquarters. It seems that the sole official duty of a vice director is to go to an annual meeting and vote in the event that the director himself shall have notified the Secretary of his inability to be present. If the director dies, then—under the resolution—the vice director stays home. That is, unless the director shall have been thoughtful enough to notify the Secretary of his approaching demise and thus make it possible for the vice director to appear and vote. In case the director has not exercised this precaution then the vice director stays home. Or he, too, may die if he feels like it, for all the difference it would make to his division. And all this nonsensical over-organization—with its accompanying expense and its doubling the political campaigning and internal strife—is set up ostensibly for the sole purpose of providing that no division lose its vote at an annual meeting in the remote event that its director is unable to attend. An alternate could have been authorized to vote by a slight change. It surely would not have mattered at this meeting if any one division had lost its vote. If its director was in the Warner-Segal-Maxim bloc his vote would not have been needed for the Combine would still have had 13 of the 16 votes anyway. While if he had been of the opposition, composed solely of Directors Jabs and Culver, the division's vote would have counted as little as their votes did.

DIRECTOR CULVER put squarely up to the Board the question of the right of a director to give out for publication any non-confidential information coming into his hands. The gang grudgingly admitted, "It is the individual director's privilege, at his discretion, and his responsibility." That "responsibility" was dropped in by way of indicating that if the "individual director" exercised his right he was assuming a heavy load of it. My predicition is that hereafter many more of the communications from Warner to directors will be labelled, "Confidential". It is questionable whether any of this stuff is confidential.

The ARRL, Inc., is stated to be a "scientific and educational institution" from which no

(Continued on page 35)

Col. Foster's Comment

(Continued from page 34)

individual ever secured any part of the profits, and as such to be exempt from the payment of income taxes so just why ANY information that affects members should be kept secret it is hard to see. Every item of information collected by headquarters is the property of the members and there is no reason why one scrap of it should be withheld from them. The owners of a corporation are entitled by law to know all about their own business but they should not be forced to go to law to get their information. This last year especially has brought the truth of this principle home to the people of the United States.

WARNER sums up his retort with, "The percentage of active amateurs who belong to ARRL is so extremely heavy that it constitutes a perfectly swell showing." We aren't interested in how "swell" it is but we are interested in knowing how "extremely heavy" it is. What we have demanded to know for several years, and what we shall find out, is: how MANY of the ARRL members are licensed amateurs, how many of such members are of the United States and how many are foreign. Of course the percentage changes slightly from day to day but it can be obtained as of any given date by checking the ARRL membership list with the latest amateur call-book and government records. Or it may be obtained very simply and cheaply by asking each member for his call if he has a license—by buying 20,000 double postcards and asking that those members who are licensed to sign their calls on the duplicates and mail them in. Then well all see just what this "perfectly swell showing" is in an organization of 20,000 that proclaims itself to be wholly "amateur". We want to make of the ARRL what it was for several years before Warner came upon the scene, an organization of licensed amateurs; but first we want to find out how many commercials and other non-amateurs have been taken into it.

Osockme, Japan.
June 23rd, 1934.

To the editor of the
magazine section of
"RADIO". Hon. Friend:

You have unquestionably read without doubt from previously sent letters of lack of radio engineering education which Scratchi fail to enjoy. Hon. neighbor friend inform me that such education can be advanced several stages with increased efficiency if new announced correspondence course in radio engineering be given look in consideration. From perusal of numerous and scandalously exaggerated phraisings of correspondence school advertising writers Scratchi find that best correspondence school to make enrollment in is such as are known as Minnieslopolis Institoot of Technicalknowledgy. Request to such school for radio engineering catalogs bring notice from Hon. postal authority that school have make movement to Cincinnapolis for non-payment of one office rent in former city. It then become quite necessary to contact with other schools which are more stable in operation. Next letter go to The Great Inter-solar College of Technical Education For Up The Ladder Students who, upon reaching top of such education ladder, can forthwith walk into office of president of any radio concern, fire the boss and take seat in boss's chair without benefit of employment application. Such school also offer post-graduating course in beekeeping, stable management and Swiss bell ringing

Such inducement sound interesting to Scratchi and upon sending enrollment fee of 25 yen in advance, there soon come to me through mails my first lesson in new school. First chapter of first lesson are entitled, "What Is A Watt and What Of It Anyway?" Further instructions say that if such subject are not of interest to student, he can skip first 400 pages of text and proceed to second lesson which are entitled, "Ohm's Laws And How To Violate Them".

Subject then become quite interesting because all calculations made from formulas given in textbook work out fine on paper but when applied to amateur transmitter in radio shack, each tube blow out one by one and it soon become apparent with Scratchi that correspondence school must be stockholder in tube manufacturing plants.

But before course are half finished I am asked to send final payment to schools and upon doing such I am mailed all of balance of lessons in one stack, together with neatly rolled Diploma which are large enough to cover roof of radio shack. President of school also attach personal letter which he forget to sign and inform me I am now ready to step out of the world of hardship and misery and enter the life of the aristocrooks of leisure, the radio engineering fraternity.

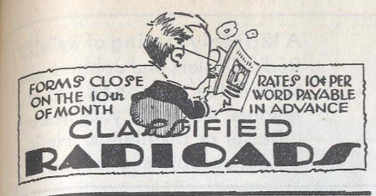
I go to print shop and have nice cards printed on which read—Hon. Igiolo Scratchi, Seasoned Radio Engineer & Employment Looker For. My quest for employment seeking begin following morning. I go from factory to factory and each manager tell me same, old sour story—" We have such many radio engineers in our plant that we ship one out free with each case of radio sets so that lazy dealers can make sure that such sets work when they and the engineer are unpacked from the box." One dealer become insulted when he open box and find half-starved engineer crawling out from under X-celsior and he promptly stuff engineer back in box again and ship him back, charges collect, to plant from which he come.

He attach note to soul of engineer's shoe through which sockless toe stick out, and upon such note he write as per follows: "A radio engineer is one whom know a mighty great deal about a very little and as time drags on he learns even more and more about less, until finally come such time when he know practically everything about nothing."

Such heart busting experience soon get under Scratchi's skin like exzeema and I thus make trail for home with one pocket full of correspondence school diploma and other pocket full of emptiness, but which once hold gold plunder which Scratchi pay over to correspondence school for course in radio engineering.

Next morning I start anew my quest for position, with added determination, because diploma say I can step into chair of any radio factory president, big or small. I walk into big factory plant, thro out my chest and shake diploma at fat president who are fast asleep in soft chair. I pound fist on table, he wake up and ask me what-in-the-who-in-the something I want. I show

(Continued on Page 37)



Scratchi

(Continued from page 36)

him my diploma and tell him to get out of chair, because Scratchi are ready to step in as president in his place. He tell me it are not very polite for me to oust him from his position as president of factory, because he have been holding such job for many long nineteen years and it would be most exceedingly hard for him to give up such position without struggle, with furthermore complications come into case because he is soul owner of factory of which he are president.

He ask me to let take look-see my diploma. I uncurl stiff parchment sheet and show him long list of great titles which correspondence school have bestown upon me. It read: "Igiolo Scratchi, E.E., M.D., Ph.D., B.A., B double A, B triple A and B.S.

He take long pencil and strike off all titles except last one which he say approve of very much and he tell me to take it to bank and have it certified. I have friend who have friend who work in bank and he give me introduction to friend who he say are teller in bank. I quickly find out he are really a teller in bank . . . he tell people where the elevator is.

I soon find correct teller person and when he look at last title on diploma he laugh like higheena. He tell me to go to see a lawyer.

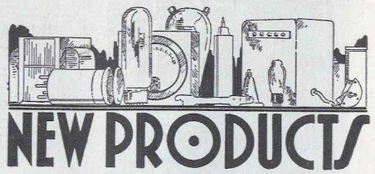
I see lawyer and tell him I wish to take legal action against school for improperly informing me of sun bright prospects for graduates but lawyer friend inform me such actions would cost more money than course cost and that court costs would also be more than course cost, so of course if court costs would be more than course costs it appears of course that no recourse can be had from courts. Such legal language when interpreted in any other kind of language simply mean that Scratchi have had again, as usual, been stung. A few more of such similar experiences and Scratchi will make request to be removed to bug house where, I hope, Hon. Editor, you and I will occupy different rooms together.

Your faithful reader,
Scratchi.

Radio Dealers and Jobbers who desire to advertise in these columns are invited to write for rates.

RADIO BUYERS' GUIDE

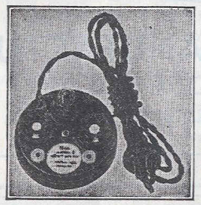
A Monthly Listing of Reliable Radio Dealers and Jobbers who solicit the patronage of our readers. Buy from your nearest Dealer or Distributor. He is dependable and reliable.



NEW PRODUCTS

Tube-Short & Leakage Tester

THE new Alden No. 9SC Tube Short and Leakage Tester accommodates all four, five, six, large seven and small seven prong tubes in two especially constructed composite sockets. An insulated control grid cap and lead are provided for connection to all tube caps. A special neon tube indicates leakages up to 1,000,000 ohms, as well as dead shorts. This tester is particularly useful in detecting cathode-to-heater shorts which cannot be tested in the average tube checker.



A special feature is the pair of jacks which permit general continuity testing when used with a pair of test leads. The circuit is so designed that either test lead may be grounded, even continuously, without causing a short circuit. A single screw through its center conveniently mounts the tester in any position. Five feet of cord is provided with a plug which may be plugged into any AC or DC outlet. The list price is $8.50.

●●●

Tobe Condenser Analyzer

THIS instrument has been designed specifically as an aid to the solution of the many problems encountered in condenser testing.

Based on a well-designed and engineered circuit, the instrument operates with ample accuracy and surprising simplicity and speed of test.

Paper, Mica, and Oil dielectric condensers are tested by the method of measuring the DC resistance under an applied voltage. The resultant leakage current is indicated by means of a special Neon Glow Tube Indicator. Good condensers having a satisfactorily high resistance, as well as open, shorted, intermittently open and closed, and poor leaky condensers are readily indicated by this instrument.

Of interest is the complete analysis the instrument affords electrolytic condensers. Methods of procedure in testing this type of condenser accompanied by technical information constitute a basis for this test. The Glow Tube Indicator quickly gives a measurement of the DC leakage current at the rated voltage passed by the condenser under test. Satisfactory and defective electrolytic condensers are quickly identified.

The instrument contains a built-in power supply operating on a 110 volt AC 60 cycles. Voltages up to 700 volts DC are available for testing at the output terminals. The instrument is encased in a metal container finished in black Damaskene wrinkle. The size of the Analyzer case is 8¾-in. by 4½-in. by 7½-in. Net price. $11.40, east of the Rockies. $11.70 on the west coast.

●●●

Get This New Catalog

Ohmite Manufacturing Company, 636 N. Albany Avenue, Chicago, announces a new Rheostat and Resistor Catalog No. 10. This catalog has eight pages of helpful information concerning the use of these items in both radio and electrical work. It lists many new types of resistors, power rheostats, and replacement units.

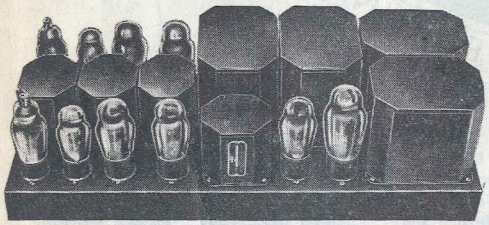
This catalog will be sent free to anyone writing for it.

A. Hawkins
F. Lampkin

UTC

Presents

High Quality Public Address Audio Components In a Parallel Push Pull 45 A Prime Amplifier



45 A Prime Amplifier

Ideal for broadcasting, recording, and public address applications. Will drive output amplifiers modulating up to 500 watts A.F. into R.F. stage.

High power output with low cost power tubes.

SPECIFICATIONS

- Input will match 50, 200, and 500 ohm lines. Center tap on 200 and 500 ohm lines for double button microphone.
- Output will match 500, 200, 16, 8, 5, 3, and 1.5 ohms.
- Three balanced push pull audio stages. Tubes used: 2-57's triode connected, 2-56's, 4-45's in parallel push pull fixed bias, 1-83, 1-45.
- Stable fixed C bias for output stage.
- Undistorted class A prime output 38 Watts.
- Gain + 90 D B.
  Trap resonant filter affords maximum filtering efficiency.

List price $63.50—Net to dealers, hams..... **$38.10**

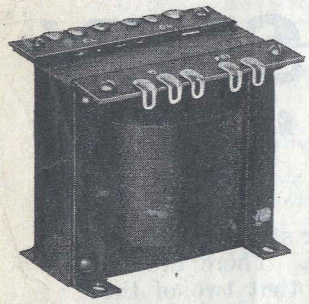
Fully shielded drilled deck for audio and power sections. List price $9.00—Net to dealers, hams ..... **$ 5.40**

	List Price	Dealer's Price
PA-245—output for fixed or self bias 45's A prime (20 watt peak power) to 500, 200, 16, 8, 5, 3, 1.5 ohms	$7.00	**$4.20**
PA-201—output for self bias 45's A prime to 5000 and 3000 ohms	7.00	**$4.20**

UTC Public Address Type components used are:

	List Price	Dealer's Price
1—PA-135—500, 200, or 50 ohm line to push pull grids	$ 6.50	$ 3.90
1—PA-133—triode 57 plates to 56 grids	6.00	3.60
1—PA-233 driver 56 plates to 45 grids	6.00	3.60
1—PA-445—A prime push pull parallel 45 output fixed or self bias	12.50	7.50
1—PA-103—A prime input swinging choke	8.00	4.80
1—PA-102—Output trap resonant smoothing choke	8.00	4.80
1—PA-425—Heavy duty A prime 45 plate filament and C bias transformer	12.00	7.20
1—PA-45 —High impedance C bias choke	4.50	2.70
	$63.50	$38.10

UTC 45 A prime kits, drilled decks and associated components now available through your local distributor.



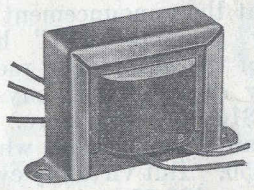
U555F

UTC MIGHTY MITE AUDIO TRANSFORMERS

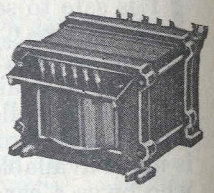
are now in use in all the popular transceiver circuits

Low in price but mighty in performance.

The 56 -MC hounds have been hounding us to make these ultra compact units available. Here they are—dressed up to go places and do things.



U19



UPT4

	List Price	Net to Dealers, Hams
U-19—Driver plate to 19, 49, 79 or 89 class B grids	$ 2.00	$ 1.20
U-19M—Class B 19, 49, 79, or 89 plates to 5000 or 3500 ohms	2.50	1.50
U-41—Interstage audio 4:1 ratio	1.50	.90
U-51—Single plate to 2 grids 2½:1 ratio	1.55	.93
UPM—Single power pentode 18, 20, 33, 41, 32, 2A5, 47, 42A to 4000 and 2000 ohms	1.75	1.05
UTM—Single power triode 71, 45, 59, to 4000, 2000 ohms	1.75	1.05
UMG—Single or double button mike to 1 grid	1.60	.96
UPMG—Single plate and double button mike to one grid	2.00	1.20
PC-1—Filter choke—10 henrys—40 MA—200 ohms DC	.95	.57
PC-2—Filter choke—15 henrys—35 MA—300 ohms DC	.90	.54
PC-3—Filter choke—16 henrys—30 MA—450 ohms DC	.90	.54
PC-4—Tapped filter choke—20 henrys—25 MA—600 ohms tapped at 200 ohms	1.10	.66
FT-1—Filament transformer—Pri. 115 A.C. Secondary 2½ V.C.T. 3 A	1.25	.75
FT-2—Filament transformer—Pri. 115 A.C. Secondary—6.3 V.C.T. 1.2 A.	1.25	.75

Plate and filament transformers for Low Power Transmitter and Power Amplifiers.

	List Price	Net to Dealers
UPT1—Primary 115 V.A.C. 60 cycles. Secondaries: 750 V.C.T. at 125 M.A., 2½ V.C.T. 3 A., 2½ V.C.T. 10 A., 5 V.C.T. 3 A.	$5.50	$ 3.30
UPT2—Primary 115 V.A.C. 60 cycles. Secondaries: 950 V.C.T. at 200 M.A., 2½ V.C.T. 5 A., 2½ V.C.T. 5 A. 5 V.C.T. 3 A	8.00	4.80
UPT3—Primary 115 V.A.C. 60 cycles. Secondaries: 1100 V.C.T. at 150 M.A., 2½ V.C.T. 5 A., 5 V.C.T. 3 A., 7½ V.C.T. 3 A.	8.75	5.25
UPT4—Primary 115 V.A.C. 60 cycles. Secondary: 650-550-0-650-550 at 200 MA.	9.00	5.40
U225F—Pri. 115 A.C. Secondaries: 2½ V.C.T. 5 A., 2½ V.C.T. 5 A., 5 V.C.T. 3 A.	4.00	2.40
U257F—Pri. 115 A.C. Secondaries: 2½ V.C.T. 5 A., 5 V.C.T. 3 A., 7½ V.C.T. 3 A.	4.50	2.70
U227F—Pri. 115 A.C. Secondaries: 2½ V.C.T. 5 A., 7½ V.C.T. 3 A., 7½ V.C.T. 3 A.	4.50	2.70
U555F—Pri. 115 A.C. Secondaries: 5 V.C.T. 3 A., 5 V.C.T. 3 A., 5 V.C.T. 3 A.	4.50	2.70
U577F—Pri. 115 A.C. Secondaries: 5 V.C.T. 3 A., 7½ V.C.T. 3 A., 7½ V.C.T. 3 A.	4.50	2.70

The UTC HIPERM ALLOY audio transformers are described in the new U-1000C bulletin

Send for your FREE Copy Today

16 PAGES OF VALUABLE DATA COVERING NEWLY DESIGNED AND TESTED HIGH FIDELITY AND WIDE RANGE AMPLIFIER CIRCUITS

UNITED TRANSFORMER CORP.

Export Division, 15 Laight St., New York, N. Y.

264-266 CANAL STREET NEW YORK, N. Y.

Exclusive Pacific Coast Distributors Carrying a Complete Stock of UTC Products

UPPER CALIFORNIA

Offenbach Electric Co. ..... 1452 Market St., San Francisco
C. Wenger Company ..... 1020 Oak St., Oakland
sale Radio & Electric Supply ..... 271 Ninth St., San Francisco
TLE, WASH.—Seattle Radio Supply Inc. ..... 2319 Second Ave.
nd Radio Supply Co. ..... 1300 W. Burnside, Portland, Ore.

LOWER CALIFORNIA

Pacific Radio Exchange Inc. ..... 729 S. Main St., Los Angeles
Radio Supply Co. ..... 912-14 S. Broadway, Los Angeles
Coast Electric Co. ..... 744 G. St., San Diego
Prest & Dean Radio Co. ..... 400 American Avenue, Long Beach