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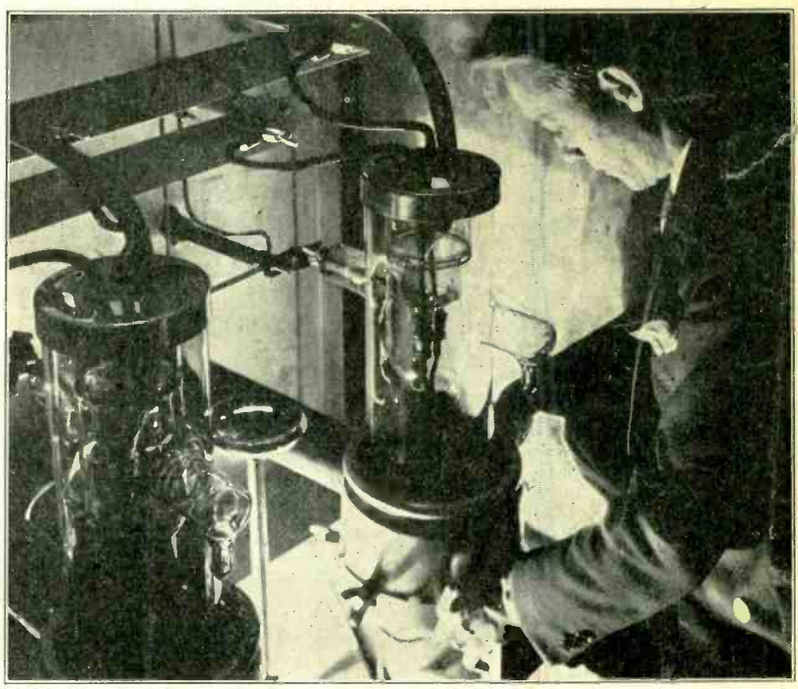
RADIO

ESTABLISHED 1917

SHORT-WAVE AND EXPERIMENTAL

–IN THIS ISSUE–

Some Timely Suggestions on Antenna Design
A New 5-10 Transceiver of Improved Design
I. F. Crystal Filter for the Banehawk Super
The Decibel . . . . The How and Why of It



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RADIOTELEPHONE DEPARTMENT - - HAM HINTS - - TUBE TECHNIQUE
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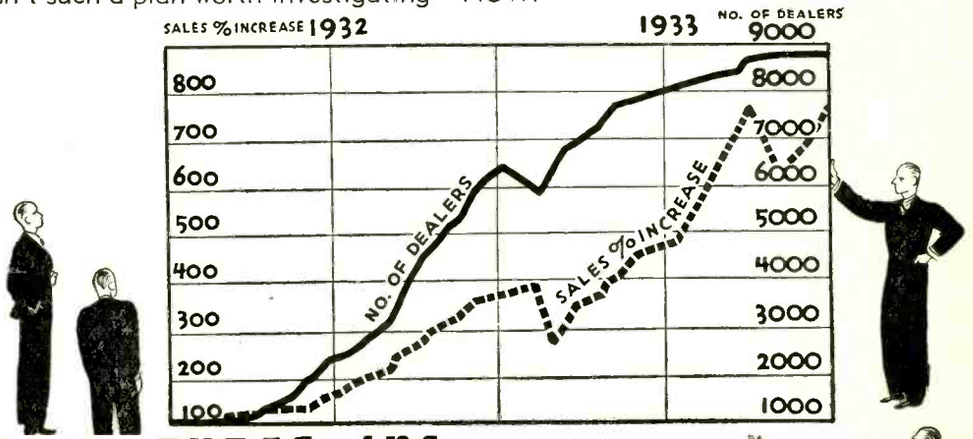

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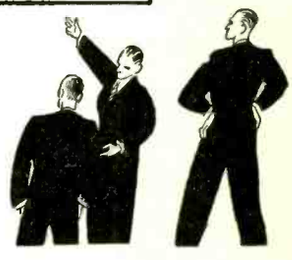

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RADIOTORIAL COMMENT

Honor Where Honor Is Due

AMATEUR and experimental radio is the heir of a great host of unsung inventors. Every amateur is of course familiar with the names of Marconi and deForest, for example, and their great contributions to the art of radio. But how many realize that these men were the heirs of patient workers who preceded them?

Faraday envisioned electromagnetic lines of force a hundred years ago. Fifty years or so later, Maxwell, stimulated by Faraday's vision, gave mathematical proof that electromagnetic disturbances are propagated through space as waves. Hertz, some years later, gave experimental proof of Maxwell's theory. In the late eighties of the nineteenth century Crookes predicted that these waves could be used for wireless telegraphy. Ten more years elapsed before Marconi commercialized the idea.

The vacuum tube invented by deForest had an equally ancient lineage. His accomplishment would have been impossible without the knowledge gained from preceding scientists who discovered the existence and the properties of the electron.

Faraday was immortalized by the farad, as had likewise been Ampere, Volta, Ohm, and Henry by the well-known units which bear their names. Maxwell, like Gilbert, was commemorated by less-known units. Hertz, Marconi, and deForest are yet to be so honored, unless, perchance, the word Marconigram survives the ravages of time.

But it is not necessary to search ancient history for instances where honor has not been accorded where honor is due. Many a radio inventor has patiently worked for years to perfect some discovery from which he gains neither reputation nor financial reward. They are unknown to fame and possess but few of this world's goods. Therefore, it becomes our pleasure to record a few accomplishments which might otherwise pass unnoticed.

A case in point is the electron-coupled oscillator so widely used by amateurs. How many know that this is the invention of Lieut. Jennings B. Dow, U.S.N., now radio officer of the radio-controlled U.S.S. Utah, which is manless in action? Although he has been granted numerous patents, he has asked royalty from none. It was he who wrote the first worthwhile information about continuous waves, which this magazine published as the "C. W. Manual" when the great majority of amateurs were still using spark transmitters. It is to him that the amateur is indebted for much of the present stability of his short-wave receiver. Is it too much to ask that the electron-coupled oscillator be called the Dow Oscillator?

Another instance is supplied by the crystal-filter receiver. This was invented and announced by Dr. James Robinson of England as the Stenode. For months it was the cause of heated arguments which went so far as to question the existence of side-bands. Why not call it the Robinson Stenode?

Continuation of such a chronicle of achievement for the benefit of amateur radio would fill these columns to overflowing. Men like Bliley, Collins, Dellenbaugh, Heintz, Jones, Kruse, Lampkin, Phelps, Silver and Terman, to mention alphabetically only a few whose names come vividly to mind, have contributed to the common welfare new ideas and circuits that make possible today's remarkable results with short-wave radio. Is it too much to ask that their names be linked with their work?

In answer, "RADIO" pledges itself to do its part in identifying these men, and other worthy workers, with their ideas, so that their work may become synonymous with their names and their names with their work. While "their light is none the less for having lit that of their neighbor," they appreciate some recognition of the fact now, no matter what may be time's rigid appraisal in the dim and distant future.

●●●

A Spring Cleaning

'TIS THE SPRING of the year and, in the words of the poet, a young man's fancy lightly turns to thoughts of love, or something to that effect. Meanwhile his more seriously-minded elders are more prosaically thinking about cleaning and renovating the house, which we are told is now a patriotic duty. This may be what the Minneapolis-St. Paul amateurs had in mind when they recently passed a resolution demanding that the directors of the nominal association of American radio amateurs "clean house from the grassroots", a demand which has been enthusiastically echoed throughout the nation.

Men of experience and vision have long realized that the non-commercial users of radio are poorly organized and lack leadership adequate for effective work. But it remained for the Minnesotans to discern what is radically wrong in amateur affairs, to have the courage to trace it to its lair, and to have the forbearance to request that the house be cleaned instead of being torn down to make place for a better.

The Golddust twins' task is much easier than that imposed upon Hercules when told to clean the equally malodorous stables of Augeus, king of Elis. These stables housed three thousand oxen and had not been cleaned for thirty yeasr. To scour the place he diverted two rivers from their courses. He did the job so well that he was given a more difficult one.

Men are today moving and thinking in new directions. They are recovering from the stupor of indifference and are demanding reform. Those erstwhile leaders who had allowed the wrongs to exist, but who are wise in their generation, are acceding to the demands. Only the foolish are opposing them.

Here's hoping that those who are trying to direct the destinies of amateur radio can read and understand the handwriting writ so boldly on the wall. Here's hats off to the St. Paul-Minneapolis gang!

●●●

"Late Again"

ANXIOUS to get their copies of "RADIO" at the same time that other radio publications are received, hundreds of our subscribers have complained that the magazine does not reach them soon enough. As one subscriber put it: "Life is unbearable without 'RADIO'." This magazine goes to press on the 25th of each month, off the press six days later, into the mails on the following day and should reach you no later than the 10th of the month of issue, i.e., this May issue should be in your hands on or before May 10th, whether you are a subscriber or buy your copy from a radio dealer or at a newsstand. Copies are mailed to all —without discrimination, within 24 hours after the ink has dried.

When the magazine reaches you it is up-to-date and down-to-the-minute. Our opportunity to present last-minute facts would not come to you until the following month, if we advance our publication date even as little as a week.

Nothing is as stale as stale news. So "RADIO" will strive to keep you fully abreast of these fast-moving times in radio.

COL. FOSTER'S COMMENT

Senate Committee on Foreign Relations Recommends Ratification of Madrid Treaty

ON APRIL 6 the Senate Committee on Foreign Relations recommended by printed report to the Senate that the Madrid convention be ratified without amendment.

The report comprises—exclusive of the title—17 pages. Ten of them are taken up by testimony largely aimed to show that the "small group of amateurs" who have been opposing the new restrictions on amateur message-handling don't know what they are talking about. Eight of those 10 pages are given to a verbatim reprint of K. B. Warner's pamphlet, "International Message Handling," which had been transmitted to the Senate Committee by Dr. Joliffe, Chief Engineer of the Federal Radio Commission. Here is the letter:

Federal Radio Commission,
Washington, D. C.,
March 3, 1934.

Hon. Key Pittman,
Chairman Committee on Foreign Relations, United States Senate, Washington, D. C.

My Dear Senator Pittman:

As requested by you, there are enclosed 25 copies of summary of answers to questions concerning amateur radio as given out at hearing held Feb. 28. 1934. on International Telecommunication Convention.

There is also enclosed a pamphlet, International Message Handling, by K. S. Warner, secretary, American Radio Relay League. This pamphlet discusses the attitude of the American Relay League with respect to the Madrid Convention.

I wish to call your attention particularly to the last paragraph of this pamphlet which reads in part, "I have heard it said that it is the position of the ARRL headquarters that the treaty must be ratified. Our position is much simpler than that. It is simply that our executive committee, after thorough-going study, can find no reason from our standpoint why the treaty should not be ratified.

Very truly yours,
(Signed) C. E. JOLLIFFE,
Chief Eng'r

FROM THE RECORD it appears that the only request to which Dr. Jolliffe was responding was for a summary of some questions and answers that had been presented to the Committee at an earlier meeting which had not been recorded stenographically. He evidently thought highly of the pamphlet and believed a reading of it by the Senators would aid them in making their recommendation to the main body of the Senate.

The intelligentsia among the amateurs regard the pamphlet as a weird display of pathetically involved reasoning, but Dr. Jolliffe directs the Committee's attention to its conclusion that the ARRL sees no reason for opposing the treaty.

Dr. Jolliffe perhaps does not know that the policies of the ARRL are determined by its Board of Directors but that in this case the Board was never permitted by Warner to pass on the question whether the ARRL should or should not oppose ratification. Dr. Jolliffe perhaps does not know that the directors of the ARRL are amateurs, while a majority of its executive committee—including Warner—is composed of paid employees.

Dr. Jolliffe perhaps does not know that only a small proportion of the amateurs of the United States are members of the ARRL.

Dr. Jolliffe perhaps does not know that only a small proportion of the members of the ARRL itself are amateurs, while by far the larger proportion are commercial radio people.

The report of the Senate Committee on Foreign Relations is quite revealing. In next month's issue we shall review it in detail.

EXPLOITATION

WHEN men stopped working for a livelihood and started working to "make money" the great game of exploiting the other fellow was born. That game had been reduced to a science when the crash of 1929 showed it up in all its ugliness. No activity that could provide a basis for exploiting the other fellow had escaped. And the game still goes on, for exploiters are not reformed in a day, if ever.

Amateur activities that can be used for making money are being so used. Sports of any kind that are spectacular enough to attract an audience are being used for just that purpose. Football, tennis, polo, boxing, and all the rest of these "amateur" hobbies, are highly spectacular and highly commercialized. The amateurs who are in these hobbies purely for the love of them attract the "gate" and the showmen collect the money. The amateurs who provide the entertainment get nothing but the enjoyment of the hobby itself.

Many amateur hobbies do not attract a paying gate. Amateur radio does not; there are no spectators and, therefore, no gate. But radio amateurs are being exploited for commercial gain nevertheless. Radio amateurs are in a class by themselves. There is no game to be won. All that a radio amateur may achieve is a knowledge of the science of radio and skill in the art of its use. There is rivalry of a sort—the urge to be the first to discover or the first to reach an imagined goal—but the incentive for competition is not strong. The radio amateur gets his reward from giving rather than taking.

Here the Exploitation Begins

AND just here is where the exploitation of the radio amateurs began. It was amateurs—non-commercial investigators—who made the first discoveries. Marconi is called the father of radio. He is no more the father of it than I am. He is merely the man who first put the profit motive into radio communications—the man who first developed a way for making money out of radio. The radio amateurs, generally speaking, have disclosed their discoveries freely among themselves. In the amateur spirit they have always shared them with their fellows. Commercial people, from Marconi on down the line, then seized upon the discoveries, either directly or by employing amateurs to show them how to make "practical" use (that is to say, money-making use), of the discoveries. If the amateurs had been sufficiently money-wise to pool their discoveries and protect themselves from commercial exploitation I presume they would have ceased to be amateurs; but at any rate their string of patents would have made those of the commercial people look very sickly.

But the radio amateurs never banded themselves together for the mutual protection of their rights. In the early days they didn't know they had any rights. In fact only a few of them know it even now. If there is one class of people in the world with an inferiority complex it is the radio amateurs. They haven't yet learned that as citizens of the United States they have certain fundamental rights that commercial people can be forced to respect. There has been infused into them the false belief that they have no such thing as rights — only the privilege of using the air until it is "needed for commercial development". The amateurs not only have been taught this doctrine by commercial people but they have for years been busily engaged in teaching it to one another.

The commercial people never had any such complex. They assumed that the public domain of the air was their oyster, and the amateurs fell over one another in their hurry to embrace that assumption. They permitted the commercials to seize great areas of the air for which the commercials had little use. If Congress ever takes it into its head to delve into the means by which most of the channels of the air came into the hands of the commercial interests Congress will develop some astounding facts. It is about as rational for the people's air to be wholly controlled by private commercial interests as it would be to permit those interests to have exclusive use of the oceans.

The amateurs have never organized to oppose with force and diligence such control of the air. They have foregathered, to be sure, but only for the fun of associating with their fellows. In the early days of radio there were amateur-radio clubs; but the members had no definite aim other than the exchange of views in their hobby. Some of these associations had their publications for the dissemination of news and knowledge, but none of them ever

visualized the non-commercial radio men as having any fundamental right to the use of their share of the air. The amateurs themselves had accepted the dogma that the air belonged primarily to the money-makers. And that false belief has obtained right down to the year 1934. Not only is it believed ,but is preached, by the American Radio Relay League, an organization that has existed since 1914. And 20 years of reiteration can create quite a miasma of misbeliefs.

The Old Order Changeth

WHEN the ARRL was organized it was purely an amateur association. Its chief claim to distinction from the other amateur radio associations then in existence was its purpose to advance the art of transmitting messages by radio. Every applicant for membership had to be the owner of a transmitting station and have the ability to receive a message. Mr. Maxim and Mr. Tuska, founder and manager of the ARRL, started as a venture of their own a publication that they named "QST". In the very first issue these requirements for membership were set forth. I take it that the ARRL remained of amateur membership down to 1919 when K. B. Warner took charge; for on page 6 of "QST" for July of that year we find this statement:

> *"The ARRL is a progressive, enthusiastic, 100 per cent amateur and wholly non-commercial organization of radio amateurs, and affiliation with it will mean association with the oldest, strongest and cleanest amateur organization in the country—association without commercialism. . . . The ARRL is the only amateur organization recognized by the Government and this is because it is the only purely amateur and non-commercial association in the country."*

In 1919 Warner was hired by Maxim and Tuska at 30 or 40 dollars a week plus a bonus for each new subscriber or member or a share of some kind in the profits of the association. Just what the contract provided I don't know, but the point is that the arrangement was expected to produce profits and a part of them was to go to Warner. The profits materialized. In a short time Warner's share of them became very large, thus justifying the inducements held out by Maxim and Tuska. Now, when a manager has to look to profits for his chief remuneration his efforts inevitably are directed to making profits. That is a truism universally accepted.

The ARRL then borrowed several thousands of dollars from individual amateurs and bought the magazine from Maxim and Tuska. Then the ARRL became very much indeed a "business". It came still more under the influence of commercial people whose advertising constituted the magazine's chief support. This is not to say that "QST" is more influenced by advertisers than many other publications. Virtually all publications that are not subsidized are influenced more or less by advertisers without whose money they could not continue. But it IS to say that an amateur organization that cannot support its official organ from membership dues and turns to the support of commercial advertising has dropped a goodly part of its amateur status.

Advertisers Exert Influence

BY WAY of proof that advertisers and the commercial component of the ARRL membership do influence the editorial policy of "QST" I submit this: Commercial communications interests have systematically deprived the amateurs of their rights and their share of the air. News of the movements of commercial radio interests are replete with actions of great significance to amateur radio, and yet one may look through years of "QST's"

(Continued on page 36)

THE president of the American Radio Relay League in his recent annual report to the directors of that organization has this to say:

> ***"In the case of Madrid, the Board appointed Mr. Warner, Mr. Segal and Mr. Clair Foster to represent them. Mr. Foster declined to go, thereby relieving himself of his share of the responsibility. Responsibility thereupon had to be entirely assumed by Mr. Warner and Mr. Segal".***

THAT is an attempt to convey to the directors the thought that I had assumed a responsibility to represent the ARRL, along with Warner and Segal, at Madrid. The president knows perfectly well that I had no responsibility whatever and that I assumed none. The directors who attended the meeting of 1932 are also aware of this. The directors who have come into the Board since then may not know it. To them I make the following statement of the facts.

At the 1931 meeting, when I was not a director, the Board appropriated $10,000 to defray the expenses of three men to be sent to represent the ARRL at Madrid in the summer of 1932. The Board at the same time named Warner and Segal as two of the three. And the Board then and there instructed Warner and Segal to select a third man and submit his name to the directors for approval. I get this from the "confidential" report of the meeting.

And later they took the responsibility of effecting the payment to Segal of $45 a day, up to a maximum of $3,000, in addition to his expenses; although such a proposal was not mentioned until after I had declined to go and it was seen that a considerable part of the Board's appropriation would thereby remain unexpended. Nor would the Board have had any say in this matter if Vice-President Stewart had not demanded a mail vote on it after it came to his attention at a meeting subsequently of the Executive Committee.

And Warner and Segal "assumed the entire responsibility" of Segal's leaving Madrid after his $45 a day had run up to the stipulated maximum of $3,000, although if I myself had accepted the duty of representing the ARRL—even though being paid nothing for my services—I should have felt bound to remain on the job until the convention terminated. Not that I believe it made any difference to the amateurs whether Segal quit the job or remained, but merely by way of showing that having to "assume the entire responsibility" was not without its advantages to Mr. Segal.

And after Warner returned, (and ever after), he refused to permit the board of directors to decide the League's policy with respect to the new Madrid restriction on message-handling. He "assumed the entire responsibility" of this by stubbornly maintaining that it is the function of the Executive Committee to determine the policy in this especial case, not the function of the directors—that in this especial instance he would take no instructions from the board of directors.

No, there is nothing in the attitude of Warner and Segal, either before or after Madrid, that leads to any conclusion other than that they were delighted not to have a third man hanging around to interfere with their plans. So President Maxim's attempt to make the directors believe I had thrown an added responsibility on Warner and Segal strikes me as the sheerest of sophistry.

For a whole year Warner and Segal named no third man to the directors. Meanwhile they had proceeded with their plans for Madrid. They had conferred often and long with various commercial representatives and government agencies, with the State Department, with representatives of Canada, with foreign amateur societies, and so on. They had determined to ask for no more amateur frequencies, and they had secured a mail vote from the directors of ARRL putting the League on record as asking for no more—although they knew that the Canadian Government itself was preparing to demand wider bands for Canadian amateurs.

In other words, Warner and Segal had the ARRL all committed to their plans BEFORE the directors' meeting of 1932, without giving the third man—whoever he might be—the opportunity to have a say in any of the planning.

NONE of the directors seem to have expressed throughout the year any interest in the matter of the third man for whom their orders had provided, but towards the close of the meeting of 1932 somebody brought up the question. Segal then got up and told the Board just what kind of man he and Warner wanted as their co-delegate. He ended by saying—much to my surprise—"In short, we want Mr. Foster." I said, laughingly, that I could not fill Mr. Segal's exacting specifications and that I could not accept. The president then said he would entertain a motion that I be drafted for the job. I gave it as my opinion that a third man no longer was needed and that Warner and Segal would better go by themselves. There was some talk around the table and I then cut the matter short by saying I would wire my answer from California.

I should have been dumb indeed if I hadn't seen through such a palpable subterfuge as selecting me after the organization I was presumed to represent was all committed and hog-tied. Even so I should have accepted if I had thought my doing so would have got the amateurs anything. I don't mind being taken for a sucker—any more than I have minded acquiring a host of enemies—if it will get amateur radio anything. But I went from Hartford to Washington and there talked with some very asture men and got the low-down on much of the preparation that had been made for Madrid. I became convinced that, no matter what the foreigners and the commercials might like to do, our Congress would never stand for any further trimming of the amateur bands in the United States. In fact the sentiment was quite the other way. And it is Congress that governs our country—not commercial interests, not the Federal Radio Commission, not the State Department, and most certainly not a lot of foreign nations and their commercials.

So, believing there wasn't one chance in a thousand that we amateurs should lose any part of our meagre bands at Madrid, I wired from California that I declined to be the third man. As for my declining having forced Warner and Segal to "assume the entire responsibility", they already had taken it. CLAIR FOSTER, W6HM. ●

Address by Sumner B. Young

Delivered At the Business Meeting of the Iowa ARRL Convention, Held At Hotel Savery III, Des Moines, Iowa

TODAY IN AMATEUR RADIO
By LOUIS R. HUBER

Des Moines, Iowa.
21 April 1934.

CUSTOMARILY, the Iowa convention comes just after the ARRL board meeting, giving the opportunity for the midwest division director to tell his constituents what happened at the meeting in West Hartford. This year, the story was different—the constituents told the director what he had to do at the meeting before it was held.

"Resolved: That the authorized convention of the Iowa section of the ARRL, assembled in Des Moines, Iowa, this 20th day of April, 1934, after having heard all sides express their respective views, hereby finds itself in general agreement with the views expressed in the pamphlet published by the Minneapolis Radio Club entitled 'Let's Put Our Own House In Order', and that the said convention hereby instructs the director of this division to support these views at the coming meeting of the board of directors of the American Radio Relay League, Inc., at Hartford on May 11th, 1934."

A reporter attending the meeting, which began at seven o'clock Friday evening and lasted until eleven, with over 200 in attendance, would never have believed that a short, to-the-point instruction such as this could be made, judging from the past and judging from the somnolent atmosphere of the meeting when it began.

Director Kerr lit the fuse by reading his three-column legal-size eight-point report-and-request-for-advice sheet, in which financial statements, QST circulation figures, N-prefix, QST contents, and Warner problems were included and in which the signficant statement "(Mr. Warner) . . . is entitled to stand on his record . . . ." was made.

This fuse, lit among the dry-as-dust figures and allowed to smoulder through the three tedious columns, smoked and fizzed until the gunpowder of the evening was introduced in the medium of the remarkable speech of Sumner B. Young, W9AQH of Minneapolis, who, in twenty pages of vital information and sound counsel, held his audience almost breathless with interest.

One would suppose that a chairman of a meeting, on having questions of life-and-death import brought forth and explained, and left to the discretion of a constituting body in person, would order these questions out first for discussion. But not so Mr. Kerr—who reached his hand into the figurative hat of the question-box and dragged forth . . . the question of whether the board should let down the bars on license examinations!

Naturally, the question was shoved aside and the matter of Madrid brought to the platform at once. J. H. Deming, W9JI, of Ames, Iowa, spoke first and then followed Frank J. Sadilek, Leonard Collett, Guy E. Wilson, W9EL of Kansas City, Mo., the writer, Elwin J. O'Brien, W9GND of Iowa City, all critical of the manner in which the Madrid matter was handled and all deploring the secrecy in which the results of the Madrid meeting were buried.

Secretary Warner was severely scored by all these speakers for his part in amateur representation at the 1927 conference and at the Madrid conference and when the question ". . . on the basis of his record, is Mr. Warner entitled to continue as spokesman for amateur radio?" the reply was a deafening "NO" from the floor. At this point Mr. Kerr proposed a ballot on the question "Do we want Warner?" and the results were: yes, 1; no, 91—with the rest remaining neutral.

The writer then called for a vote on the resolution quoted in the second paragraph of this article, and the results were: for, 150; against, 4—remainder not voting.

Lt. C. H. Morgan of the USNR then called for a vote on the matter of ARRL approving the assignment of N prefixes to active naval reserve amateur stations. The results: approving, 153; not approving, 1—rest non-commital.

The surprise fireworks of the evening came in the form of a vote on the question of whether the ARRL should cooperate with the National Broadcasting Company and RCA in the dramatizing over NBC networks of amateur radio, in the effort to promote widespread interest in 5-meter communication, with resultant increased sale of 5-meter transmitters by commercial companies and of beginners' pamphlets by ARRL. It developed that this proposition has been put before the directors in a communication sent from West Hartford a few days previous. Although Mr. Kerr had not mentioned the matter in his lengthy opening talk, it was presented by Mr. Young and fully explained in his 25-minute talk. The results: opposed to the plan—everybody. A vote was taken at this time also on the question of whether the ARRL should suggest licensing of 5-meter operation to persons not knowing the Continental Code, and this, too, was unanimously disapproved.

* * *

TO a dyed-in-the-wool boat-rocker like the writer, who has been customarily pilloried with the rest of "those radical westerners", this meeting was of the nature of a miracle. Here we have the spectacle of the erstwhile staid Middle West, the hinterland of staunch and conservative hams, coming to the front with a thunderous criticism aiming to purge the ARRL of its defects.

No one can say that the meeting was anti-ARRL. It was, on the contrary, oozing with loyalty. The Minneapolis group was to a man ARRL. The sense of the meeting, too, was defined at one point as considering the ARRL as the one logical organization to sponsor the cause of amateur radio, and that those assembled were not interested in forming any other organization for this purpose.

This meeting, therefore, is the second great exoneration of our "western radicals" (including the writer, who is a W9, a W7 and a K7)—the first being the original pamphlet of the Minneapolis Club aiming to "put our house in order."

And this report, written "the morning after the night before" and rushed westward, is a grand hurrah, a shout of glee over something that was hoped for but hardly expected. As one old timer said during the closing minutes of the meeting —"I never saw anything like it before—did you?"

Sumner B. Young's Address

Gentlemen of the Convention:

AS THIS is my first visit to Des Moines, I suppose it is necessary for me to introduce myself. My name is Sumner B. Young, and my home is in Minneapolis. At the present time I operate two amateur radio stations; one in Minneapolis, having the call W9AQH, and one at Wayzata, Minnesota, signing W9HCC. My prewar call was 1CO, and my first call after the late unpleasantness was 1AE.

To show that I am not concealing anything, I wish to say at the outset that I am a member of the law firm of Prendergast, Flannery & Young, in Minneapolis, and that one of our clients is the Northwestern Bell Telephone Company, which belongs to the Bell System.

However, in telling you what I think will improve the American Radio Relay League, I feel sure that I am doing nothing against the interests of the Telephone Company. So far as I know, the A. T. & T. has no designs on the radio amateurs, and I believe that its attitude is well demonstrated by the fact that when an amateur station is found interfering with the Trans-Atlantic telephone circuits the owner is called immediately by long-distance phone, and requested to stop this interference, instead of being turned over to the radio inspector.

I have been a radio amateur for twenty-one years this month. My stations are well equipped, and I believe that anybody who has seen them can well understand why I would be very unlikely to try to wreck the American Radio Relay League for any reason whatsoever.

I believe that all of us in this room want to see the League succeed, and that any differences of opinion which may exist are as to the methods of improvement.

With that in mind, I would like to present to you my idea of what the commercial interests plan to do in regard to the radio amateur, and also an outline plan of self-preservation and counter-attack. **I am reading this paper to you for the very good reason that I do not want to be misquoted.**

In figuring out any course of action, it is always advisable to have some idea of what the opposition probably will do. In many cases it is impossible to judge their plan on the basis of actual knowledge. Many isolated facts must be pieced together and supplemented by a consideration of what we would do if we were in their shoes.

So, for the sole purpose of trying to figure out what we are up against, I have attempted to place myself in the shoes of the commercial interests, and have made use of such facts as have come to my knowledge. Perhaps many of you have more facts to go on than I have, and I don't claim that my work is one of finished perfection.

First of all, it is safe to assume that the commercials will not voluntarily relinquish further frequencies to us.

This much is certain for a number of fairly obvious reasons. For instance: An increase in amateur efficiency might be against their interests from a revenue angle, or they might consider such a step to be a dangerous precedent, for it would allow the people to get something without a struggle. Others in the commercial camp would argue that such a proceeding would result in the loss of "face."

In any event we may be sure that the commercials will take a wholly selfish attitude, and we must remember that in many countries outside of the U. S. A. communication systems are not run by private persons, but are government agencies; and the one idea of many governments is to keep the people under their respective thumbs.

Furthermore, the amateur market, meaning, of course, the market for amateur equipment and supplies, is not capable of unlimited expansion unless more frequencies are relinquished by the

commercials than they have any idea of parting with. True, we believe that they plan to encourage amateur operation on frequencies above 28,000 kilocycles, in order to develop a new market immediately, but we shall postpone discussion of this matter for a later time.

Secondly, the commercial interests probably will resist, in vigorous fashion, any attempts to enlarge the size of our bands.

When the amateur representatives went to Madrid, it is said that they made a deal with the American delegation, whereby the amateurs were to receive the unlimited backing of the American delegation, **but only upon the condition that the "Hams" would not ask for any further frequencies at that conference.**

Complete confirmation of this is not available, but the statement is probably true, as the information reached us from somebody who should know.

New Frequencies

THE policy of giving up nothing without a struggle, would doubtless be of equal weight here, as well as when applied to a question of voluntarily presenting us with additional wavelengths.

In any event, the task of obtaining new frequencies has, in the past, appeared to be so hopeless to the American Radio Relay League, that their accredited representatives have not even attempted the job.

One of the most interesting developments, and one of the most recent, is the scheme of the commercials to popularize the use by amateurs of the high-frequency bands from 28,000 kilocycles up to the ¾ meter band by removing the requirement that an applicant for an operator's license shall know the code, in the case of those desiring to engage only in wireless telephone communication on those low wave lengths.

The idea, apparently, is to develop an entirely new amateur market, composed of persons who have neither the desire nor the ability to learn the Continental Code.

A letter embodying these suggestions of the commercial interests, and signed by K. B. Warner, recently went out to all the directors of the American Radio Relay League.

As I understand it, one of the leading commercials plans to put on a series of broadcasts of fifteen minutes each, ballyhooing amateur radio, and informing the public that more information on the subject may be had by sending 25 cents to West Hartford for a booklet.

This looks very much like the use of the League for purposes not strictly amateur.

It probably will result in the recruiting of new and hard-to-assimilate "Hams" in carload lots, and a nice market will probably be opened up for cheap radio-phone equipment for use on the higher frequencies

Probably some attempt will be made to develop, at the same time, a new type of relaying in short jumps, probably semi-automatic in operation, such as the automatic relaying by one transmitter of signals received from a distant station.

Let us pause for a moment and see what the probable effects of this proposed popularization of the higher frequencies (and the exploitation of this market by commercial interests, with the help of headquarters) will be.

It is by no means certain that the new type of relaying proposed will be of much practical use. The co-operation of too many stations will be needed in order to transmit any given message over an appreciable distance.

Some of the newcomers, attracted by this propaganda, will look for new worlds to conquer, will learn the code, and a trek will start to the higher wave-lengths; and our present bands will become unmercifully crowded.

No serious work will then be possible on those lower frequencies. As a matter of fact, it is daily becoming more difficult to obtain worthwhile results, even now.

Another result will be, that the commercials, by virtue of this tie-up with headquarters, will gain increasing influence there, which will not work out for our general good.

Meanwhile, certain preliminary steps, calculated eventually to destroy us, will have been going on.

First, our Trans-Pacific traffic will have been destroyed, limited, or hampered by the Madrid Treaty until such time as special arrangements shall have been entered into between the United States Government and other nations in order to permit the exchange of third party international messages. These special arrangements will probably require much time and effort to negotiate.

Furthermore, an attack probably will be made on our right to handle domestic third-party messages, on the ground that the service is so slow and unreliable that the handling of such messages is not necessary, nor in the public interest, nor a contribution to public convenience.

Although stations like W9USA, which operated at the Century of Progress in Chicago last summer, have been based on a good idea, namely the demonstration of our work and skill to the public in general, **these enterprises were premature.**

Actual experience demonstrated that our relay lines were not well enough organized to stand up under the strain of handling thousands of uninteresting messages solicited from the public. Only a very small percentage of the messages which left Chicago were delivered promptly, and a very unfavorable impression was created.

Amateur Traffic

SOLICITATION of messages from the general public at public places has always made the commercials nervous. I predict that they will almost surely be successful in putting a stop to this practice if we attempt to continue it under existing conditions, because we can't show that the service was worth a tinker's damn.

The unfortunate part about it is, that in closing up stations of this character, they will have undertaken, with success, the first step in shutting us off from our right to handle domestic third-party traffic.

Let us elaborate the probable scheme of the commercials to get the amateur where they want him, a little further.

If they can gain a foothold at headquarters in West Hartford, either by virtue of their League membership or by means of the leverage which their advertising appropriations might exert, they will do all they can to encourage the amateurs to abandon traffic handling, and to dissipate their energies in activities which may be amusing to some of the members, but which really do not count at all in a battle for self-preservation. They will smile with approval upon QSO parties, sweepstakes contests, DX contests, and mere QSL-hunting, for instance.

The last stage will be the sudden, unexpected, final onslaught, namely, the sweeping up of all of our lower frequencies, leaving us high and dry except for a few of the higher frequencies from 28,000 kilocycles up.

To those of you who believe that I am overpessimistic, and that such a thing could never happen, let me say that this would merely be a repetition of what happened to us in 1913, **when the commercial interests and the Army and Navy appropriated every wave which was supposed to be worth anything, and left the amateurs of the United States in possession of only the supposedly useless wave-lengths from 200 meters down.**

What the amateur did with these supposedly valueless wave-lengths is a glorious achievement, but there is small possibility that we could repeat our triumph, and make the ultra-high frequencies into something very much worthwhile.

And if we did perform this miracle, there is no good reason to suppose that the fruits of our victory would at last be immune from commercial poaching, and that these ultra-high frequencies, made useful by us, would not be gobbled up as well.

Now, then, I have painted a discouraging and a disquieting picture, and it is up to me to tell you what I believe should be done about it.

Mr. Young's Plan

HERE is my plain of self-preservation and of counter-attack. In some points it fits in with present League policies, and at others it does not:

To begin with, it is axiomatic that we must have something to sell to the public in order to hold our place in the air.

The idea that if the public, or a respectable section of it, wishes to use **their own air** for their own enjoyment, then a place should be set aside for them **as a matter of right and common decency**, has not received the recognition which it deserves, even in the United States of America, which is supposed to be a democratic country.

In the U. S. A., about 35,000 of us have learned to communicate with each other over the air, and the fascination of this friendly interchange of news and ideas is very real. Our right to continue to operate our radio stations is really just one aspect of the right of free speech, but few persons have recognized this fact.

Of course, in countries such as those of Central Europe, where the citizen is only so much "cannon-fodder" and potential tax-money, any such claim would be laughed at; but it seems to me that something can be done with this theory in the United States, particularly if and when our numbers increase several fold.

Let me explain, for a moment: I don't mean to suggest that we should continually, **and without discrimination,** strive to bring more and more amateurs into the game. They should not be brought in faster than they can be properly assimilated and added to our League.

And remember, there is nothing in it for us amateurs, to have our high-frequency bands filled up by a whole lot of new-comers in order to make a Roman holiday for the manufacturers of cheap radio-phone apparatus.

Our best bet, then, is to go to the public, and prove to them that we are really of some public good.

Well, what can we say?

In the past we have furnished operators to the Army, the Navy, the Coast Guard, and the Marine Corps, in time of war. That is an excellent record, but the public may feel that many other specialists went to war, and that our record is by no means unusual; and the public does not realize how long it takes to turn out a good radio operator. Furthermore, it is usually a long time between wars, **and the public forgets.**

For many years we have given excellent emergency communication in time of public disaster, such as floods and earthquakes. We have had the sensation of being heroes one day and pains-in-the-neck the next. **Again, the truth of the matter is, that the public forgets.**

We have produced some scientists, but amateur radio is not their exclusive source; and the commercial interests have plenty of time and money to train research men at their own expense.

We can drop messages into Alaska with more precision and speed than anybody else (see, for instance, the excellent article by Louis Huber in the April issue of "R/9").

Once-upon-a-time we really developed an efficient Trans-Pacific traffic, but it looks as if the Madrid Treaty would hamper this, and we strongly suspect that the commercials are out to stop it anyway.

Occasionally a domestic radiogram beats the mail to its destination, but not often.

Amateur radio is a good thing to keep growing boys out of mischief; but there are lots of boys, and others activities, such as Boy Scout work, for instance, can do this equally well.

Well, what about all this, anyway?

There is nothing to do but to polish up our assets, quit engaging in foolish activities, and start selling ourselves to the public.... To fail to do so is to engage in a progressive kind of suicide.

Obviously, this sale cannot be accomplished unless and until the public knows our side of the story.

Now, specifically, what should we do?

The first thing which I would do, would be to bolster up our domestic relay lines until they are capable of performing some really decent service to the public in general.

We should, **at once,** quit originating traffic where the message is not sure to beat the United States mail to its destination.

To put our lines in shape, some League money must be spent on the problem; in particular, the S. C. M.'s and the R. M.'s should be given sufficient funds so that they can get into proper touch with the League members in their respective territories, and really organize them in an effective way. Although some of their expenses are, I believe, now paid by the League, these are **nominal amounts only,** and do not amount to much. Under existing conditions, few of these gentlemen have sufficient private resources to allow them to send out the numerous circular letters really necessary to this work, or to pay traveling expenses.

We should quit soliciting messages at Fairs, and at public places. This is no hardship. The messages usually are both unimportant and uninteresting. **We can resume this practice later, when we are equipped to do it right.**

We should junk all our existing traffic rules, and write some decent ones, instead. So long as a station can hold messages 48 hours before being obligated to mail them to their destination, it is perfectly possible to start a message from Chicago and to have it pass in 100 or 200 mile jumps to Minneapolis, with a delay of just under 48 hours at every relaying point. The message may arrive in from four days up to a week after leaving Chicago, and not one single rule in our present relay book will have been shattered. Some of W9USA's messages took three weeks.

Our aim should be quality and not quantity, both as regards to the number of relay lines in existence and to the number of messages passing over them.

I believe it is advisable to build up club stations at strategic points at, for instance, Chicago, New York, Los Angeles, Kansas City and St. Louis, which can stay open at least eight hours a day, and be operated by a number of experienced amateurs.

We should be more particular about who receives an official relay station appointment, also.

Next, I would take all necessary steps to preserve or to re-gain our Trans-Pacific traffic.

There is small chance of preserving it in the strict sense, for the Madrid Treaty will very probably be ratified by the U. S. A., due largely to the attitude taken by the present officials of the A. R. R. L.

Consequently, there will be nothing left for us to do but try to persuade our government to negotiate the proper special arrangements with other countries, in order to allow international third-party messages to be handled. **This means vexatious delay.**

Incidentally, I believe it would be extremely good policy to refrain from illegal operation in the meanwhile.

As a third major stage, I believe that we should draw closer than ever to the Army and Navy, join up with their reserve net-works, and perform our drill duties faithfully.

As a fourth measure, I would fall in wholeheartedly with the recommendations of the League (and others) to prepare ourselves for further public emergencies, so that when hurricane, earthquake, or flood, strikes our respective communities, we will be able to get on the air in a minimum of time.

Reorganizing the League

MOST important of all, I believe we should reorganize the League itself, in order to fashion it into a more effective weapon.

I suggest the organization of a vigorous and

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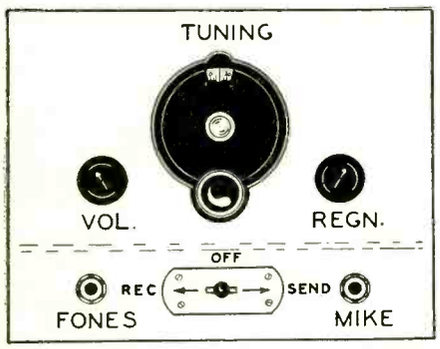
5 or 10 Meter Transceiver

By FRANK C. JONES
Ultra-Short-Wave Editor

SUMMER and its automobile trips will soon be here again. Five or ten meter phone work offers an interesting possibility for tests between cars, or between a car on a mountain side and some city in the distance below. Requests for a powerful transceiver have been made and the circuit shown should fulfill this need. Some sets of this type have been in service for several months on the construction work of the great San Francisco-Oakland Bay bridge and have always put out a good strong signal of excellent intelligibility.

The power output ranges from about one watt carrier at 160 volts plate supply to about three watts at 250 volts. These powers are suitable for use in cities or level forests of from two to six miles on five meters. These same sets will transmit and receive up to any visual distance (a hundred miles or more) between mountain sides. On 10 meters the absorption and reflection by buildings and small hills is much less and the short distance ranges are greatly increased. Occasionally a 10 meter signal may pop in from a point 500 to 800 miles away on days which are particularly



Front View of Transceiver

suitable for this frequency. This form of receiver is quite sensitive since it is an efficient super-regenerative circuit on the receive position. It also emits bad interference since it is a grid-leak type of super-regenerator. However, this form of detection has proven very satisfactory when using type 41, 42 or 2A5 pentode tubes from a standpoint of good sensitivity and ability to detect, without undue distortion, weak or extremely strong signals. The latter effect is obtained by returning the grid leak to a high positive potential which makes it act more nearly like an AVC receiver than any other form of super-regenerator.

High sensitivity is obtained by relatively tight coupling to a resonant antenna and operation of the super-regenerative detector at a moderate value of actual plate potential and grid bias, followed by a high gain audio stage. Too many super-regenerative sets give too much noise and too little signal because of improper circuit constants and too little audio amplification following the detector.

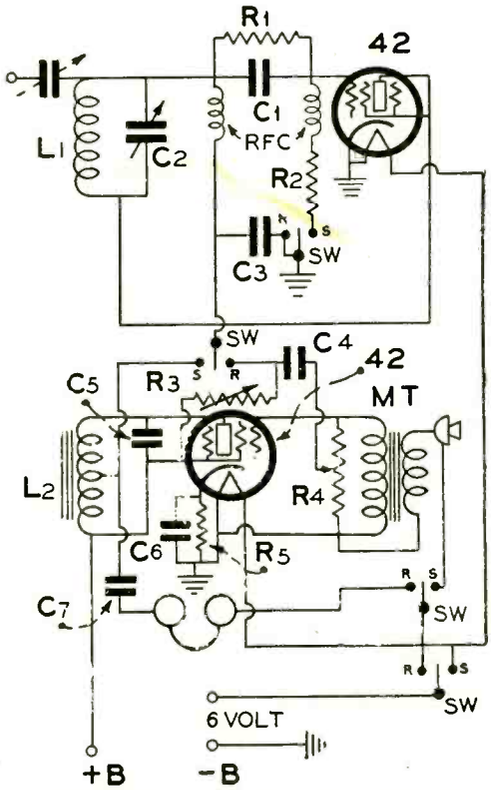
The circuit consists of two tubes such as the type 42 six volt pentode power tube. A four pole double throw anti-capacity or spring leaf switch is used to either transmit or receive with six volt power supply being shut off in the center, or off position of the switch. A tuning control, volume control, and receiver super-regeneration control are also provided since the adjustment of the later minimizes receiver radiation. In the receiver position, one tube acts as a super-regenerative detector and the other as an audio amplifier. In the transmit position, the actual plate voltage on the former tube is increased greatly and a low value of grid leak makes it into a powerful oscillator. The audio amplifier becomes the modulator and the headset is cut off and the single button mike cut on in the transmit position.

The transmitting oscillator draws relatively high plate current on these short wavelengths and best results are obtained when the modulator has a step-down output transformer or choke for coupling. A center-tapped output transformer or a center-tapped 30 or 40 henry choke works very nicely and gives a high percentage of modulation as compared to the usual Heising choke coupling to the oscillator. This choke carries the combined oscillator and modulator plate current so it should be one having a suitable air gap if good speech quality is desired.

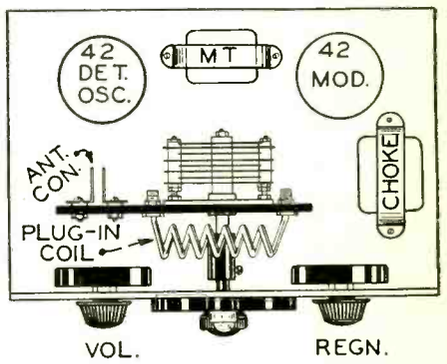
The mike transformer can be any single button-to-grid type of transformer. The volume control for receiving allows any volume range desired on the receive position but has no effect on the transmitter except to act as a fixed resistor load across the mike transformer secondary, thereby improving the audio quality.

The regeneration control is desirable since the relative feedback is greater on 10 meters than on 5 meters and it can also be set at a value near the breaking-off point of super-regeneration. This minimizes receiver radiation. This variable resistor should be capable of carrying two or three milliamperes of detector plate current and serves as a resistance coupling to the audio amplifier. This resistance coupling drops the plate voltage on receive position.

The values of condensers and resistors shown in the detector circuit are quite important for proper super-regeneration, especially the plate return and grid blocking condensers. The leads from the tuning condenser to the tube should be as short as possible, not over two inches at the most. The plug-in coil should have its two pin jacks mounted very close to the tuning condenser terminals, preferably on the same piece of bakelite or hard-rubber sub-panel. This coil should be at least ¾ of an inch away from any metal shields. The tuning condenser must have an insulating coupling in its shaft connection to the tuning dial. The complete receiver should be enclosed in a metal cabinet with a metal front panel for shielding and prevention of



L1—56 MC-6T No. 12—⅝-in. diam. spaced ⅛-in. between turns. 28 MC-12T No. 12—⅝-in. diam. spaced 3½-in. between turns.
L2—Center-tapped choke.
R1—1 Megohm.
R2—5000w 1 Watt.
R3—50,000w.
R4—250,000w POT.
R5—600w 1 Watt.
SW—4 Pdt. center is "off".
C1—.00025
C2—15 Mmfd.
C3—.006
C4—.1 Mfd.
C5—.006
C6—10 Mfd.
C7—.5 Mfd.



Correct Placement of Parts

hand capacity. The antenna coupling condenser can be two right angle brackets about ⅛ inch apart and ⅝ inches square. A slot should be cut in the mounting screw hole of one of these brackets in order to have a slight variation of coupling in order to adjust it to a point where the receiver has a tendency to pull out of super-regeneration with the regeneration control set at about half way position. This condenser should also be mounted on the tuning condenser vertical subpanel.

The tubes can be mounted on a metal or bakelite horizontal subpanel with the tuning condenser and coil above and the send-receive switch below. The RF chokes should be mounted beneath this subpanel near the grid condenser and grid terminal of the oscillator socket. The chokes which have proven most satisfactory for both 10 and 5 meters, are made by winding No. 30 DSC wire for 1¼ inches on a ⅜ inch diameter bakelite rod. These chokes can be mounted by means of a short 6-32 machine screw which does not extend into the RF choke winding itself. The chokes should be dipped in clear lacquer or coil "dope" and dried before using.

An 8 mfd. electrolytic condenser is shown connected across the B plate supply as most dynamotors or B eliminators are not well filtered. Even with B battery power supply this condenser is useful because it prevents a sort of fringe howl in the receiver when the batteries become old and have high internal resistance. The 10 mfd. electrolytic by-pass condenser across the 2 watt 600 ohm cathode resistor can be of the 25 volt type. The ½ mfd.

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Getting the Most Out of the Single-Wire Fed Hertz Antenna

By JAMES P. DOBYNS, W9DXP

IN the general rush that has been made to put up doublet transmitting antennas, a good many amateurs have forgotten about one of the old graybeards of amateur antennas which can perform in a most fratifying manner if we construct and adjust it properly. This is none other than our old friend the single-wire fed Hertz.

There is little than can be said in favor of any ordinarily-used amateur antenna that cannot be said of the single-wire fed type, and perhaps the single-wire outfit has one lone advantage of its own.

All of this is contingent upon having this little-understood antenna properly adjusted—which holds true with any sky-hook, of course. It may be added that very few of this particular species are properly lined up.

In conversations with amateurs generally, it is apparent that few of them have any idea why the system works at all. Either an antenna is voltage fed from one end, or current fed from the middle, while this hybird doesn't seem to fall into either category. As a matter of fact it is a combination of the two, depending upon a matching of impedances to effect the power transfer from the traismitter to the radiator.

The empirical formula calling for the attaching of the feeder 14 per cent of the half-wave antenna's length from its center is a good starting point—but it is only that. We all know that design on paper and performance in the line of stations worked don't always coincide. We design an antenna according to formula—and the results are either satisfactory or we discard the system and try another antenna and another, until we find a type that seems to work best for us.

The fault of this procedure is that maximum antenna efficiency for our individual station and location may never be achieved. Perhaps we eventually install one of the relatively foolproof, reliable Zepps, and accept with an air of resignation the fact that our feeders are too long or too short for best efficiency.

This is regrettable because the antenna is, in the light of improved transmitting equipment, likely to be the weak link in the chain that connects us with the distant parts of the world. We may have a single-signal super and a fine crystal controlled transmitter, but if our antenna will neither take power from the transmitter nor radiate it, we might as well be using the old UV202 we had back in 1925.

Antenna Length

THE wide success which has greeted almost every type of amateur antenna shows that nearly any type will work effectively if it happens to fit in with the physical conditions which exist at a given location. But when we have an antenna 60 feet above ground and our transmitter is in the basement, we have a feeding problem on our hands. Most of us use a crystal which practically assigns a frequency to us, and there we operate. What we want our radiator to do is respond with maximum efficiency to that particular frequency and perhaps the even harmonics of that frequency.

It is usually stated that the antenna proper can be as much as 2 per cent off its proper mechanical length without affecting its radiating properties appreciably. But unless some process for accurately determining just what its length should be for a given frequency at an individual location, most amateurs will never know whether their antenna is even within that allowable 2 per cent or not. It is certain that if the antenna length is wrong for the frequency we impress on it that the distribution of voltage and current upon it will not be what we think it is.

For maximum efficiency, the exact length of the antenna is of importance. True, it will have a fairly broad resonance curve because a Hertz antenna has a radiation resistance in the neighborhood of 60 to 80 ohms; but we want maximum efficiency, and the many tests that have been made by individual experimenters show that more power will go into the antenna if its length is exactly right.

By establishing a relationship between frequency and the speed at which radio waves

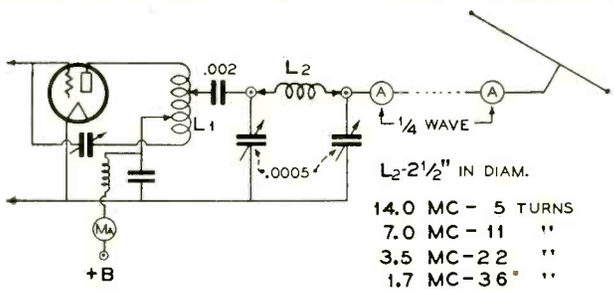


FIG. 1

travel, we can set up a theoretical length for an antenna. Both theory and experience have taught us that this length must be shortened because of various phenomena which tend to "load" the antenna. For a half-wave Hertz the formula becomes:

$$\text{Length (in feet)} = \frac{492{,}000}{\text{Freq. in KC}} \times K$$

With K being the product of the phenomena that load the antenna. Factor K is the result of the antenna's proximity to surroundings, its resistance, inductance, capacitive properties, operating frequency, physical properties of the wire itself and to a certain extent the method by which the antenna is fed.

It becomes apparent that since all the things which make up factor K will differ with every antenna that we can't assign it an arbitrary value. Experimental results based on the thousands of amateur antennas that have been erected indicate that K will be in the neighborhood of .935 to .975, however.

Now it may be safe to start on the assumption that K is normally about .950, and that a 7100 kilocycle Hertz antenna will be about 66 feet long. But it is also quite likely that it should be 64 feet long or 67½ feet long for your individual location.

The average amateur, after hunting up some of the methods of determining proper length of an antenna gives up and makes the best of it. Some of the methods that have been devised won't work on a single-wire fed radiator, because a maximum current indication at the center of the antenna is no assurance whatever that the antenna length is right for the frequency impressed on it.

How to Determine the Proper Length

WELL, how can we easily determine what should be the proper length of our own individual antenna—out in our own back yard, not someone else's—using our own frequency and our own pet feeder system?

Simply build up a small oscillator—a TNT using a type 45 tube with 45 or 90 volts on the plate will be satisfactory—and use it as a driver for our antenna. Put a small milliameter in the grid circuit; one with a full scale reading of five milliamperes or less. Then when we strike a dip in this meter's reading, we know we have hit the antenna's natural period.

Next listen for this little driver's signal on your election coupled monitor, or that superhet of yours, and see how far away from your crystal controlled frequency it is. The answer will be obvious—either add on or cut off antenna wire until you can zero-beat your transmitter's oscillator, the driver, and your monitor or superhet. It won't be easy to do, but it can be done. A regenerative receiver, because of the interlocking between the regeneration and tuning controls, and its tendency to be "pulled" by a strong signal, will not be satisfactory. Borrow another electron-coupled monitor from a nearby amateur.

Having the length exactly right, how are we to know whether the feeder is hooked to the antenna at exactly the proper point? That's not going to be difficult, either, but before we determine the point experimentally, let's see why the feeder transfers power at all, and why its current-voltage relationship must be matched to a current-voltage relationship existing on the antenna.

We are familiar with the fact that on a half-wave Hertz the current reaches a maximum at the center and a minimum at the ends, and that the voltage reaches a maximum at the ends and a minimum at the center. If the antenna has a radiation resistance of 70 ohms, and the transmitter is putting 70 watts into the antenna, the current at the center of the antenna will be one ampere. T he voltage will be 70 volts. At the ends of the antenna the voltage will reach a very high figure, and the current will reach an extremely low figure, both values depending somewhat upon the effectiveness with which the antenna is insulated. Even with a low power such as this the RF voltage may be in the neighborhood of 5,000 volts or more—so insulation is important.

Now if we recall that impedance is the ratio of voltage over current in an RF circuit, it can be seen readily that the antenna will have different values of impedance at selected points between one end and the middle, and duplicate impedance values at corresponding points on the other half of the antenna.

It is obvious that since the voltage is 70 times greater than the current at the center of the antenna, that the impedance at this point is 70 ohms. If we could construct a single-wire feeder having a surge-impedance

(Continued on page 23)

The Banehawk Super-Heterodyne

Part V
Mechanical Details and I. F. Amplifier Data

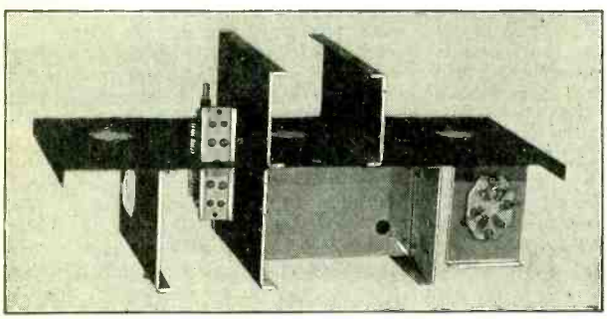
By CLAYTON F. BANE

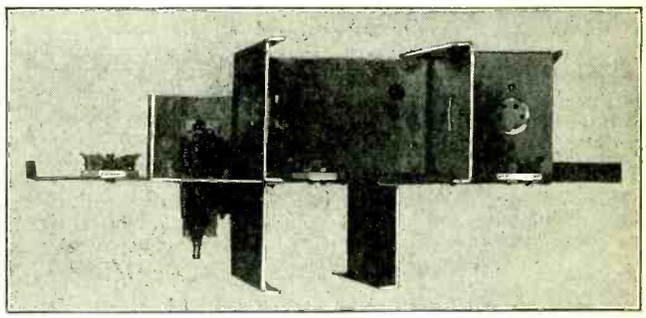
HAVING discussed some theoretical considerations of intermediate amplifiers in our last installment, we will conclude the BANEHAWK series with practical data on the IF. Power supply units will be discussed next month.

In designing an IF amplifier, one of the first considerations is the proper placement of parts. This is highly important for a great number of reasons, not the least of which is to provide short leads, and in this way avoid oscillation due to pick-up between stages. The photograph on the facing page shows our final arrangement which provides a very excellent compromise in the length of the grid and plate leads. Obviously, with the grid lead coming from the top of the shield can, and the plate leads coming from the bottom, it is possible to make one of these leads very short, but impossible to make both off them equally short. We struck a compromise by mounting the IF tubes in a horizontal position; in this way we have achieved reasonably-short and direct grid and plate leads.

The entire IF assembly, i.e., the tubes, transformers, condensers and resistances, are all mounted on a sub-base which in turn is supported from the main panel by two-inch brass studs. Since air tuned trimmers are used and these trimmers are only accessible from the bottom of the set, the horizontal mount of the entire assembly has another very definite advantage. We could not look forward with any pleasure to removing all the back shielding to get at the IF trimmers. Access from the top or bottom was impossible because the power supply effectively covers the top and the high frequency portion is on the bottom. The best way to get at the trimmers was from the front panel. This front-panel tuning of the IF was not adopted for any other reason than the fact that this offered the most convenient method of getting at them.

The selection of IF transformers is not as easy as it may at first appear. If air-tuned transformers are used no particular difficulty would be encountered, since a varied assortment of these are available at very reasonable prices. Notable among these are the Hammarlund and National. We made up our own transformers, using Cardwell midget trimmers and Miller coils. Standard McMurdo-Silver air-tuned transformers, the same type as used in the Silver IF unit, are used in the last three stages. In any case, square cans are a virtual necessity and a small amount of ingenuity must be exercised to get the assembly in a small can. However, it can be done if the right trimmers are used.





The method of mounting the two-gang variable condenser is shown in these two illustrations. One section of the condenser protrudes through the metal center panel. A hole is cut in this panel to permit the condenser to pass through.

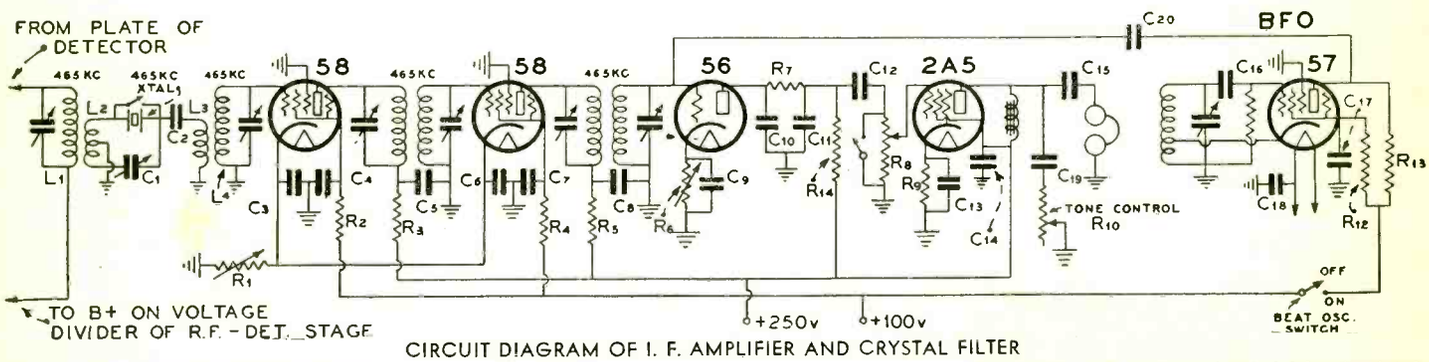
The Crystal Filter

IT WILL be further noted upon a close inspection of the photographs that there is what appears to be an extra transformer on the deck. This other transformer is part of the crystal filter. It would be an excellent idea to make provision for this transformer, whether or not a crystal filter is originally planned. In fact, this extra transformer can be used to good advantage as a band-pass stage—a very excellent feture for providing selectivity for phone reception without introducing distortion, due to radical cutting-off of the higher frequency sidebands.

In order to make a crystal filter effective it is absolutely essential that all of the signal coming from the high frequency portion passes through the crystal to reach the first IF grid. The quartz filter can be likened to an extremely low-C resonant circuit of the series variety. This, of course, is in the series position, the one most used.

It is the property of series resonant circuits that they offer a very high impedance to all frequencies but the resonant frequency. An ordinary circuit with inductance and capacity can never have as high a Q as a quartz crystal. To make this more understandable, let us quote some data from Dr. Terman's RADIO ENGINEERING: "As an example of a coil with an exceptionally high Q, $\left(\frac{wL}{R}\right)$ we find a coil of 93-38 Litz wire to have a Q of 900 at a frequency of 400 KC. Contrast this to a Q of approximately 10,300 for an X-cut crystal, 3.0 by 0.40 CM at a frequency of about 90 KC. This crystal has an equivalent inductance of 137 henries, a C of .0235 mmf and an R of approximately 7,500 ohms."

Probably one or the principal reasons for

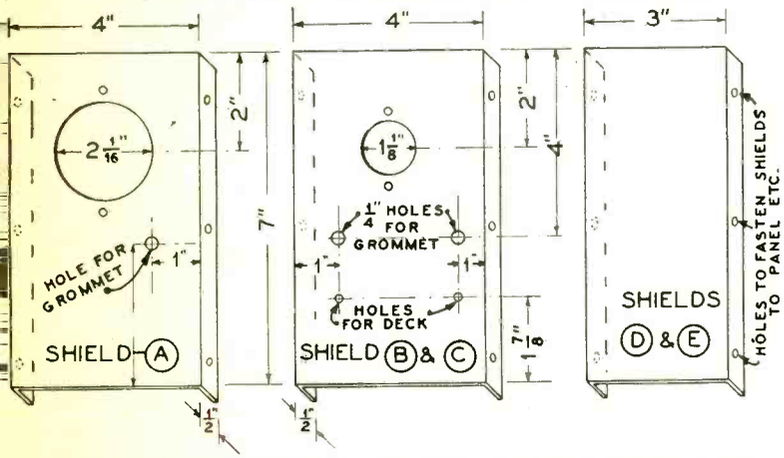


CIRCUIT DIAGRAM OF I. F. AMPLIFIER AND CRYSTAL FILTER

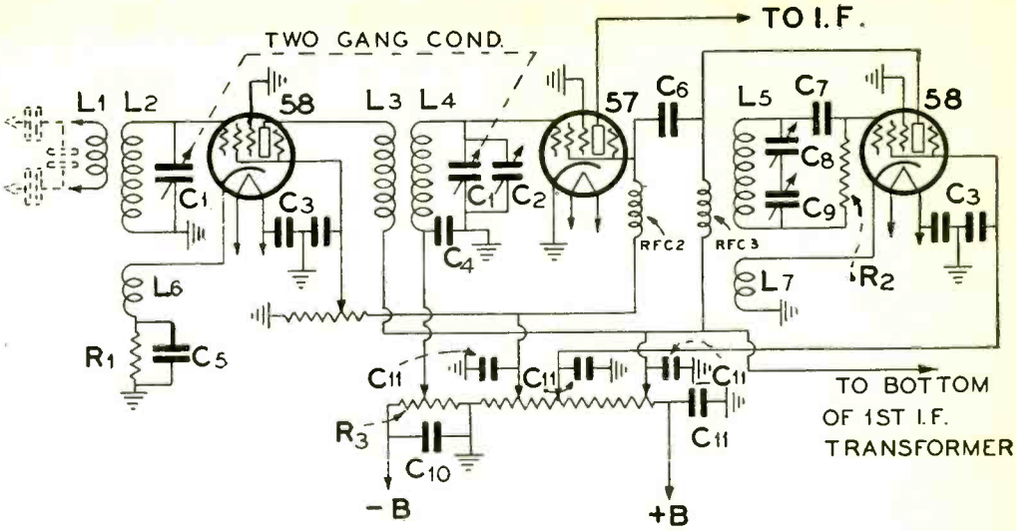
L1—One winding of 465 KC transformer.
L2—Approximately 25-1 step-down ratio from L1 Wound in 2 sections directly on top of L1.
L3—Same as L2 but no tap—wound directly on top of L4.
L4—One winding of 465 KC transformer.
Note:—United Transformer Co.'s 30 henry, 50 mill iron-cored choke is used in plate circuit of 2A5 output stage.
C1—2 plate Hammerlund "Star" condenser. Phasing condenser.
C2—.00005 mica condenser.
C3—.1 mfd.
C4—.01 mfd.
C5 .01 mfd. —
C6—.1 mfd.
C7—.01 mfd.
C8—.1 mfd.
C9—.5 mfd.
C10-11—.00025 postage stamp mica.
C12—.01.
C13—8 mfd. electrolytic.
C14—.1 mfd.
C15—1 mfd.
C16—.00025 postage stamp mica.
C17—.01.
C18—.01.
C19—.05.
C20—Very small capacity—Either sleeve-type or twisted wire type.
R1—50,000 ohms variable (central lab.) insulated shaft.
R2—50,000 ohms ½ watt fixed resistor.
R3—1000 ohm 1 watt fixed resistor.
R4—50.000 ohm ½ watt fixed resistor.
R5—1000 ohm 1 watt fixed resistor.
R6—50,000 variable—insulated shaft.
R7—1500 ohm 1 watt.
R8—500,000 ohm variable. In.
R9—500 ohm 5 watt fixed resistor.
R10—25,000 ohm variable—tone control.
R11—50,000 ohm ½ watt fixed resistor.
R12—50,000 ohms ½ watt.
R13—25,000 ohms 1 watt.
R14—75,000 ohms 1 watt.

the drop in volume in many of the older filters has been due to a wild mis-match of tank-to-crystal impedance. We find that a parallel resonant circuit tuned to around 460 KC has an impedance of approximately 100,000 ohms, whereas the resistance of a 451 KC quartz plate is about 9,000 ohms! Something wrong here. Obviously, some means of stepping the impedance down to approximate that of the crystal must be adopted. Our own crystal filter is practically an exact copy of the Hammarlund unit, which shows extremely competent engineering. Instead of the old untuned primary, a tuned primary is utilized, providing a voltage step-up and at the same time allowing the plate voltage to be fed in at the bottom without recourse to an RFC. The secondary is untuned and is wound directly on top of the primary. The input coil to the crystal should have a step-down ratio of approximately 20 to 1. Naturally, this step-down ratio also steps down the voltage so that it is necessary to provide a step-up ratio to the grid coil of the first IF stage in order to bring the voltage back to its original value. The bottom of the grid coil is grounded in the usual manner, the C bias for this stage being provided by the usual cathode resistor.

The holder for the quartz plate is again very similar to that used in the Hammarlund filter. A bakelite base, the thickness of which is slightly less than the crystal, is slotted to act as a holder for the crystal. The holder plates are made of heavy gauge brass (⅛-in.), in order to avoid any tendency to warp. The plates are ground perfectly flat. Two screws hold the plates to the bakelite base and separators are added between the plates and the crystal to provide an air gap. This gap can be very easily adjusted by putting the crystal in position and covering one face with a piece of paper to act as an air-gap gauge. Adjust the spacers under the top plate until it is just bringing pressure on the crystal and paper. Remove the paper and you have the air gap all set.

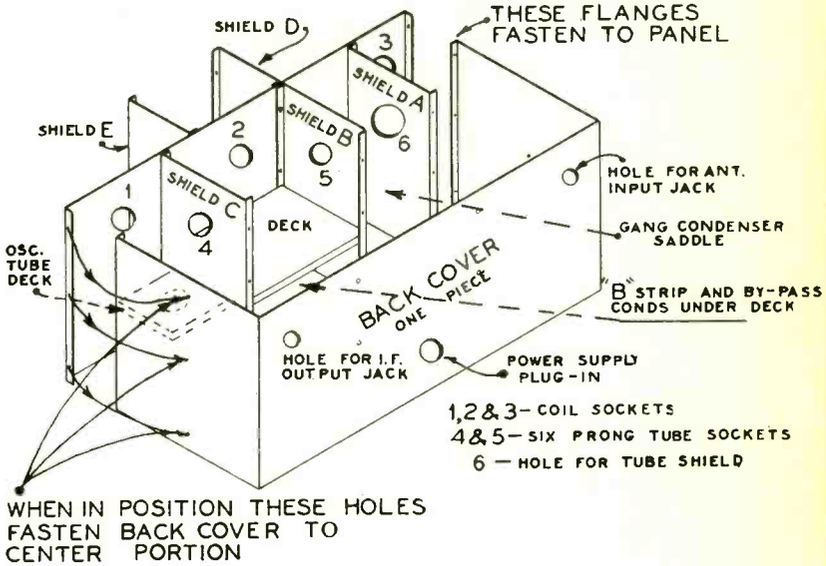


Detail Drawing of Shield Partitions. The large round hole in Partition A holds the horizontally-mounted tube shield can.



FRONT END BANEHAWK SUPER

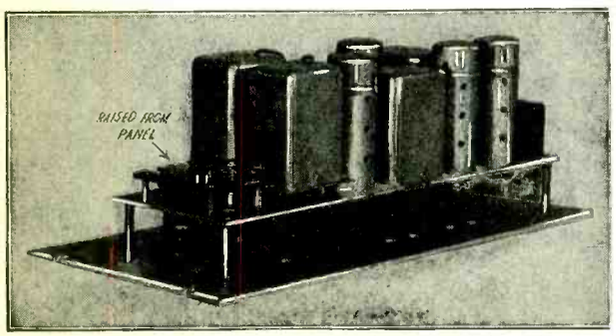
The legend and list of parts for the front end was given in a previous issue.



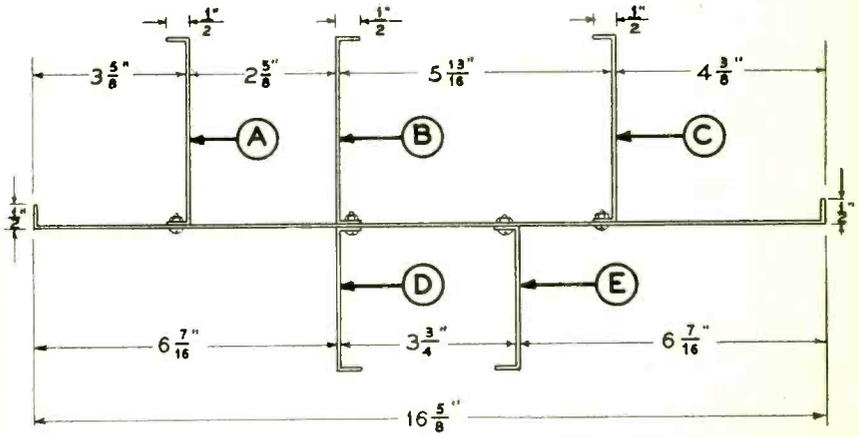
One of the most troublesome things in an IF stage is oscillation between stages. The causes for this are quite varied but can usually be broken-down into a few main causes. Inter-coil coupling is one of the worst offenders, followed closely by common-cathode, or common-screen coupling.

(Continued on page 31)

Editor's Note: The entire Banehawk Series with large illustrations of other views of the receiver will soon be printed in pamphlet form. You can have a copy on request.



I. F. Amplifier Rack with Crystal Filter at left end



LOOKING DOWN ON R.F. & DET. STAGE SHIELDING ASSEMBLY

METAL USED IS 16 GAUGE STEEL, COPPER OR CADMIUM PLATED.

TRANSMITTING "TECHS"

By W6WB

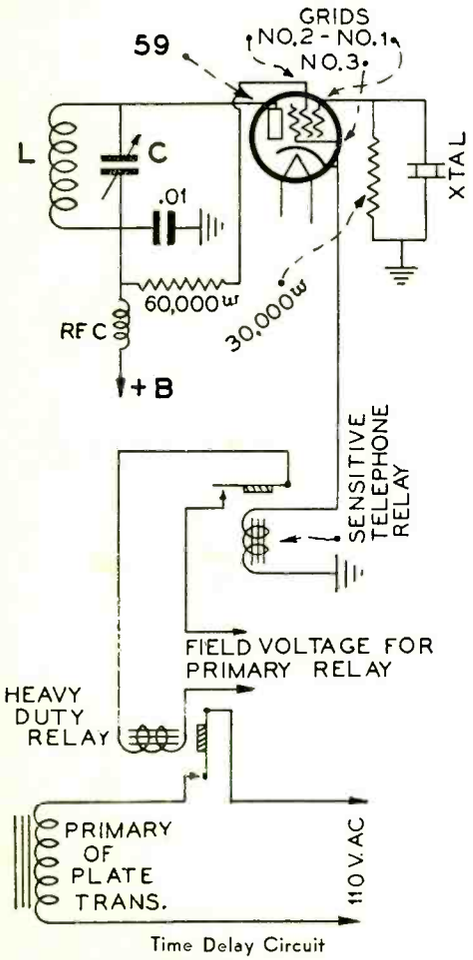
THERE are a great many minor points about various transmitter details which, because of brevity, are not suitable for manuscript in themselves. Thus we present them in the form of short "Techs".

About Crystal Oscillators and Time-Delay Circuits

THE stage used a type 59 tube—this particular tube being used because it was of the cathode type. The cathode in this particular tube is a rather slow heater (requiring usually about 20 to 30 seconds to come to operating temperature). The plate current of the crystal tube was used to advantage to operate a relay which in turn controlled the power input to the plate transformer for the slow-heating 66's in the high-voltage rectifier. Of course, a relay sentitive enough to perform this duty usually has contacts that are unsuited to break the primary directly. This small relay controlled a larger one in the primary circuit. It is usually much easier to use the cathode with a small sensitive relay than to use a much more expensive and complicated time-delay relay. Thank Mr. Frank Jones for this stunt—it works beautifully in practice. The diagram shows how it is done.

And More About Crystal Oscillators

DURING the course of some recent experiments with the aforementioned 59 crystal oscillator stage, but without the time-delay affair, considerable trouble was experienced due to instability. This trouble entirely disappeared when the plate blocking condenser (a .002) was replaced with a .01. Henceforth and hereafter, all of our oscillator plate blocking condensers are going to be **.01 and nothing smaller!**



Time Delay Circuit

Feedback In the 65

A GREAT number of inquiries have been received from readers asking for dope on the '65. Our personal experience with these tubes has shown that at low plate voltages (300 to 400 volts) the '65 is practically the same as the "ten", considering power output only. With 600 to 800 volts on the plate, the '65 (we mean the new carbon platers) really seems to be worth the price asked. Continued use at this voltage has developed no ill effects.

THERE is a fallacious belief in some circles that a screen-grid tube, such as the '65, can be installed in any old way without having to be neutralized. This is not always the case. The screening in most of these tubes is usually not perfect, and rather rigid precautions must be taken to avoid oscillation. For one thing, this means that the grid circuit, if link coupling is used, must be well removed and preferably shielded from the plate circuit. In the case of capacitive coupling to the grid of the '65, the tap on the crystal stage must be placed well down from the plate end to avoid tuned-grid-tuned-plate effects. In two separate cases in two different transmitters, oscillation stubbornly persisted, despite elaborate precautions. Both of these transmitter stages used series plate feed with no RF choke in the positive, high voltage lead. The addition of one of the popular small RF chokes in this positive lead resulted in the complete disappearance of oscillation. This same idea would be equally applicable to the 860 and is a good line of attack when all else fails to cure oscillation. These tubes can be neutralized without particular difficulty, if and when necessary.

The Gammatron, Excitation Requirements

NO less than fifty amateurs during the last month have asked us about the amount of excitation required to excite one of the new Gammatrons.

Very roughly speaking, the Gammatron is similar to the '52 in its excitation requirements. This statement should not be taken literally because actually the 354 requires less excitation than the '52. For purposes of comparison for those who are familiar with the '52, the likening of the two tubes in this respect is not so far-fetched. It is fairly safe to predict from experience that the 354 cannot be properly excited from the ordinary doubler stage, as some would hope. In suggesting a suitable lineup of exciting stages, several alternates present themselves. A 47 crystal oscillator with 3.5 mc crystal, into a 46 doubler, into a '10 or 841, into another '10 or pair of '10's would do an excellent job. This same combination, but with the substitution of an 800 for the last '10 is an excellent one. It is also conceivable that an 80 meter crystal stage, a neutralized '10 and the final would make a fair combination for 80 meter work. This same layout, but with the substitution of a 40 meter plate, should give good results on 40 meters. In general, however, it is usually advisable to drive the exciting stage with another stage on the same frequency to do a really good job of exciting. Of course, much depends upon the input and plate voltage on the various stages; also, whether or not the final is to be worked as a real high-efficiency amplifier. In this latter case it is usually considered advisable to be able to provide approximately one-third the input power to the final amplifier on its grid. If we are to follow this rule, obviously any notions of driving a 354 at 1 kw input with high efficiency with a 210 or 800 must be abandoned. A 211, 203A, 852 or another 354 will do the trick.

Some Transmitter Combinations

7MC Band

3.5 MC crystal with 47 oscillator, 46, 841 or 865 doubler, or pair of 841's in push-push doubler. Buffers: 210, RK18, 865 or 800. This latter tube is not suitable in this particular position unless the doubler is really putting out.

Final amplifiers: 203A, 211, 860, 852, 354 or 800 (either single, parallel or push-pull 800's). 860's can also be used in parallel to advantage with this driver combination.

7MC Band—7MC Crystal

Buffer: 47 oscillator, 865, 210, 841, RK18. Final: Same as in previous combination.

14MC Band

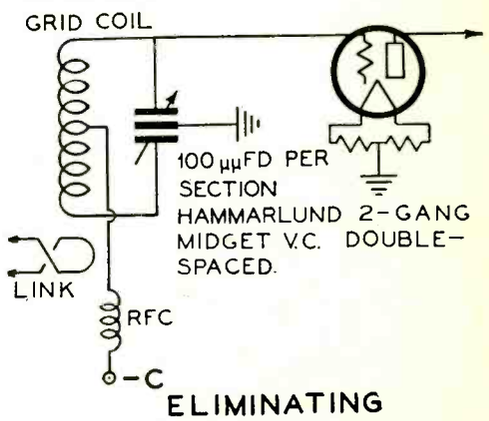
7MC crystal: 47 oscillator, 865, 841, 46, 210 or 46 doubler. Also any of these tubes in push-push.

Buffer: 210, 841, RK18, 865.

Final: 211, 800, RK18, 860 (single or parallel), 852 or 354. For either the 852 or 354 it would be preferable to provide an additional buffer stage for really efficient operation. As a typical example of a transmitter using 354 Gammatrons in the final, W6MV uses an 80 meter crystal, 46 doubler, push-push 210's and 852 into a pair of 354's in push-pull for 20 meter operation. For 40 meter operation the 46 is cut out and the push-push 210's are used as a doubler to 40, which in turn works into the 52 buffer and then into the pair of 354's. All tubes are running stone cold with 1 kw input on either 20 or 40.

Eliminating the Grid-Block Condenser When Link Coupling Is Used

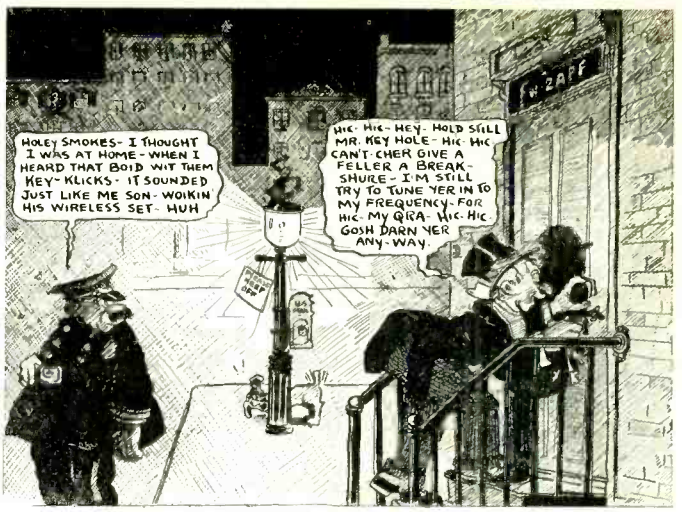
MANY users of link coupling have found that 5,000 volt condensers blow out when used between the lower end of the tuned grid tank and ground, even in low power stages such as a 210. It has been found that by using a split-stator grid tuning condenser with the rotor grounded, and by applying the C bias to the center of the grid coil this trouble can be avoided. The grid blocking condenser is entirely eliminated. Users of single-ended stages may feel that one half of the grid tank is wasted when the lower end of the coil is left hanging. However, we are not interested so much in driving voltage as in driving power, and one of the beauties of link coupling lies in that the proper step-up step-down ratio is automatically obtained to most effectively utilize the output of the preceding amplifier stage. See diagram herewith.



ELIMINATING THE GRID-BLOCKING COND.

Not a Click in a Carload

By T. KURNETT



"Key Clicks" . . . By W8EA

MANY AMATEURS (including the author) have bitterly complained of key clicks. Much has been said and volumes have been printed on how to cure key clicks. Most of the information is good, provided you have something good to try it out on. After many sleepless nights it was decided that the only sure-cure for key clicks in the familiar TNT transmitter is a sledge hammer. It is expecting a bit too much of the newcomer to enable him to eliminate all clicks by proper adjustment and operation of his first transmitter. The writer decided to tackle the problem from another angle—by completely rebuilding the outfit and still retaining as many of the original parts as possible. It was necessary to use inexpensive parts in the construction. The rebuilt outfit was required to give more output. It would not tolerate key clicks. It had to have a stable oscillator.

So it was decided that the rebuilt job would use the Dow Electron-Coupled oscillator because it can be used as a straight E.C. oscillator, a crystal-controlled E.C. oscillator or an ordinary pentode crystal oscillator. It has high enough harmonic output so that all doubling can be done in the plate circuit and the rest of the transmitter used as a straight amplifier. A 59 tube does the job in this stage.

A 46 was selected for the next stage because it is inexpensive and very easy to excite, an advantage of importance when one desires to utilize the fourth harmonic output from the oscillator. The 46 also gives generous output to excite the next stage. Being a typical ham, the writer did what most hams usually do. . . he built the final stage first. In this stage the plate condenser is of the split-stator type because it has twice the break-down voltage, is of great help in making neutralizing an easy job and because it is particularly adaptable for use with the Collins antenna coupling system. Finances prevented the purchase of a new split-stator condenser, so a four-gang BCL variable was found in the junk box . . . the plates were double-spaced and a switching arrangement was added so that the sections could be used either in parallel or in series. The parallel arrangement is quite handy for 80-meter work because the plate tank coil for the 80-meter band would be quite a huge affair if too-low C is used. The condenser was mounted on stand-off insulators.

The tube socket for the final was raised from the baseboard with wooden dowels, 3 inches high and ⅜ inch in diameter. By this means the plate leads are made very short and direct. The grid tuning condenser was mounted in front of the tube socket and the grid coil was placed at right angles to the plate coil so that its hot end came between the grid tuning condenser and the tube socket. The plate tank inductance was made from ¼-inch copper tubing and the grid coil was wound with No. 10 wire on a piece of bakelite tubing. All of the other coils were wound on tube socket bases.

Another BCL condenser was used for the buffer stage and was made into a split-stator affair by removing the center plate of the stator section and insulating both sections from each other. An extension shaft, a wooden dowel, was attached to the condenser shaft to prevent hand-capacity when tuning. The grid condenser for the oscillator was a .00035 mfd. variable. The crystal holder was mounted alongside the 7-prong oscillator tube socket. A DPDT switch was used to change the oscillator from electron coupling to crystal control in the grid circuit of the oscillator stage.

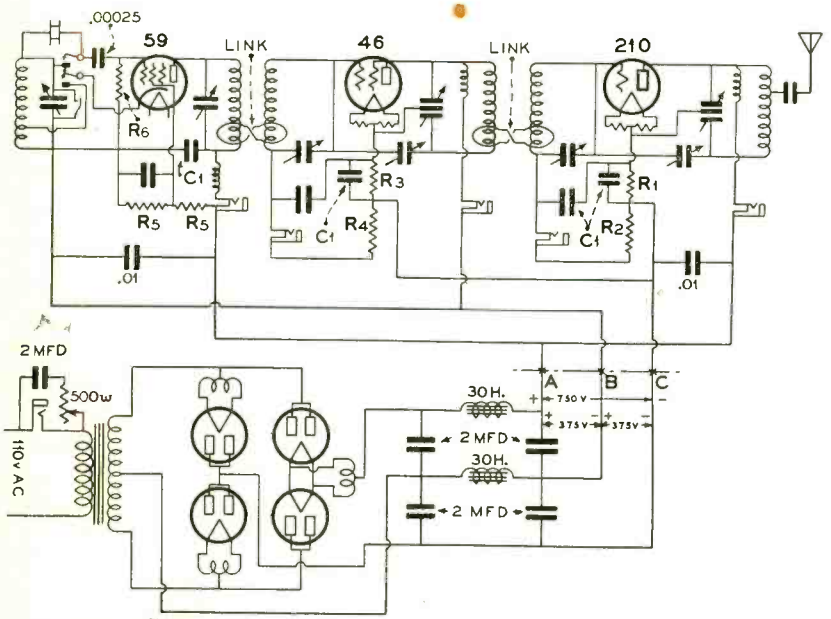
Four rubber legs were attached underneath the baseboard so that most of the wiring would be invisible. A long copper bus wire was run the length of the baseboard and all negative returns connected to this common bus. No. 12 bare copper wire was used for the wiring above the baseboard.

Parallel feed chokes were used for the buffer and final. Any choke would work if the stage is fed through the center tap of the coil, but the writer did not wish to go to the trouble of finding the exact center position of the coil. Using parallel feed through the chokes, each stage neutralized perfectly and the output was greater than when using series-feed.

Closed circuit jacks were installed in all grid and plate circuits except the oscillator grid circuit, so that a milliammeter could be plugged into any part of the circuit for current readings and for tuning to resonance.

Link coupling was used between the various stages and it has proved to give greater output than when capacitive coupling is used.

The entire transmitter operates from a single power supply. Keying is done in the primary circuit. Nearly every known system of key-click prevention was tried but the ultimate in clickless transmitters was secured only when keying was done in the primary of the transformer.



Circuit Diagram of Key-Clickless Transmitter. Note clever dual voltage power supply.

R1— 200 OHM	25WATT	R4— 3000 OHM	5 WATT	C1-.004	
R2-10,000 "	10 "	R5 — 10,000 "	10 "		
R3— 800 "	10 "	R6 — 50,000 "	1 "		

The Power Supply

A 375-VOLT plate transformer was used in the power supply and it gave a maximum of about 400 volts. More voltage was wanted. The bridge rectifier loomed up as the answer. It would give 750 volts . . . ample for the 210 tube in the final stage. So an ingenious rectifier system was used, as shown in the circuit diagram. It delivers 375 volts to the crystal oscillator and 750 volts to the final. Type 80 or 5Z3 tubes are suitable for the rectifier system. It is seen from the diagram that three voltages are supplied by this system . . . 750, 375, 375 volts respectively . . . and all from the same power transformer, one that was originally used in a BCL set using type 45 tubes.

A bridge rectifier system requires three separate filament windings. More expense? No . . . the junk box produced an old Philco

(Continued on page 17)

D-X NEWS—New Schedules, Regulations, Etc.

WELL, it serves us right for trying to present advance scores and data on the tests. Yep, it happened just as we thought—letters have been pouring in all month telling us about all the notable DX records we forget to mention in our last article on the tests.

W6QD says he did work XULA . . . soooo! Incidentally, after planning on taking the week off and devoting his entire time to the tests, Herb got tangled up in an auto wreck and succeeded in breaking his collar bone. The right arm fortunately remained intact for brass pounding.

W3BBB writes and says, among many other interesting things, that he recently worked J2CB, J2GX and J2HI. J2GX was coming through R7-8. BBB says he has never heard anything like this before on any of the bands in the last five years. He mentions that AISA is still very difficult to work.

A W2 takes exception to a statement we made some time ago to the effect that ZS2A was the most consistent ZS station. He mentions that there are a number of Africans that beat ZS2A in his neck of the woods and chides us for making such a broad statement. Maybeso—let's quote from W3BBB's recent letter, "—of course, you know who the consistent African is;—none other than our good friend OM Reid, ZS2A." Anyway it must be great to have the Yanks argue over whether or not ZS2A is the most consistent African station. For our own part, ZS2A and ZS2F lead all comers from the standpoint of consistency. Who's your pet?

W1ZI verifies our statement about ZS2A using a pair of 45's. Says he was the first station hooked in the contest.

Practically all of the DX gang seem to be interested in one thing—and that is antennas. If the gang will write in and give us the dope on their antennas it may be very possible to get enough copy together to write a splendid article on the ideal? antenna for all-around work.

W1CMX writes that he thinks the idea of an Official Bureau for the listing of allowable DX countries is a fine idea. Says that under the present "hit-and-miss system" he can count his countries a multitude of ways. He can even stretch the count to make it 126 countries!! Yessir, something is going to be done about this country business.

Heres a few more tentative contest scores:

ZL4AI-14,000, ZL4AO-13,000, ZS2A-8000, J2GX-8000, W4AJX-23,000, W7BB-11,500, W6QD-19,000, W6CXW-15,000, W6EXQ-10,000, W6FYT-24,000, K4SA-11,000, W1ZI-22,412.

W6CXW was WAC in three hours during the tests. **QSO, EA, FC. W6FYT** worked 38 countries. **W1ZI** worked 52 countries. W1SZ worked 51 countries. **W8CRA** worked three new countries to bring his grand total up to 93!

Quoting from W6WB-ON4AU QSO during tests . . . "ur sigs about QSA3 through the wildest QRM I have ever heard. Real sport, what??" (This from ON4AU).

We're still waiting for your contributions on the effect of the Moon upon DX conditions, particularly the effect as regards a prediction of likelihood of hearing certain continents in advance. **W8CRA** is working on this, as are several others.

Our recent yarn on slant antennas has caused so much comment that we feel there is a great deal more to be added by the gang. Remember, you are not helping the game if you know certain valuable data and don't pass it along. Come clean, now!

New Canadian Regulations

Effective April 1, 1934, the following regulations for Canadian amateurs took effect:

Radiotelephones operate in 1715-2000KC, 3500-3550KC, 3900-4000KC, 14100-14300KC, 28-28.5MC and 56-60MC.

All Canadian stations must be equipped with a reliable frequency meter and their transmitters must be of the MOPA type, the oscillator of which must be of stability comparable to that given by crystal control. Modulation systems for all phones other than those operating in the 28 and 56 MC bands must be operated to insure intelligible speech. The extent of modulation must not exceed 100 per cent and the modulation must be such that the frequency stability of the transmitter will not be disturbed. Portable transmitters may operate only in the 56 MC band.

(Editor:—Some of the above regulations are well suited for application in the United States amateur bands and we look for their incorporation into present U. S. regulations in the "near" future.)

Globe Wireless Inaugurates Press Broadcast

ON MARCH 31, 1934, Globe Wireless, Ltd., inaugurated a press broadcast service for ships at sea. The broadcast consists of about two thousand words of general news including sports and financial. A list of fifty closing New York stock quotations is also transmitted.

This news is supplied to Globe Wireless by the United Press and is especially edited for the traveling public.

The same broadcast is sent daily from three of the eight Globe Wireless Coastal telegraph stations. These three stations are KTK, San Francisco; WPN, New York, and KUH, Manila.

Two broadcasts are transmitted daily from KTK, San Francisco. The first broadcast is at 2230 GMT. transmitting simultaneously on 16740, 12495 and 8680 kilocycles. The second is at 1300 GMT, transmitting simultaneously on 8680 and 6400 kilocycles.

The same broadcast is re-transmitted from WPN, New York, at 0100 GMT on 8690 kilocycles.

KUH, Manila, broadcasts twice daily, the first schedule being at 0800 GMT, transmitting simultaneously on 11110 and 8345 kilocycles and the second being at 1700 GMT, transmitting simultaneously on 8345 and 5555 kilocycles.

By transmitting simultaneously on two or three frequencies, ships can choose the frequency best suited to their location at that time of day.

The number of schedules and the variety of frequencies used makes it possible to copy this press in any part of the world.

Items are numbered so that it is more convenient to obtain fill-ins from a later broadcast.

The press is addressed to all authorized subscribers to this sercise. Permission to copy the press, free of charge, may be obtained by writing to Globe Wireless, Ltd., 311 California St., San Francisco, California.

GLOBE WIRELESS, LTD.

PRESS SCHEDULES

Station	Time (GMT)	Frequencies
KTK, San Francisco	**2230**	**16740, 12495, 8680 kilocycles (17.9, 24.1, 34.5 meters)**
KTK, San Francisco	**1300**	**8680, 6400 kilocycles (34.5, 46.8 meters)**
WPN, New York	**0100**	**8690 kilocycles (45.5 meters)**
KUH, Manila	**0800**	**11110, 8345 kilocycles (27, 35.9 meters)**
KUH, Manila	**1700**	**8345, 5555 kilocycles (35.9, 54 meters)**

The same press is broadcast from each station on each schedule, for a given day.
Items are numbered to facilitate fill-ins.
Transmitters are keyed simultaneously where more than one frequency is shown.

Calls Heard At W1CNU, Stamford, Connecticut

40 METERS

CM1ML, CM2BF, CM2MG, CM2OP, CM2WD, CM5HF, CT1AZ, EA1AZ, EA1BB, EA1BC, EA3AN, EA3DL, EA4AH, EA4BG, EA4BJ, EA5BA, EA5BC, EA5BV, EA7BC, EA8GCC, HP2F, LU7AZ, K5AD, VK5SU, VP5CC, VP5PZ, X1AG, X1AK, X1SC, X2BB (SHIP), ZS2A.

20 METERS

CM2AN (FONE), CM2FA, CM2MA, CM2MG, CM2QY, CM2RZ, CT1BY, EA1AM, EA1AU, EA1AZ, EA1BC, EA5BC, G2BM, G5QA, G6VP, NY1AB, ON4AU, PA0LL, K4KD, K4SA (FONE), K5AA, K5AF, X1G (FONE).

W6 HEARD ON 40 METERS

W6AKX, AYQ, AMD, BIU, BOL, BWO, BXL, CKW, CMG, CUH, CZC, DER, EAR, EEK, EML, EPP, EPP, ERM, FPJ, HJ, HRY, HX, IJV, IQY.

W7 HEARD ON 40 METERS

W7CFY, CHR, DVY, DXZ.

W7's are very few and far between here in the East for some reason.

WAC For W1AF On 14 MC

3 Water Street Court,
Medford, Mass.
April 13, 1934.

"RADIO",
Clayton F. Bane, Editor,
Pacific Building,
San Francisco, Calif.:
Dear Mr. Bane:

After 16 years of consistent, persistent plugging, I worked J2GX Tuesday, April 10th, at 12:20 p.m. E.S.T. on 14 mc. for W.A.C.

W1DNL and W1ZI accompanied me. What a beautiful contact it was. J2GX rolled in here for about an hour QSA 5 R6-8. Then, just about the time my friends arrived home from business by taxi, after my OW frantically phoned them, he started to fade out. W1ZI, who by this time was acting as master of ceremonies with his Frankenstein, had also dropped there from R7 to R4. Gee, it was great while it lasted and our sympathies are strained to the breaking point for those who were too late.

This contact and LY1J the next day nets me a total of 78 countries worked with powers of 160 watts or less. I hope it will be an even 80 by the time this reaches you for I have dates on Sunday with ON4CSL in the Congo, and KA1NA. Pardon the optimism, hi!

Incidentally, eevrything I've got is rather lousey. My amplfier, a 203-A, is inadequately excited by a 46 doubler to 160 watts and the antenna, a half-wave zepp 7 mc. runs over the roofs of two houses not over 30 feet from the ground. It's apparently so rotten that it radiates equally well in all directions. Reports from every direction are about the same. I mention this because in every radio magazine from time to time one reads pages about the directional properties of antennas. I have never yet had an antenna that evidenced any noticeable directional properties. The absence of Asiatic contacts is not a fault of the transmitting apparatus but rather one of receiving. If you don't hear 'em, you cant' work 'em.

What a grand and glorious feeling to know that from now on everything worked is clear gravy. With the "J" and several long way 'round QSO's with VK3KX under my belt I can once more work radio instead of its' working me.

Good luck to you goys and your FB magazine which we enjoy 100% except for your taking Hartford to town now and again.

Sincerely,
(Signed) FRANK GAW, W1AF

Here's what the Tests did to an otherwise - normal fellow . . . W6QD. To cap the climax he broke his collar bone (supposedly in auto accident).

Left: South Bay Amateur Association. Standing (left to right): W6HXU, W6QD, W6CUH, W6DIO. Front row (left to right): W6GRL, W6ACL, W6EGH, W6DLN.

Globe Girdlers

W1ZI—Harris Fahnestock, Jr.

162 Coolidge Hill,
Cambridge. Mass.,
April 12, 1934.

Mr. Clayton F. Bane,
"RADIO",
Pacific Bldg.,
San Francisco, Calif.

Dear OM:

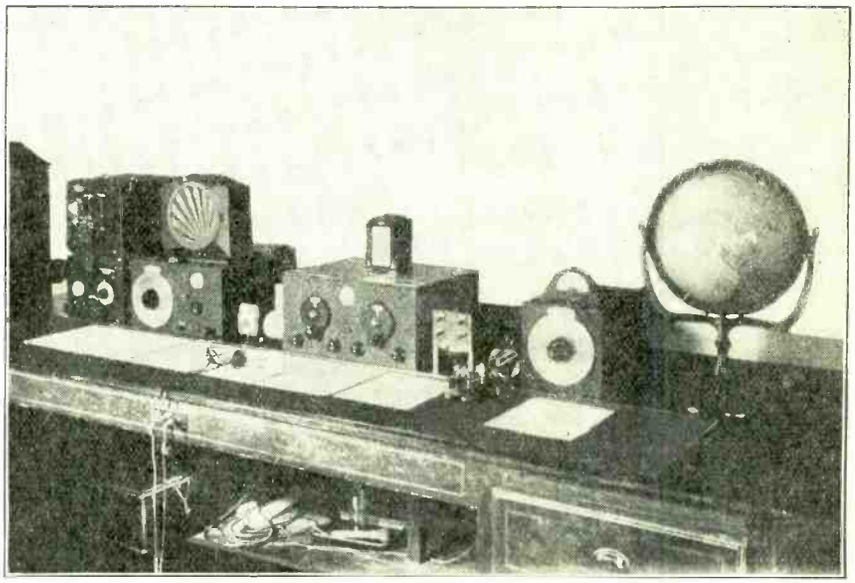
It was kind of you to write me up on the contest but you have doubtless since heard that there were a few others ahead of me. Your own West Coast W6FYT edged me by a few hundred points. I believe, and W1SZ picks up all the marbles though I did snag one more country. It's funny how a few thousand miles change one's point of view—your ten J's just give we the willies! . . . But . . .

Since I last wrote I have at last snagged the long-coveted Asian, J2GX, two days in succession, the best report being R7. The second day I worked him I thought I was all set for a 4-hour WAC but my schedule with KA1NA flopped and it was consequently nine hours. That's not so bad for New England though.

Credit W1AF with J2GX for his WAC also. We were both plenty glad it was somebody we can be sure of getting the pasteboards from.

I like your comments on slanted antennae in April "Radio." It shows a lot of knowledge of how an antenna acts. I am doing my darndest to rent a place for the summer where I can put up a flock of antennae and do some work on the subject. Either the field is too small or the rent is too high or the owners don't like radio. What a battle!

Sincerely yours,
(Signed) Harris Fahnestock, Jr.,
Radio W1ZI



Receiving Equipment at W1ZI . . . and What a Layout!

Here's the Dope On W1ZI

Countries worked: CM, CT1, CT2, CT3, CX, D, EA, EA8, E1, F, F3MTA, FF8SUD (French West Africa), FM8, G, G1, HAF, HB, HC, HH, HP, I, K4, K6. KA, LA, LU, LY, NY, OA, OE, OH. OK. ON, ON4CSL (Congo), PA, PY, SP, SU, TI, VK, VO, VP2 (Antigua), VP4 (Brit. Hond.), VP4 (Trinidad), VP5, VP6, VQ4, X, YM, YP, ZL, ZS/ZT/ZU.

Above includes 8 D's, 8 EA's, 12 F's, 16 G's, 9 PA's, 14 VK's, 8 ZL's.

Also worked but did not exchange number, EZ (Saar).

Heard but did not work, HI, CN.

Called by East USA but not heard, VP7, VP9, OZ, ZE1.

Present Station and Recent Results

Transmitter: 3.5 mc crystals, 47 oscillator with 3.5 mc tank in screen and 7 mc tank in plate fed by an 83 at 250 volts. Oscillator input kept down to about 5 watts for stability.

Doubler or amplifier, 46, feeding another 46 amplifier both run off a pair of 81's, keying being done in the plate of the second 46. Plate voltage 600.

Exciter amplifier 852 on 4800 volts.

Final amplifier pair of 852's on 4800 volts. Efficiency as judged by plate radiation close to 90 per cent.

Link coupling between last three stages.

HV power supply bridge of 866A's, 25/125 H. choke, 1 mike.

Frequency measurement: 100 kc. crystal at 50 deg. + 0.1 deg. C., 100 to 105 kc. electron coupled oscillator, RF amprifier detector and AF amplifier.

Receiver: Hendricks and Harvey SS superhet.

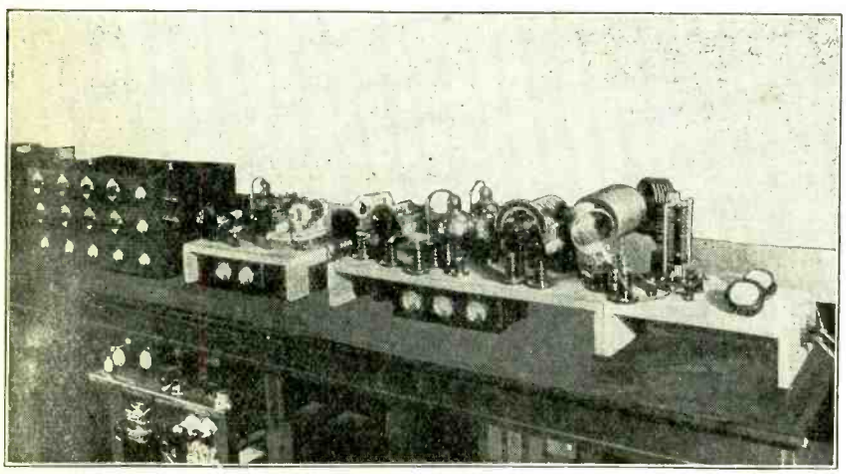
Monitor: Triode oscillator covering 3.5 mc band.

Antennae: 66 ft. zepp, average height 45 ft., 40 ft. feeders spaced 2½ in. 66 ft. doublet for receiving on 7 mc, lamp cord line. 33 ft. doublet for receiving on 14 mc, lamp cord line.

Since 1930 in this location I have worked 7- countries in all continents (Asia not yet confirmed but perfectly authentic). Among unusual or difficult countries are: Chile, French West Africa, Tunis, Philippines (both ways around), Lithuania, Austria, Belgian Congo, Egypt, Sierre Leone, Kenya, Chathem Islands, Paraguay, Japan.

Second in section in 1933 DX contest.

Only first district station to work KA both ways around. I work KA1NA the long way on 7 mc on about 50 per cent of schedules since December.

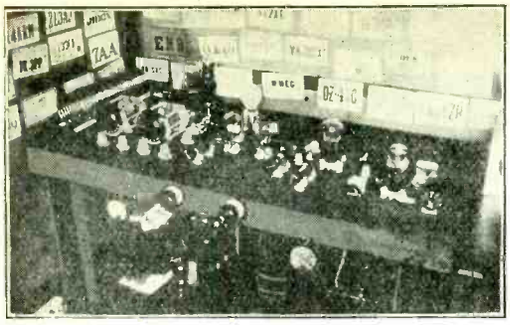


Here's What This Rig Did During the Tests

139 contacts, 3 pts. each	=417 points	Total number of points	431
11 contacts, 14 points	= 14	Countries worked	52
3 contacts, no points	= 0	Claimed score	22,412
153	431		

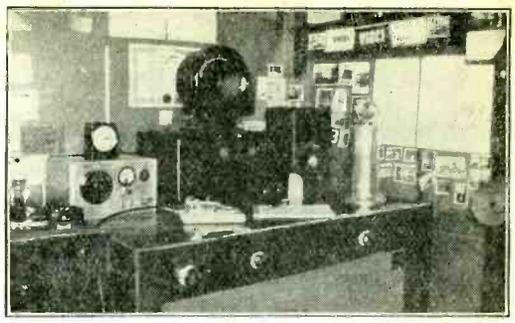
XU1A and The Tests

Lester E. Fry, W6CLP, has this to say about the tests: "J2GX had a score of 8000. The most consistent stations heard at my location were F8EB, PA0LL and F8PZ. F8PZ was the loudest European heard. F8EB was R4 to R5 and PA0LL was R6 to R7, so was F8PZ. African ZT5R was most consistent and loudest from that Continent, but ZS2A was heard both morning and evening. You can well imagine how it pleased me to work LU3FA . . . the first contact I made during the tests. It was also his first contest QSO. My score was not so large because most work was done on 7 MC. Power leaks on 14 MC were very bad. I ran up a total of 6600 points.



300 Watt Grid-Modulated Phone at W6BCX

"Woody" Smith



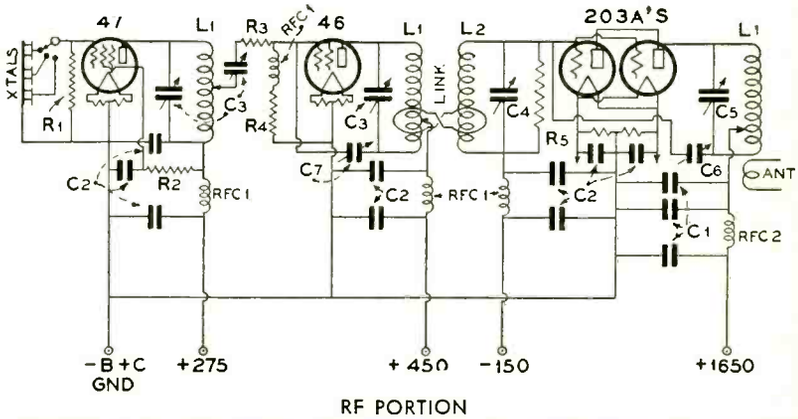
W6BCX's Receiver. It is a Silver 5-B

—RADIOTELEPHONY—

W6BCX's New Grid-Modulated Phone Station—By "Linear"

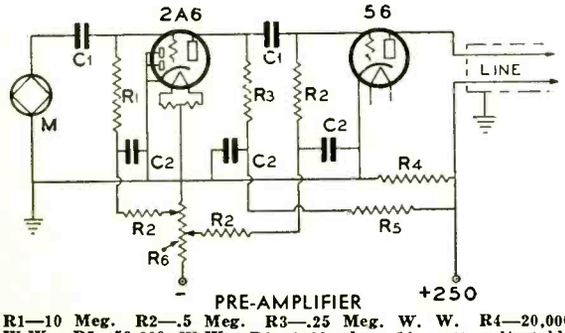
W. W. (Woody) Smith of Santa Maria, California, has one of the best-sounding phones on the air. I was listening to him a few weeks ago . . . heard him tell other amateurs that he is getting R9 reports from the East. Instead of showing one of my "Junkbox Specials" this month, I asked him to send the details, the complete circuits and all the constants. Here they are. Other amateurs who are using grid-modulated phones are kindly asked to send photos and circuit diagrams for publication in these columns. Come on, fellows. let's show 'em that we can make these grid-modulated phones do their stuff.—LINEAR.

THE transmitter uses two 203A's in the final, grid modulated for phone. By careful physical arrangement of parts and wiring, there is no tendency toward parasitics in the final stage, even though the tubes are in parallel. Two milliameters read current for entire set. One is wired permanently in plate circuit of the final, the other may be plugged in any one of three circuit-closing jacks, one of which is located in the plate circuit to the oscillator, one in the plate circuit of the buffer, and one in the grid circuit to the final. For grid-modulated phone, the excitation is adjusted to give 8 mils of rectified grid current for the two tubes. For CW, the "swamping resistor, R5, which is nothing but a common Mazda lamp, is opened to increase the excitation to the final for better efficiency and increased output. Telephone jacks are connected to a telegraph key and to the output of the modulator. Either the milliameter, the modulator, or the key may be plugged into the circuit-closing jack in the grid circuit of the final. Keying in the grid has been found to be very satisfactory with the 203A's, and in this particular set-up requires no click filter. With 500 watts input, a BCL receiver can be played in the same room, with no sign of clicks. So CW is used until about 11 p.m., when all the "Jalopie" superhets go to bed. On CW the input runs from 100 to 500 watts at 1200 volts, depending upon how much the neighbors kick about their blinking lights. With the link coupling it is possible to get over 300 watts output from the final, even though the driver is only a 46, without exceeding the dissipation rating of the 203A's. On phone the input is usually 1650 volts at 250 mils. The plate mils kick up less than 10 per cent when the final is being 100 per cent modulated, instead of 50 per cent, showing that in this case, at least, the final is operating as a variable efficiency amplifier. The tubes, therefore, actually run cooler under modulation than when "resting". In answer to those who say the system is not acting according to Hoyle, let it be said that the output has been found to be practically linear with respect to grid bias voltage, and there seems to be no carrier shift under full 100 per cent modulation. The 245's in the modulator are run class A Prime, but the grids are not driven positive, as it has been found possible to get over 10 watts of audio from them without doing so. For this reason no driver stage or special transformer is used to push the 45's. The 10 to 14 watts obtainable without drawing grid current on the 45's has been found sufficient to kick the grids of the 203's with very little distortion. The stepdown ratio and "regulation-improving" resistor minimize the effect of the variable load offered by the grids of the 203A's under modulation. All speech equipment and associated power supplies are both magnetically and electrostatically shielded, except the preamplifier, which has no transformers or chokes in it and therefore needs no magnetic shielding. The preamplifier is contained in the aluminum can upon which is mounted the Brush crystal microphone. An antenna-counterpoise antenna system of unorthodox design is being used temporarily until some way is figured out to put up a regular antenna in the restricted space available, without sacrificing efficiency. In the short time the station has been on phone several R9 reports have been received from the East Coast and Hawaii, and the signals have been reported in New Jersey R7 in the afternoon while still daylight there (3:30 p.m. Pacific time). All work is done on 75 meter phone and 80 meter CW.



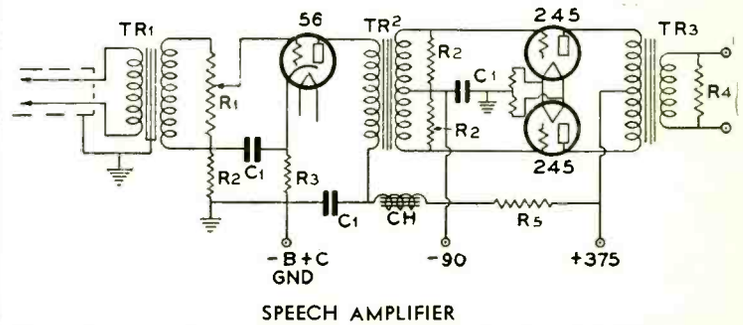
RF PORTION

C1—.005, 5000 V. C2—.004, 1000 V. C3—.0001 Midget. C4—.00035 Midget. C5—.0001, 3500 V. C6—.00005, 6000 V. C7—.00005 Midget. RFC1—Hammarlund CH-8. RFC2—National R-152. R1—15,000 ohms. R2—40,000 ohms. R3—300 ohms. R4—3000 ohms. R5—220 volt, 50 watt lamp. L1—Low "C" 3900 KC Tank Coil, L2—High "C" 3900 KC Tank Coil. X1, X2, X3, Crystals.



PRE-AMPLIFIER

R1—10 Meg. R2—.5 Meg. R3—.25 Meg. W. W. R4—20,000 W.W. R5—50,000 W.W. R6—1000 ohm, 10 watt, adjustable Electrad. C1—.01 Mica. C2—.5 paper. M—Brush Crystal Mike. (Note: W.W. indicates "Wire Wound Resistor.)



SPEECH AMPLIFIER

R1—500,000 ohms. R2—250,000 ohms. R3—3,000 ohms W.W. R4—1,200 ohms W.W. R5—30,000 ohms W.W. CH—50 henry, 15 MA. TR1—Plate to Grid Transf. TR2—P.P. Input Transf. TR3—Modulation Transf. 3-1 stepdown.

The Big, Bad Wolf Bites the BCL

By DON PABLO

★ ★ ★ ★

Unusual interest was aroused by the publication in April "RADIO" of a report that the city of Burlingame had drafted an ordinance to curb amateur radio-telephone activities because of interference with BCLs. Many readers have requested printed copies of the proposed ordinance. The Radio Inspectors of the Federal Radio Commission made a thorough investigation of the case—came to the defense of the amateur and succeeded in having the proposed ordinance killed because it was legally invalid. A complete and authoritative report of the case is here given:

★ ★ ★ ★

WHO'S afraid of the Big Bad Wolf? "I'm not," said the BCL, who proceeded to get the R. I. out with his gun-iometer, and so forth. To introduce the character, the Big Bad Wolf is Mr. Clarence Wolf of Howard Ave., Burlingame, California. Mr. Wolf is a wholesome young amateur; the R. I. is the Radio Inspector of the Federal Radio Commission. The balance of the characters are BCL's (bad and good), City Attorneys and Mayor of the City of Burlingame.

About a year ago, Wolf became interested in radio. While a new-comer in the field, long experience with sound pictures gave Mr. Wolf a very good start in radio. Naturally enough, his interest was chiefly in phone, and it was not long before a very fine low level job, with two 212Ds in push-pull for final, blossomed on the air in Burlingame. Not having had a year's experience in amateur radio, Mr. Wolf was forced to choose the 160-meter phone band for his work. And then the fun began.

One after another, BCLs heard mysterious voices in their sets. From QRA given frequently by Wolf they found out who the culprit was. Some of the broadminded ones spoke to Mr. Wolf, found him co-operative, and in short order found themselves equipped with a simple LC circuit to trap-out the signals from the phone station they didn't want to hear. Others, perhaps, suffered in silence. And then there were those, who, although they listened to plenty of broadcasting, hadn't had it affect their minds enough to make them broadminded. They spoke to the Big Bad Wolf and told him in no uncertain terms that he was going to quit that infernal racket or they'd know the reason why.

Well, the smoke that arose filtered into the doors of the Inspector of the Federal Radio Commission and Mr. Wolf was restricted in operation and his station was heard no more between the old familiar hours between 8 and 10:30 in the evening. But still some people weren't satisfied. One knew a friend of a friend who knew the unicle of the wife of a Federal Radio Commissioner, so he wrote to him and the Commission heard of Burlingame for the first time. As usual, the matter was referred directly to the San Francisco field office of the Commission.

The local FRC office had beat them to it, however, as deputies had already made an investigation of the case a few days before. They had inspected the ham phone station and found everything to their liking, no over-modulation, no harmonics, proper coupling, etc., and had toured the district and visited the various complainants.

Now, those of you who are old-timers may remember the former attitude of the old regime, when the Department of Commerce was the head of radio administration in this country. In those days any ham who interferred was expected to purchase all of the wave traps to be placed in BCLs lead-in wires, and the ham was expected to install them and make them work. But the old order changeth, and now, according to form letters from the Federal Radio Commission, the BCL must pay for any traps to cut out amateurs. While the amateur is asked to help by making tests co-operative with the BCL, no amateur is expected to make a cash outlay. Well, sir, as the story goes, some of the BCLs told the RIs on that job that they could make all the tests they wanted but that they would never consent to having any apparatus of any kind put on their radio even if it only cost 50 cents. On hearing such remarks the Inspectors can just quit early and go home.

The minority of cases were arbitrary and practically every case investigated is said to have responded to the usual formula of wave trap, either series or shunt, in either ground, aerial or power supply wires.

But the fly in the ointment was that someone knew the Mayor of the city. A petition was made to have something done about the Big Bad Wolf. And imagine, the Bad Wolf already had his tail on the ground with restricted hours of operation. And the secret is, the Big Bad Wolf wasn't a wolf at all, but a sheep in wolf's clothing, or something like that. To explain, he wasn't a bad fellow at all; rather a nice chap, if you know what I mean. He was reasonable. The Inspector in Charge up at San Francisco suggested to him to remain off the air entirely until all the smoke blew away and also until Mr. Wolf had passed an examination for Radiotelephone Second Class License. This latter idea would make it possible for Wolf to gain Class A License even before having been an amateur one year, and thus go on 80-meter phone for the express benefit of the BCLs. Mr. Wolf did pass the exam and secured his Radiophone Second Class License.

Now I might digress enough to mention that Wolf needn't have quit operating, he could have gone right on scaring all the BCLs with his BIG BAD Wolf suit. Legally, he had a federal license to operate, and that license is good until revoked by the commission. The only necessity was for him to remain quiet during restricted hours. But, he stayed off the air entirely except for tests made in the wee sma' hours of the morning.

Coming back again to the mayor's office, this gentleman called his city attorney and orders were given to do something. So action started and a new city ordinance was drafted. And, generally speaking, here is how it went: "It shall be unlawful for any person, firm, corporation, etc. ad infinitum . . . to operate, cause to be operated any broadcasting or radio station during the hours between 5 a.m. and 11 p.m. . . ." The fine was something like $50 and a jail sentence was stipulated. The ordinance came up for a hearing before the city council of Burlingame and all interested parties were asked to be present.

Among those present were sundry BCLs, the Big Bad Wolf and others. "Others interested" happened to include our well known inspector in charge of the Twelfth Radio District. The meeting progressed, the ordinance was read and objections to the ordinance were asked for. And there was an objection. The proposed ordinance if passed would have been legally invalid.

This had not been the first attempt of a municipality to pass an ordinance usurping the powers relegated to the Federal government. Out came the records and the following court decision in the case of Whitehurst vs. Grimes (21F. (2d) 787) was read.

"*Radio communications are all interstate. This is so, though they may be intended only for intrastate transmission; and interstate transmission may be seriously affected by communications intended only for intrastate transmission. Such communications admit of and require a uniform system of regulation and control throughout the United States, and Congress has covered the field by appropriate legislation.*"

Another very important decision also was read from the case of the State Freight Tax (15 Wall 232, 21 L. ed. 146) and here quoted.

"*. . . the rule has been asserted with great clearness, that whenever the subjects over which a power to regulate commerce is asserted are in their nature national, or admit of one uniform system or plan of regulation, they may be said to be of such a nature as to require exclusive legislation by Congress. (A number of cases cited).*"

From a legal standpoint other cases were cited at that meeting. So, what happened? Another notch in the amateur's gun; the ordinance was changed entirely to cover interference by apparatus such as motors, X-rays, violet ray machines and a clause was added that the ordinance should not be construed in any way to conflict with any Federal laws on the subject, and the radio amateur was left out of the deal entirely.

Not a Click in a Carload

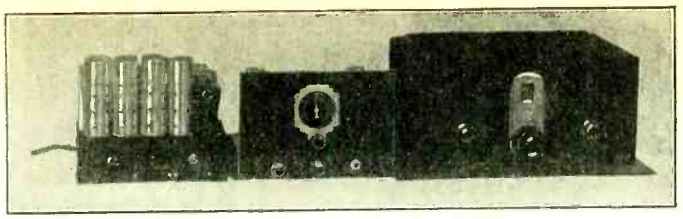
(Continued from page 13)

B eliminator. Three 5-volt windings were wound on the core of the eliminator transformer, after the original windings had first been removed. Center-tap resistances were used across these windings because this was a simpler method than that of bringing out center-tap leads from the transformer windings.

A separate transformer was used for the 2½ volt and the 7½ volt requirements for the tubes in the transmitter proper.

The circuit diagram also shows the inexpensive filter system used. T-9 crystal pure DC reports are received, so the filter must be OK. This power unit and filter system lends itself admirably to primary keying. However, as an extra precaution, a capacity resistance filter was connected across the key terminals. This filter consists of a 2 mfd. condenser and a 500 ohm variable resistor. No clicks can be heard, even in the BCL sets used in the same room where the transmitter is located.

If the crystal or Dow Oscillator is sluggish in starting when primary keying is used, this can be corrected by putting a 10 to 25 watt lamp across the key. This does not give the bad spacing wave which usually accompanies primary keying. In most cases the oscillator runs full blast and only the final stage is being keyed. In the arrangement used by the writer, all stages are being keyed. The lamp across the key keeps the oscillator barely oscillating and the signal from the oscillator is barely audible to amateurs who live a block from my location. In many cases the lamp across the key need not be used at all.



Converting the S-W-5 Into a Super-Heterodyne With the New McMurdo Silver I. F. Unit

By CLINTON OSBORNE

THE NATIONAL SW-5 receiver can be easily converted into a modern superheterodyne by the addition of the new McMurdo Silver IF Amplifier unit. When so converted the builder will be relieved of a great deal of extra work because the Silver unit can be easily and quickly connected to the SW-5. A separate control for the oscillator will be required. The SW-5 receiver remains in appearance very much the same as originally, the controls being unchanged; the same cabinet, mounting and power supply are all retained, because they are entirely suitable for the purpose.

The Silver IF unit has a powerful output tube, a 2A5 pentode, led directly through an output condenser to an output jack, which can be used to operate a loudspeaker or a pair of phones. The 2A5 has plenty of power to operate any of the usual types of loudspeakers with satisfactory valume level, for practically any location. The circuit as shown includes simply the output jack. The loudspeaker unit used will generally have a proper transformer to match the speaker coil impedance, in the case of a dynamic unit, or a magnetic (high inductance) speaker can be opertaed driectly from the jack, without the need of an output transformer. No use is made of the audio system originally provided in the SW-5, and to save current the tubes are removed from the audio amplifier.

In the SW-5 the radio frequency stage operates exactly as it did before, and is a satisfactory arrangement. It provides enough selectivity to eliminate a good proportion of the image interference which would otherwise be objectionable. The radio frequency stage is, of course, ganged with the detector stage, and this provides a simple single control for these two separate circuits. It would have been rather difficult to have ganged the oscillator circuit into the RF-detector arrangement, without involved mechanical construction and without adding possible electrical complications. With the addition of a separate oscillator and a separate control, the problem is solved by simply adding the oscillator in a shielding can, or mounting, without running into difficulties.

The tuned-radio-frequency stage is left exactly the same as it was originally, except thta a 58 tube is installed, as shown. The detector (now the mixer, or first detector) is changed sligh ly. The grid leak and condenser are removed because this type of detection is not desirable in the new arrangement. The tickler is placed in the cathode lead, as shown; the same winding serves here as it formerly did in the plate circuit of the original set-up. The lead of this winding nearest the ground side of the grid coil connects to the cathode, the efiect being a continuous winding (one lead being grounded) and the other connected to the cathode. The detector, being of the "power" type in the new circuit, is fitted with a variable bias resistor. This resistor (R1) helps very materially in decreasing noise and at the same time it increases signal strength.

The 57 oscillator needs but little comment, except that it should be mounted in a shielding can, and a single lead is run from the plate of the 57 oscillator to the shield of the mixer tube with the .0001 mfd. coupling condenser (C4) providing the necessary feed between the oscillator and shield. Both the screen and plate are shunt fed through small RF chokes. These should be of the best grade, otherwise objectionable feedbacks may result. Hammarlund, National, or similar high-grade chokes should be used in this location. The Dow oscillator circuit is electron coupled and it is admirably well suited for the work. Band spreading is provided in the oscillator by the usual series band-spread arrangement.

The McMurdo Silver IF unit has two type 58 tubes as IF amplifiers, a 57 as the beat-frequency oscillator for heterodyne reception (with a switch to cut it off for receiving modulated signals), a 56 second detector, and a 2A5 power output pentode. The unit provides plenty of gain, in fact it gives almost more gain than is needed in the usual location, and the resultant receiver is very sensitive indeed. The IF amplifier is designed to peak at 465 KC, which has been found to be very efficient for this class of work.

The McMurdo Silver IF unit can be purchased ready wired, or the builder can buy it unwired. In either case, it is complete and ready to go, with the addition of a dropping resistor (R3) for the screen voltages, and proper output connections which are simply an audio frequency choke and two condensers. The audio frequency choke should have enough current-carrying capacity so that it will handle the normal plate current of the 2A5 tube, which is about 35 to 40 ma. Two output condensers are indicated (C10 and C-11). These effectively insulate the output circuit from the high voltage plate supply. This is particularly necessary when using head receiveds; if a loud speaker is used, with a proper output transformer, C11 may be omitted, or, if the transformer will carry the load, it may be used in place of the audio frequency choke and the two condensers omitted entirely.

The McMurdo Silver IF unit is provided with a beat frequency oscillator for heterodyne reception. It can be turned on or off at will. There is also a gain control provided with the unit, so that the gain and resultant output level can be easily controlled. The adjustments for the intermediate stages, the beat oscillator, and second detector are all accessible from the bottom of the IF chassis, and tune very sharply. A satisfactory aligning job can be done by setting to a given signal and tuning for maximum, although obviously an oscillator and an output meter will give more accurate and satisfactory results.

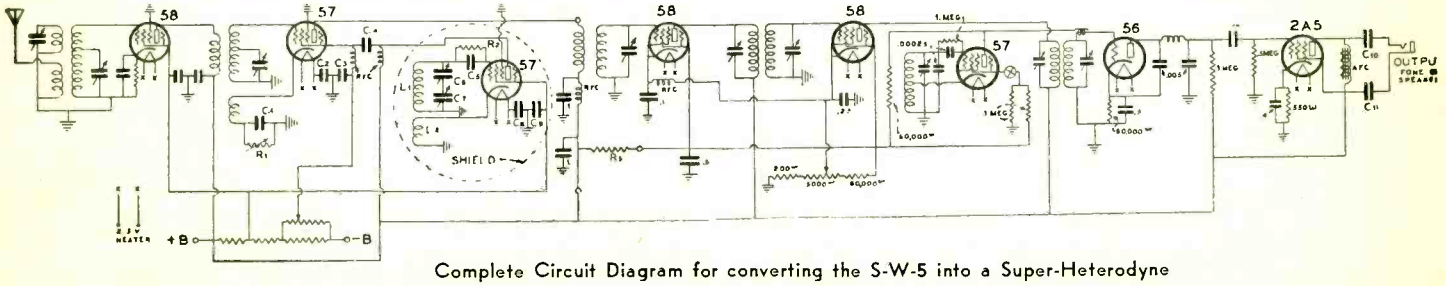
The use of regeneration in the first detector of a superheterodyne may be considered unusual, but it is believed that it will be found well worth-while and entirely satisfactory. A very slight increase in the noise level may result. The control is quite positive and gives very good performance.

All in all, anyone who desires to rebuild the SW-5 into a super will be well repaid for his time and money.

List of Parts, SW-5 Circuit Shown Below

R1—2000 ohms variable resistor.
R2—50,000 ohms fixed resistor.
R3—25,000 ohms fixed resistor.
C1, C2, C3, C8, C9—.01 mfd. fixed condensers.
C4—.0001 mfd. fixed condensers (mica)
C5—.00025 mfd. fixed condenser (mica).
C6, C7—100 mmf. midget condensers.
C10, C11—1.0 mfd. fixed condenser (300 volt).

This data also applies for the SW-45 receiver of the National Co. The only difference is that the SW-45 uses a pair of 45 tubes in push-pull in the power output stage instead of the 227s used in the SW-5.



Complete Circuit Diagram for converting the S-W-5 into a Super-Heterodyne

The Decibel

What It Means . . . . and How to Use It

By D. B. McGOWN, Technical Editor

THE decibel unit originated as a purely electrical measurement in telephony and has become very useful in other classes of work, such as in radio systems, amplifier measurement, measurements of loudness intensity in acoustical testing, sound measurements and even to indicate to the physician the patient's ability to hear certain sounds whereby the degree of deafness may be accurately determined.

The apparent complexity of the decibel may be attributed to the fact that it is not a simple linear function like the volt, ampere, gallon, yard, pound or ton; it is a logarithmic unit. Such a unit is one which depends for its value on the EXPONENT of a number; if for example, we take the number 10, which is the base of the common system of logarithms, and multiply it by itself, the result will be 100. This may also be written 10^2 (or 10 raised to the second power). It is still further correct and customary to say that 10, logarithm 2 (usually written 10 log 2, for brevity) is 100. Or, in other words, the number 10 raised to the second power is 100, no matter how it is written. Likewise, 10 raised to the third power, or 10 log 3, is 1000, and 10 log 4 would be 10,000, and so on; as the logarithm is increased the number increases according to the power or exponent indicated. This may also be thought of as the base number 10 "multiplied by itself so and so many times", which is another way of saying the same thing. A little thought will show that if 10 raised to the 2nd power is 100, therefore ten raised to some power between 1 and 2 must be some number between 10 and 100, or if it is raised to some power between 2 and 3 the resulting number must be somewhere between 100 and 1000. Thus, if ten is multiplied by itself 1.3010 times the result will be 20, or "the log of 20 is 1.3010." Likewise, the log of 30 is 1.4471, and the decimal constantly increases until we get to 99, when the log is 1.9956 and the log of 100 is 2, as stated. If the condition is still further investigated we will find that the decimal fractions repeat themselves constantly, in sequence, but each time with a great numerical (10 times) increase in the value of the indicated number, i.e., if the log of 20 is 1.3010, the log of 200 is 2.3010, of 2000, 3.3010, 20,000, 4.3010, etc.

The actual numerical values of logarithms of commonly used numbers are shown in the accompanying table (Fig. 1) where the numbers from 1 to 10 are given with their logarithms; the numbers from 10 to 100, with intervals of 5, and from 100 to 1000, at intervals of 10. This table of logarithms is quite brief and is carried out to but 4 places of decimals. More complete tables are usually available, carried out to 5 or 6 places, which are complete to the tenth of a unit from 10 to 1000. These small differences, however, are unimportant in working with decibels, and hence the table presented will serve adequately. All these numbers represent (so to speak) the number of times 10 must be multiplied by itself (the logarithm) to give the number desired. Thus it will be seen that this series of decimal fractions increases numerically much more in the beginning of the series than toward the end, a characteristic of logarithmic progressions, and a fact which will be quite evident because these numbers all represent a "square" function, where the base 10 is indicated as multiplied by itself the indicated number of times, instead of simple addition or subtraction such as we are familiar with. It is beyond the scope of this article to explain just how these numbers are obtained and it is also obviously difficult, arithmetically, to actually perform the indicated multiplication which is not, however, generally necessary. For a more complete explanation of logarithms reference to any text on the subject will explain the matter more fully.

Law of Psycho-Physics

THE response of the human ear to sound is not a simple and direct proportion but a logarithmic one, and the effect which the brain receives, transmitted to it from the ear as sound, is approximately proportional to the logarithm of the intensity of the stimulus. This is called the "Weber-Fechner Law of Psycho-Physics" and is of extreme importance because it indicates a different type of sensitivity response than that which we should otherwise expect from our general experience. On this basis, a sound which is just audible may be taken as a sound of unit intensity, or the "threshold of audibility" as it is called in acoustical work. If this sound is increased until it is very loud it will seem to be 60 times as loud as the first sound. This figure has been determined experimentally within quite a definitely stated range. Such a sound might be a shout, the firing of a pistol, or other similar sound. If the energy required to produce the sound 60 times as loud as the original is measured, it will be found that the loud sound instead of requiring 60 times the energy of the smaller for its production will require about one million times the energy.. This seems almost unbelievable, but nevertheless it is a fact. The limit of one million times audibility is taken as a standard of loudness for reference; sounds actually exist which require energy greatly in excess of the one-million-times-ratio, but they are unusual. Riveting machines, loud automobile horns or sirens, locomotive or steamboat whistles, etc., and which are of such high energy content that they can be felt, as well as heard are included in this classification. This condition is called the "threshold of feeling" and is only experienced under unusual conditions. The sound of 1,000,000 times intensity is very loud. Suppose this sound is reduced to but half as loud. In this case it would require but 1000 times the power of the just-audible sound, and intermediate sound levels would require intermediate power requirements. This sound energy content is in fact a logarithmic ratio, and is a very important condition. This logarithmic variation of intensity of sound power as compared with the apparent response of the ear seems confusing. but once it is clearly in mind it will be seen that the ear is enormously more sensitive to weak sounds than to loud ones. As sound varies inversely in intensity with the square of the distance from the source, it is evident that if this condition were not the case we would be unable to hear any sounds except those nearby, which might be dangerous as well as highly inconvenient.

A somewhat similar condition exists with regard to the frequency of sound, or the sensation of "pitch", as it is called in music, except that the base of the logarithm is 2 instead of 10. There is the same interval of pitch (or frequency) between 32 and 64 cycles or double vibrations per second that there is between 2048 and 4096. In either case the listener would say that the higher frequency was "twice as high" as the lower one, or one octave higher, as it would be expressed in music. This logarithmic quality of pitch is the reason why it is usual to draw fidelity curves of a piece of equipment on "semi-log" paper, where the vertical scale is uniformly spaced (although marked in decibels), while a curve of from 32 to 10,000 cycles would require three complete "cycles" of ten units each, but the horizontal units instead of be-

FIGURE 1

TABLE OF LOGARITHMS FROM 1 TO 1000

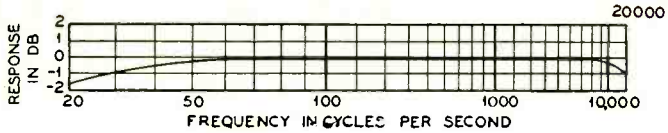
(Base 10)

No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
1	0.0000	15	1.1760	60	1.7781	100	2.00	200	2.3010	300	2.4771	400	2.6020	500	2.6989	600	2.7781	700	2.8450	800	2.9030	900	2.9542
2	0.3010	20	1.3010	65	1.8129	110	2.0413	210	2.3222	310	2.4913	410	2.6127	510	2.7075	610	2.7853	710	2.8512	810	2.9084	910	2.9590
3	0.4771	25	1.3979	70	1.8450	120	2.0791	220	2.3424	320	2.5051	420	2.6232	520	2.7160	620	2.7923	720	2.8573	820	2.9138	920	2.9637
4	0.6020	30	1.4771	75	1.8750	130	2.1139	230	2.3617	330	2.5185	430	2.6334	530	2.7242	630	2.7993	730	2.8633	830	2.9190	930	2.9684
5	0.6989	35	1.5440	80	1.9030	140	2.1461	240	2.3802	340	2.5314	440	2.6434	540	2.7323	640	2.8061	740	2.8692	840	2.9242	940	2.9731
6	0.7781	40	1.6026	85	1.9294	150	2.1760	250	2.3979	350	2.5440	450	2.6532	550	2.7403	650	2.8129	750	2.8750	850	2.9294	950	2.9777
7	0.8450	45	1.6532	90	1.9542	160	2.2041	260	2.4149	360	2.5563	460	2.6627	560	2.7481	660	2.8195	760	2.8808	860	2.9344	960	2.9822
8	0.9030	50	1.6989	95	1.9777	170	2.2304	270	2.4313	370	2.5682	470	2.6720	570	2.7558	670	2.8260	770	2.8864	870	2.9395	970	2.9867
9	0.9542	55	1.7403	100	2.000	180	2.2552	280	2.4471	380	2.5797	480	2.6812	580	2.7634	680	2.8325	780	2.8920	880	2.9444	980	2.9912
10	1.000					190	2.2787	290	2.4623	390	2.5910	490	2.6901	590	2.7708	690	2.8388	790	2.8976	890	2.9493	990	2.9956

ing uniform increase every 10 units. Thus the first 10 units from zero to 100 would be calibrated in units of 10, the second in units of 100, and the third group of 10 in units of 1,000.

FIG. 2

The response curve of United Transformer.



The decibel unit of measurement is used almost universally today to indicate sound loudness, and as we are dealing with speech circuits of various kinds it is used entirely interchangeable with electrical currents which may have been set up by a sound, or which may be used to produce a sound. The decibel was formerly known as the "transmission unit" and by international agreement it has been called by the name given. The decibel is a tenth of a bel, named in honor of Dr. Alexander Graham Bell, the inventor of the telephone. The decibel is a decimal fraction of the bel, and is defined as follows: "Two powers are said to differ by 1 bel or 10 decibels when the larger power is 10 times greater than the other". Another similar but more complete definition is: "In any electrical speech circuit the gain or less expressed in decibels between any two points of the circuit is ten times the common logarithm of the ratio of the power at one point to the power at the other point."

THE decibel may be expressed in a generalized form by the equation:

$$Ndb = 10 \log_{10} \frac{P1}{P2} \qquad (1)$$

A single decibel in practical operation is a difference in loudness when there is just enough change in the power involved so that a TRAINED ear can just distinguish the loss or gain involved in the change.

As an example, suppose an amplifier delivers 1000 milliawatts of sound of fixed and unvarying intensity. How much more power must be added to permit the ear to just notice the difference? By referring to a table of logarithms, or decibels, we find that 1db corresponds to a power ratio of 1.25, and thus substituting in the formula,

$$DB = 1.0 \left(\text{where } \frac{P1}{P2} = 1.25 \right)$$

$$\text{or } \frac{P1}{1000} = 1.25$$

or P1 = 1.25 watts, output power.

If it is desired to use ratios of current or voltage instead of power, it is only necessary to convert these voltages and resistances to powers, get the ratio and convert to d.b., or to use the following formula where voltage ratios are involved:

$$P_1 = \frac{E_1^2}{R_1}$$

$$P_2 = \frac{E_2^2}{R_2}$$

From equation No. 1.

$$Ndb = 10 \log_{10} \frac{\frac{E_1^2}{R_1}}{\frac{E_2^2}{R_2}} \qquad (2)$$

$$\text{or } Ndb = 20 \log_{10} \frac{E_1}{\frac{\sqrt{R_1}}{E_2 \sqrt{R_2}}}$$

or where current ratios are involved.

$$Ndb = 20 \log_{10} \frac{(I_1)^2 R_1}{(I_2)^2 R_2} = 20 \log_{10} \frac{I_1 \sqrt{R_1}}{I_2 \sqrt{R_2}}$$

in which the factor 20 appears because of the voltages in the equation are squared. When you square a number the logarithm is doubled. If the impedances across which the voltages appear, or through which the currents flow, are equal, the expression for d.b. becomes:

$$Ndb = 20 \log \frac{E_1}{E_2} \text{ or } 20 \log \frac{I_1}{I_2} \qquad (3)$$

To actually perform these operations the following applies: In order to convert power ratios into d.b., look up the logarithm of the ratio and multiply it by 10. To convert current or voltage ratios to d.b., look up the logarithm, and if the impedances are equal multiply this logarithm by 20. If the impedances are not equal, use the formula given above (No. 2). In looking up logarithms, the following facts must be kept in mind: the numbers from zero to 10 have logs between zero and 1.00, i.e., there is no figure to the left of the decimal point (Log 2.00 is 0.30103); all numbers from 1 and 100 have logs between 1 and 2: i.e., the whole number part of the decimal fraction (as written) is between 1 and 2 (log 20 is 1.30103), and between 100 and 1000 the log is between 2 and 3, as explained in the first few paragraphs above.

Thus the power gain corresponding to 100 is 20 d.b., and the power gain corresponding to 200 is 23 d.b., and for a power ratio of 300 the gain is 24 d.b., etc.

In converting d.b. to power ratios the reverse operation is performed. If the gain is 28 d.b., we divide by 10, and get 2.8. The figure "2" tells us that the number lies somewhere between 100 and 1000, and when looked-up in a log table we find that 0.8 is the log of 6.31, and hence the voltage ratio is 631.

Suppose an amplifier has 1 volt applied to its terminals (input which has a resistance of 10,000 ohms. The output is 4000 ohms, and the potential across this is 40 volts. What is the gain in d.b.?

Power input =

$$P_1 = \frac{(E_1)^2}{R_1} = \frac{1^2}{10{,}000} = 10^{-4} \text{ watts} = \frac{1}{10{,}000} \text{ watts}$$

Power output =

$$P_0 = \frac{(E_0)^2}{R_0} = \frac{40^2}{4000} = \frac{1600}{4000} = 0.4 \text{ watts.}$$

$$\text{Power ratio} = \frac{P_0}{P_1} = \frac{0.4}{10^{-4}} = .4 \times 10^4 = 4000$$

Power gain = 10 log 4000 = 36 d.b.

(This is because the log of 4 is 0.6020, and because the first figure of the logs of all numbers between 1000 and 10,000 is 3, and the power gain is 10 times the log of 4000.)

Other similar examples will doubtless recommend themselves to the reader. A careful study of the results is necessary to obtain a clear picture of the relationships existing between the various units.

Referring to the table (Fig. 3) it will be seen that when the power ratio is doubled the gain is increased by 3 d.b., and whenever the power ratio is multiplied by 10 the gain is 10 decibels. To use more familiar terms, if a sound is increased so it is "twice as loud", it will require four times the power, which is a gain of 4 d.b. in power; if the sound is three times as loud, it will require 9 times the power; 4 times as loud, 16 times the power, etc.

The decibel therefore neglects the differences in sound volume which are likewise neglected by the human ear, and hence is a very flexible and satisfactory unit. It is more satisfactory to use than the direct amplification ratios because decibels can be added or subtracted numerically, without difficulty. It would be quite difficult to state offhand the power output of an amplifier system which has an amplification of 100,000,000,000 times, starting with 0.000,000,006 watts input. But if the input were stated as "minus 60 d.b." and the overall gain as "110 d.b." with an "output level" as plus 30 d.b., the puzzling zeros drop out of the calculations and it is easy to transpose the final figure of 30 d.b. into the definite figure of 6.00 watts, if this is desired.

FIGURE 3

Relations Between Decibels, Current, Voltage and Power Ratios

d.b.	$\frac{I_1}{I_0}$ or $\frac{E_1}{E_0}$	$\frac{P_1}{P_0}$	$\frac{I_0}{I_1}$ or $\frac{E_0}{E_1}$	$\frac{P_0}{P_1}$	d.b.	$\frac{I_1}{I_0}$ or $\frac{E_1}{E_0}$	$\frac{P_1}{P_0}$	$\frac{I_0}{I_1}$ or $\frac{E_0}{E_1}$	$\frac{P_0}{P_1}$
1	1.12	1.25	0.89	0.79	26	19.95	398.0	0.050	0.0025
2	1.26	1.59	0.79	0.63	27	22.39	501.0	0.044	0.002
3	1.41	1.99	0.70	0.50	28	25.12	631.0	0.039	0.0016
4	1.58	2.51	0.63	0.39	29	28.18	794.0	0.035	0.0012
5	1.77	3.16	0.56	0.31	30	31.62	1000.00	0.031	0.0010
6	1.99	3.99	0.50	0.25	31	35.48	—	0.028	—
7	2.23	5.01	0.44	0.19	32	39.48	—	0.025	—
8	2.51	6.31	0.39	0.16	33	44.67	—	0.022	—
9	2.81	7.94	0.35	0.126	34	50.12	—	0.019	—
10	3.16	10.00	0.316	0.100	35	56.20	—	0.017	—
11	3.55	12.60	0.281	0.080	36	63.10	—	0.016	—
12	3.99	15.86	0.251	0.063	37	70.80	—	0.014	—
13	4.46	19.96	0.223	0.050	38	79.40	—	0.0126	—
14	5.01	25.13	0.1995	0.040	39	89.12	—	0.0112	—
15	5.62	31.62	0.1778	0.031	40	100.00	—	0.0100	—
16	6.31	39.80	0.159	0.025	41	112.2	—	0.0089	—
17	7.08	50.12	0.141	0.0199	42	125.0	—	0.0080	—
18	7.94	63.10	0.126	0.0159	43	141.3	—	0.0070	—
19	8.91	79.42	0.112	0.0126	44	158.5	—	0.0063	—
20	10.00	100.00	0.100	0.010	45	177.81	—	0.0056	—
21	11.22	126.0	0.089	0.0079	46	199.50	—	0.0050	—
22	12.60	158.5	0.079	0.0063	47	22.40	—	0.0044	—
23	14.13	199.6	0.070	0.0050	48	251.2	—	0.0039	—
24	15.86	251.0	0.063	0.0039	49	281.8	—	0.0035	—
25	17.78	316.0	0.056	0.0031	50	316.2	—	0.0031	—

Decibel-Watt Conversion

FIG. 4 is a table giving decibel-watt conversions, and it will be found to be very handy. This is carried out over most of the common range of work, although the low level end may require extension, which can be easily done by simply dividing by ten, (moving the decimal point, and adding a zero) as the numerical values repeat themselves, as inspection will show. For example, minus 8 d.b. is 0.00095 watts, and minus 18 d.b. is 0.000095 watts, and in similar manner, minus 28 d.b. would be 0.0000095 watts, minus 38 d.b. is 0.00000095 watts, etc. The high end of the table is carried to 6000 watts, a figure which is not required except in high-power radio transmitters, and 10 d.b. above that would, of course, be 60,000 watts.

ZERO LEVEL

A SHARP distinction should be kept in mind between "zero power" and "zero level", which latter should more properly be called "zero reference level", arbitrarily established as .006 watts, or 6 milliwatts. This may also be expressed as 1.73 volts across a 500 ohms load, and under such conditions the current will be 0.00346 amperes (3.46 milliamperes). Obviously "zero level" cannot mean zero sound current, and there is a great range between this apparently small figure of 6 milliwatts and the lowest levels from which it is possible to satisfactorily amplify sound currents. At present writing this figure is probably somewhere between 80 and 100 d.b. below reference level in practical systems using very high grade apparatus. It can probably be exceeded in laboratory work by 20 or 30 d.b.; an almost unbelievable small amount of energy, but still within possible limits of test and experiment.

PRACTICAL USES

IN practical use, the equations and calculations given may generally be reduced to tables and the actual sound and speech levels can be quite easily recognized by anyone after a certain amount of experience. The present popular system of "R" measurements of intensity of radio signals depends on a decibel relationship, although it is rather crudely expressed.

The difference in signals differing by a single "R" step which are "R-1" and "R-2", or "R-8" and "R-9' for example is usually about 6 d.b., and in general practice it is assumed that the average variation in intensity between a just audible sound (R-1 signal) and an extremely loud sound (R-9 signal) is 60 d.b. As there are 9 steps in the "R" system of audibility, or 54 d.b., this system has entirely normal and correct basic principles for its use. If properly and truthfully used it is really an indication of comparative signal strength. The only weaknesses are the difference in opinion between various observers, due to actual differences in their apparatus and the sensitivity of their ears, as well as the personal judgment of the operators themselves. The all too-common tendency to exaggerate by saying that an "R-3" signal is "R-5" or "R-6", in the belief that it will make the other fellow feel better, is another weakness.

The decibel scale also explains another factor which is often very puzzling in reference to the apparently-wonderful range of a low-powered transmitter. There is a lack of noteworthy results when a higher-powered substitute fails to bring in more than a possible occasional remark that the station sounds better, or louder—perchance. Usually the small, low-powered station is being run to the ultimate limit or nearly so, and is putting about 50 watts into the antenna. The higher-powered replacement (assuming equal frequency stability, proper filtering and other details) may deliver 200 watts to the antenna, which actually corresponds to a power ratio of 4 times, or the signal at a given location would be normally 6 d.b. higher. A difference of 6 d.b. is not particularly noticeable at a receiving station, especially where no accurate means of measuring the received signal strength is available, or where regenerative amplification is used. If tests are made at close intervals, say a few seconds apart, allowing time only to switch over from a low to a high powered transmitter, the difference usually becomes quite apparent, but because there is only a probable difference of one step in the "R" scale it is not anything to enthuse over. If, however, considerable time has elapsed between tests on low- and higher-powered apparatus, the receiving operator may well report no noticeable difference in signal strength. When we add to this the variable and erratic conditions that may result in propogation conditions between stations, differences in receiving equipment, local noise levels, and a host of other things, it is not at all surprising that a change in power of from 50 to 200 watts on the air often will show no great improvement, much to the owner's disappointment.

This condition is even more pronounced in modulated systems, such as used for radio telephony. Here, unless the operator makes it a practice to "ride the gain" by continually watching his speech input level and making constant corrections for differences in speech volume as is done as a routine matter in broadcast practice, differences of level of even greater than 6 or 8 d.b. may easily be encountered and passed over entirely. The distance from the microphone and its condition, the presence of a poor old tube in a speech amplifier, a low voltage due to a poor resistor, or countless other things can easily cause great differences in the modulation of a telephone station, with resultant differences in the apparent range and performance.

RELATIONSHIP BETWEEN WATTS AND SOUND LEVEL

IN LOUDSPEAKER work and in modulator systems there is a great deal of erroneous opinion due to an improper conception of the relationship between watts and actual sound levels in decibels. It is quite common for anyone in these fields to discuss glibly the changes he is going to make in a certain unit, whereby he will by the substitution of certain tubes or parts obtain "twice as much power", and with the complete assurance that this means a great deal more sound volume—or something or other—usually the latter. Take for example a pair of 45 tubes in class A push-pull, operated on 275 volts. According to the manufacturer's data, these particular tubes under normal conditions will deliver approximately 4.5 watts of undistorted sound energy. This corresponds to about plus 29 decibels output level, and as such should be capable of operating a large number of small loudspeakers or several fairly large ones, or modulating a small receiving tube transmitter (certain liberties being taken with modulator theory at the moment). This 29 decibels will deliver a good healthy "sock" to a single horn, mounted in a small auditorium, but still it is only fairly satisfactory. Suppose we take the next-larger class A tube, the UX-250. A pair of these tubes will deliver about 10 or 11 watts, when operated according to the manufacturer's ratings. How much actual loudness

(Continued on page 32)

FIGURE 4

Decibels Versus Watts Output, Levels

D.B.	Watts	D.B.	Watts	D.B.	Watts	D.B.	Watts
—20	0.00006	0*	0.006	20	0.600	40	60.00
—19	0.000076	1	0.0076	21	0.759	41	75.90
—18	0.000095	2	0.0095	22	0.948	42	94.87
—17	0.00011	3	0.0119	23	1.185	43	118.59
—16	0.00015	4	0.0153	24	1.518	44	151.8
—14	0.00023	6	0.0237	26	2.371	46	237.18
—13	0.000303	7	0.0305	27	3.036	47	303.60
—12	0.000397	8	0.0380	28	3.795	48	379.50
—11	0.000474	9	0.0474	29	4.743	49	474.37
—10	0.0006	10	0.060	30	6.000	50	600.00
— 9	0.00076	11	0.0759	31	7.590	51	759.00
— 8	0.00095	12	0.0948	32	9.487	52	948.75
— 7	0.00119	13	0.1187	33	11.859	53	1185.94
— 6	0.00152	14	0.1518	34	15.180	54	1518.00
— 5	0.00190	15	0.1898	35	18.975	55	1897.50
— 4	0.00237	16	0.2372	36	23.718	56	2371.88
— 3	0.00303	17	0.3037	37	30.360	57	3036.00
— 2	0.00397	18	0.3795	38	37.950	58	3795.00
— 1	0.00474	19	0.4744	39	47.43	59	4743.75
						60	6000.00

*"Zero Level", more properly should be called " zero reference level".

FIGURE 5

Number of Speakers, at Level Indicated Which Can Be Operated

Output Level Per Speaker						
D.B.	Watts	28DB	33DB	36DB	39DB	42DB
33	11.86	—	1	2	4	8
32	9.49	—	1	2	5	10
31	7.59	—	1	3	6	12
31	7.59	—	1	3	6	12
30	6.00	—	2	4	8	16
29	4.74	—	2	5	10	20
28	3.79	1	3	6	12	25
27	3.04	1	4	8	16	32
26	2.37	1	5	10	20	40
25	1.90	2	6	12	25	50
24	1.52	2	8	16	32	64
23	1.19	3	10	20	40	80
22	0.95	4	12	25	50	100
21	0.76	5	16	32	64	128
21	0.60	6	20	40	80	160
19	0.47	8	25	50	100	200
18	0.38	10	32	64	128	256
17	0.30	12	40	80	160	320
16	0.24	16	50	100	200	400
15	0.19	20	64	128	256	512
14	0.15	25	80	160	320	640
13	0.12	32	100	200	400	800
12	0.09	40	128	256	512	1024
11	0.08	50	160	320	640	1280
10	0.06	64	200	400	800	1600
9	0.05	80	256	512	1024	2048
8	0.04	100	320	640	1280	2560
7	0.03	128	400	800	1600	3200

To use this table, proceed as follows: For example, to operate a group of 24 speakers at 19 d.b. level; look in the first column and find 19, then check horizontally until we find the nearest figure to 24 (which is 25) and then check at the top of the column, and obtain the necessary power in d.b. that the amplifier must deliver to operate this group of loudspeakers.

Circuit Data on Improved Class B Amplifiers

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

CLASS B amplification while inherently simple will give poor results in practical operation unless proper precautions are taken in the entire design of an amplifier. The average amateur has discovered this quickly after setting up a Class B amplifier. This article is not intended to cover the theory of Class B amplification, but rather to illustrate a number of developments which tend to simplify and improve the typical Class B amplifier using 203A, 800, or similar tubes in the output stage.

General Amplifier Requirements

THE four major requirements for any amplifier are low frequency discrimination, low harmonic content, ample power handling ability and low hum level.

The first of these qualities is governed almost entirely by the transformers used. Good transformers are valuable, one commercial grade having a uniform response from 30 to 15,000 cycles.

Factors Governing Class B Harmonic Content

THE second factor, harmonic distortion, is the most difficult to control in Class B amplifiers. As is well known, a Class B system requires for low harmonic content:

(a) Sufficient driving power.
(b) Good driver regulation.
(c) Good plate supply regulation.
(d) Proper bias having good regulation.
(e) Proper impedance matching throughout the circuits.
(f) Precautions to prevent RF oscillations in the grid circuits.

All of these factors have been considered in the amplifier schematics described below.

Driver Power

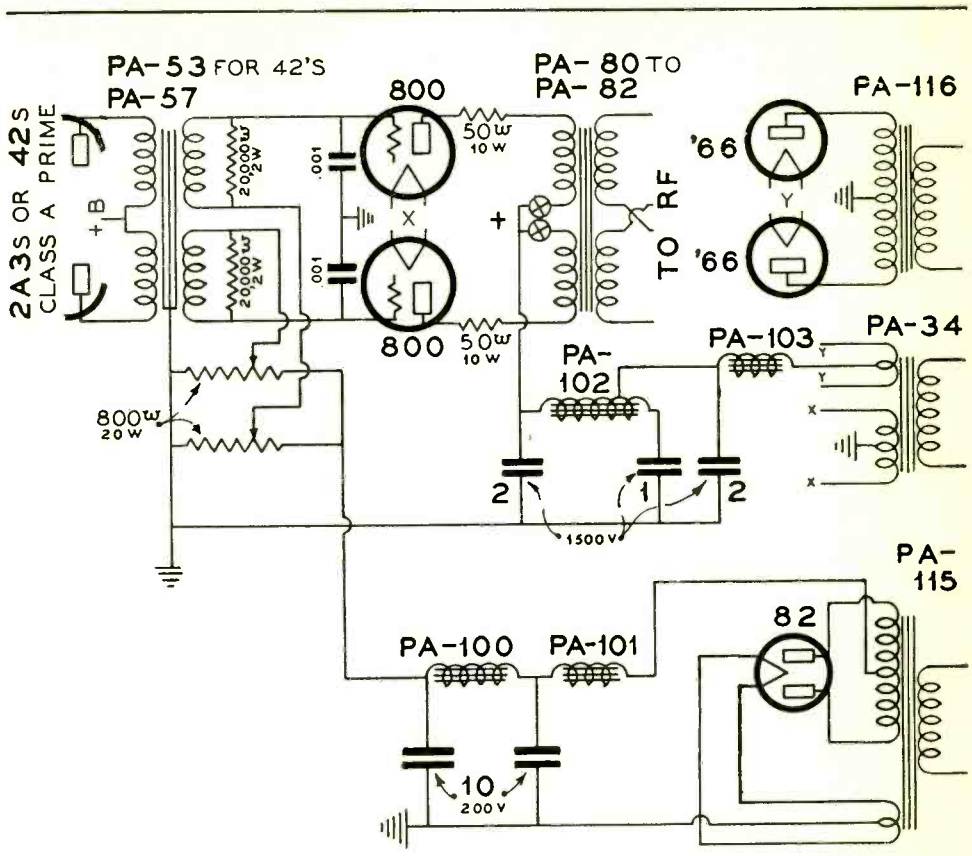
EXAMINING these distortional factors in order, we find that our first requirement is sufficient driving power. Inasmuch as considerable grid current is taken by Class B tubes, a definite power must be available from the preceding driver tube. In addition to this, the transformer design should be such that high efficiency is obtained at all audio levels. A good Class B input transformer should have an efficiency of 85% or over. In the average Class B amplifier, the available driver tube power should be at least 5% of the Class B output.

Driver Regulation

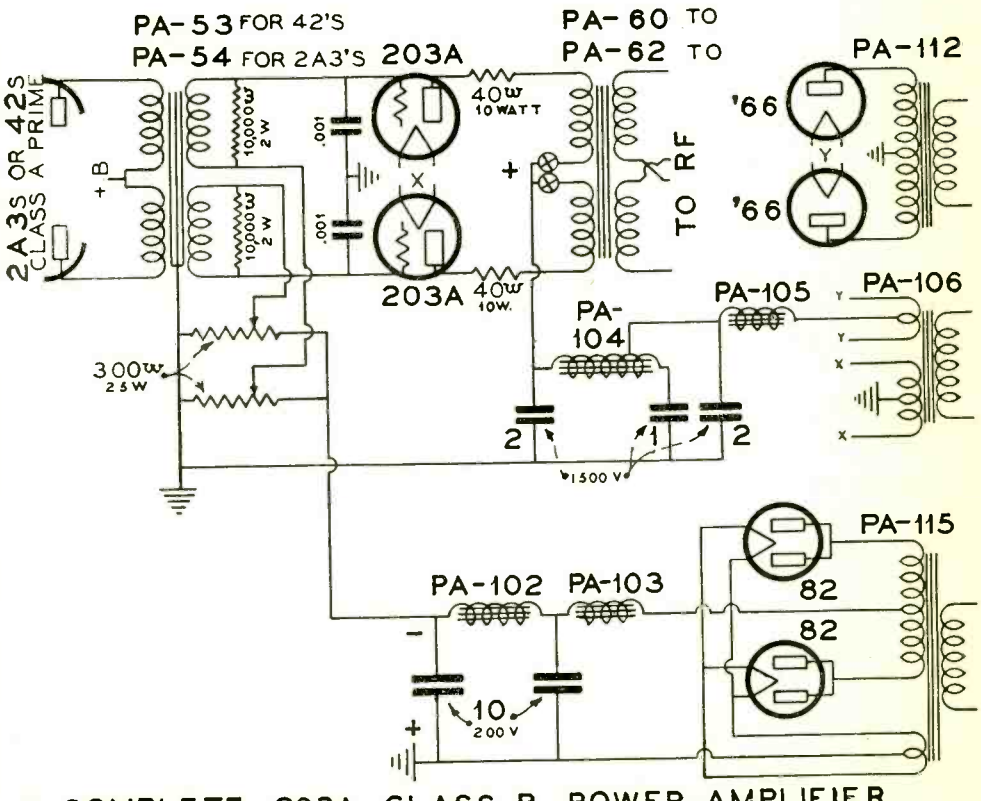
GOOD driver regulation is an important factor inasmuch as the grid impedance of the Class B tube drops very greatly at high power levels. It is essential to use a high stepdown ratio in the input transformer so that when the Class B grids are very low in impedance, sufficiently high reflected load will be thrown on the driver tube to maintain clean response.

To help maintain a constant reflected impedance to the driver tubes, loading resistors are used in the Class B grid circuits as per the diagram.

While the input transformer design is irrelevant as few readers will desire to construct their own transformers, there is one important feature in the design of this transformer. An input transformer can be designed in such a manner that a certain amount of third harmonic distortion is intentionally introduced into the system. This distortion in the grid circuit is in reverse phase to that in the output of the Class B tube. The result is that with proper design, an appreciable



COMPLETE 800 CLASS B POWER AMPLIFIER WITH BIAS RECTIFIER



COMPLETE 203A CLASS B POWER AMPLIFIER WITH BIAS RECTIFIER

nullification of the distorting effects can be obtained, and greater power output developed at normal harmonic content.

It is evident that maximum nullification will be obtained if no phase displacement is effected between the input and output distortions. This is possible if leakage reactance in the transformer is kept down to a very low value.

Plate Supply Regulation

THE methods of obtaining good plate regulation have been described in the past. It is desirable to use mercury vapor rectifiers under all conditions and to use a saturated input reactor. The action of the saturated input reactor is very readily apparent if we consider choke input and condenser input filter circuits. A condenser input filter circuit, as the amateur well knows, will deliver appreciably greater voltage than choke input. This is due to the fact that the input condenser is charged during the high peak voltages of the rectified AC and then discharges when the rectified voltage is lower, helping to maintain a high average DC output voltage. Where choke input is used in a filter circuit, this cannot take place and the result is that in a typical rectifier, the DC output voltage is approximately 90% of the RMS transformer voltage. Where a swinging input reactor is used, a compromise is obtained. When small amounts of plate current are drawn through this reactor, its inductance is high and the circuit is practically choke input. When high plate currents are flowing, the choke is saturated with the result that the inductance between the DC output of the rectifier and the first condenser is sufficiently low to allow an appreciable charging of the first condenser at peak AC voltages. This helps increase the DC voltage so that compensation is made for the additional voltage drop in the chokes and power transformer.

Another important factor governing the regulation of the total rectifier system is the regulation of the power transformer itself.

Bias Supply

THE bias voltage on Class B tubes is generally not critical. It is far more important that the plate current be balanced than that the bias voltage be within 10% of its normal value. One of the major difficulties in high power Class B systems is the method of obtaining bias. While fresh batteries are ideal, they are expensive, unreliable and messy. The amplifier schematics here shown use a bias rectifier designed to eliminate the use of batteries. Through the use of a liberally designed power transformer, mercury hot cathode rectifiers and a saturated input reactor, the DC output of this bias system can be kept very constant. In the 203A amplifier shown, 250 mils is thrown away in the bias potentiometers. This tends to stabilize the grid bias action even when high grid currents are present. The equalization of the tube plate currents is readily accomplished with the two potentiometers indicated.

Impedance Matching

ANOTHER important point in keeping harmonic content in Class B systems to a low level is the proper loading of the Class B tubes. The load in such a system, very much like with pentode tubes, is quite critical. When operated into a Class C stage, the plate load is non-inductive and constant in value. This is readily matched to the Class B tube. It is this constancy in load that has made Class B so popular in transmitter circuits. If one uses a Class B amplifier to operate a loud speaker system, difficulties will normally be encountered. This is due to the fact that the loud speaker is highly inductive in nature and therefore a valuable reactance as respects frequency. In other words, while the reflected impedance of the speaker system may be 6000 ohms at 1000 cycles, it might be four times that value at a higher frequency. Naturally, such a great mismatch at the higher frequency would introduce a large degree of harmonics. This effect can be neutralized to a very considerabl extent through the use of an equalizing network. A typical network for use with Class B 203A's consists of a 6000 ohm resistor and a .04 mfd. condenser connected in series from each 203A plate to ground. The values for equalizing networks of this type for various tubes are described in a bulletin recently released by the United Transformer Corp. It is interesting to know with regard to Class B output transformers, that these differ very appreciably from Class A output transformers. As discussed in the April issue of "RADIO", the high frequency response of an output transformer is dependent principally on low leakage reactance and low distributed capacitance in the transformer structure. In a Class A transformer, the leakage reactance computations are based on the entire primary and secondary, inasmuch as the entire windings are normally in use. However, in a Class B output transformer, only one-half the primary is really working at a time. It is therefore necessary to maintain a low leakage reactance between the secondary and each half of the primary. It is consequently necessary to have a much more closely coupled coil structure in the output of a Class B system than in the output of a Class A system.

RF Oscillations

ANOTHER form of distortion which is often mistaken for higher harmonics is due to an audio oscillation in the output tubes. This oscillation occurs only when an audio frequency signal is applied to the grids and results in an audible rasp in the output. To remedy this effect, a shunt path for this high frequency oscillation should be introduced from the Class B grid to ground. This effect is apparent in almost all Class B tubes. However, the effect is most marked in larger tubes such as 203A, etc. Tests have indicated that a .001 mfd. condenser connected between grid and ground is highly suitable for this high frequency shunt. An additional aid in stabilizing the circuit is obtained through resistors in the plate circuits of the Class B tubes. These are illustrated in the schematics where a Class B amplifier is used to operate a speaker load and has an equalizing network, as described above, the value of this condenser can be cut in half; in other words, a .0005 mfd. condenser can be used.

The third amplifier requirement given above, ample power handling ability, is governed by the tubes used, and the efficiency of the associated components.

Hum Level

THE fourth requirement, low hum level, is affected by plate supply hum, filament supply hum, electrostatic pickup and electromagnetic pickup. The filter circuits shown in the schematics use a hum-bucking arrangement which is much more efficient than a brute force filter. In this way, the plate supply ripple can be kept to a small value economically.

Magnetic pickup is the most difficult to cure, but by using transformers which are completely encased in sheet metal or cast-iron housings, this effect can be practically eliminated. Audio and power components should be kept as far as possible from each other to prevent both electrostatic and electromagnetic coupling.

With proper precautions, the amateur should be able to build a transmitter using Class B audio amplification equal in quality to that of normal broadcast station practice.

Single-Wire Fed Antenna

(Continued from page 9)

of 70 ohms, we could connect it at the exact center of the antenna and our antenna would take power from the transmitter if we could in turn match this 70 ohm feeder to the tank of the final amplifier.

Unfortunately such a feeder cannot be constructed satisfactorily, even with a two-wire line, to say nothing of attempting it with a single wire.

Nor can we take a wire preferably of a non-resonant length and say definitely that it will have a given value of surge-impedance. Accordingly we have to determine experimentally where any wire we may choose should be attached to the antenna to have an impedance that will match the impedance of the antenna at the point of connection. Experiment indicates that number 14 wire used as a feeder will have an impedance somewhere in the neighborhood of 500 to 600 ohms, with smaller wire having higher impedance values and larger wire smaller impedance values.

What we have to do then is find some point on our antenna where the voltage is five or six hundred times the current. With all the variable factors which enter into any antenna setup, a formula cannot be much better than an approximation and a starting point.

What we want is to have our feeder possess a constant impedance from the point where it leaves the transmitter to the point where it joins the antenna. If the impedance is not constant, the feeder has a "standing wave" on it which is doing some radiating on its own hook. This radiation pattern will sadly impair the efficiency of the whole system, as part of it may exactly cancel out a portion of the radiation pattern of the antenna.

Standing Waves

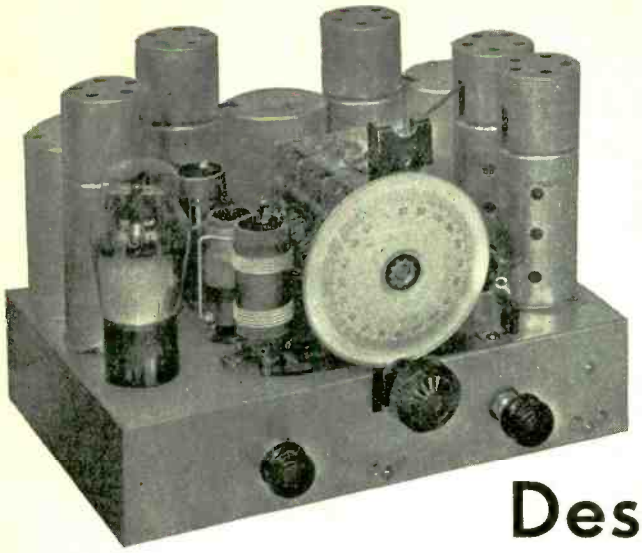
FORTUNATELY it is very easy to determine if there is a standing wave on the feeder. We have noted that the greatest difference in RF current values on the antenna exist as between a reading taken at one end of the antenna and at the center. This is a quarter-wave apart. Similarly, if there is a standing wave on the feeder it will become apparent if we place RF ammeters a quarter-wave apart in the feeder and note their readings. Or we can use the same meter, and insert it in the feeder at quarter-wave points to see if the current value is the same at these points.

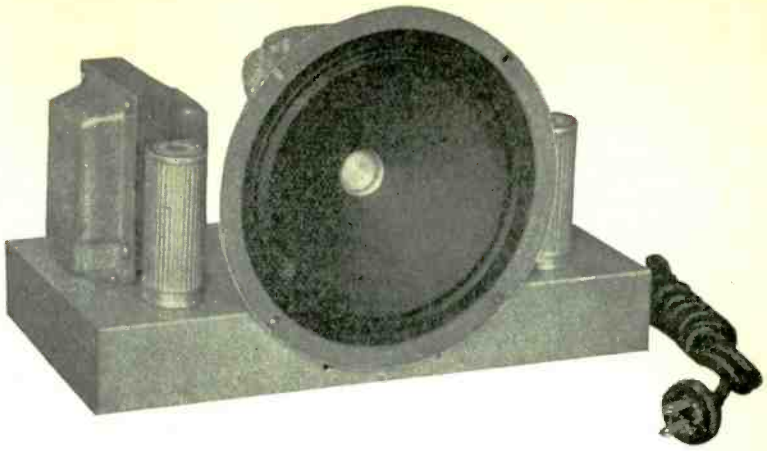
If the reading is not the same, there is a standing wave on the feeder. If, for instance, the meter reads 500 milliamperes at the transmitter and 200 milliamperes when inserted out the feeder a quarter wave distant from the transmitter, there is need for moving the feeder connection point on the antenna. Move it out towards the end a foot. The readings may now be 400 milliamperes next to the transmitter and 300 milliamperes a quarter-wave out on the line. Move it out on the antenna another foot. If the meter reads 350 milliamps at both points, now, the standing wave is gone, and the feeder is performing properly.

As to this antenna's lone advantage. Using number 14 wire for a feed-wire, the feeder-impedance is in the neighborhood of 500 to 600 ohms. With a transmitter putting 70 watts into the antenna, our feeder current will be in the neighborhood of 340 to 375 milliamperes, RF current. A voltage on the order of 500 or 600 times this magnitude will still be low—in this case around 200 RMS volts.

Those values aren't very startling, are they? Not hard to insulate. Not of sufficient magnitude to require heavy wire, nor elaborate spacement away from other objects. Obviously the field about a wire carrying voltage and current of this order is small. The result is that the feeder transfers power effec-

(Continued on page 34)





All-Wave Super-Het Design and Construction

By R. T. POUNDS
(Chief Engineer, J. W. Miller Co.)

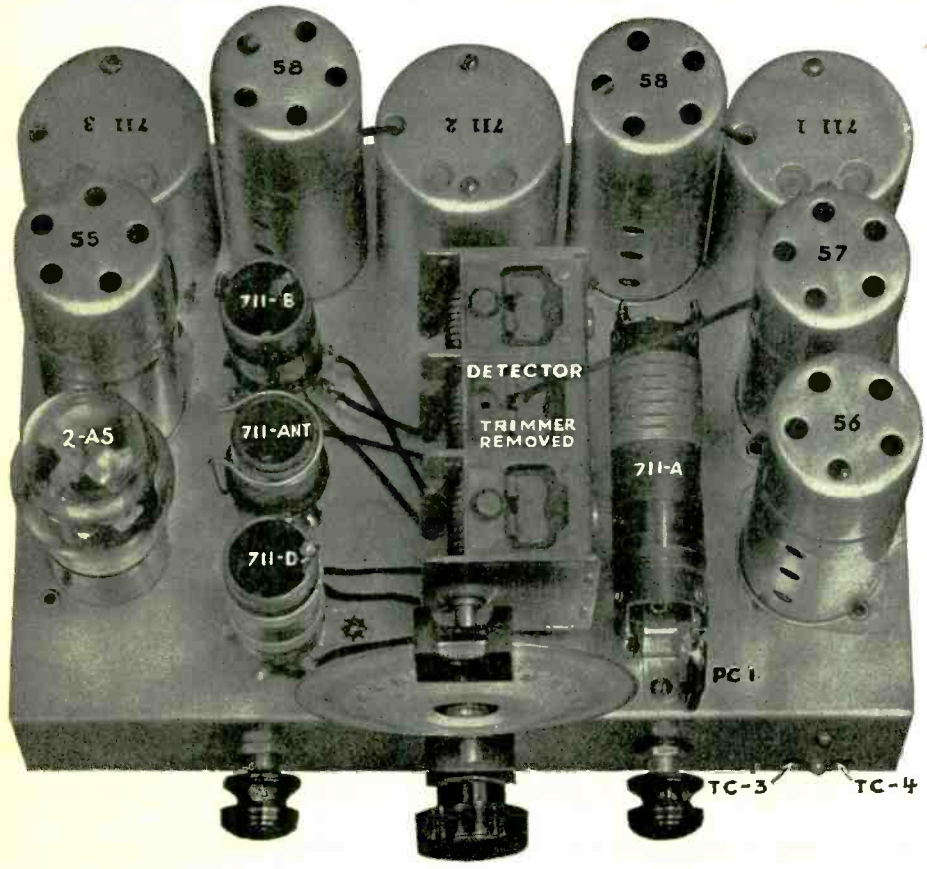
DURING the past year there has been a decided increase in the interest displayed in short wave reception. Simultaneously there has been much energy expended and many ideas, some original, others ancient, applied to the development of better short wave receivers. Unfortunately, however, a great number of these receivers while possessing some features of unusual merit have failed to meet the requirements of any large percentage of otherwise prospective users, by the fact the designer refused to overcome his own prejudiced ideas regarding worthwhile improvements which were in his eye highly impractical.

IT IS a distinct trait of human nature to resent any attempt to change ideas regarding fundamental principles of any branch of human knowledge or science that is universally recognized as fundamentally sound and correct. For this reason the development and advancement of any commercial product has always been and probably always will be retarded, not only by the designers' but also the ultimate consumers' ideas, regarding the principles governing its construction. An outstanding example of this may be found in one of our most commonly used commercial products, the automobile. It is only after many years of manufacturing and public use of this product that any thought has been given to change the body design to that which is now recognized as being fundamentally the only correct construction. Even to this day, the influence of the original horseless carriage may be found in the design of high speed automobiles.

The writer does not wish to convey the impression that he is the foremost authority on all branches of short wave receivers. However, he would like to stress the fact that, in the receiver to be described, all personal prejudices have been eliminated, and any worthwhile idea or suggestion offered has been given a thorough test and the relative merits of similar ideas, as, for instance, certain circuit arrangements, etc., have been carefully compared before definitely accepting either one as producing superior performance.

The result has been the development of an all wave receiver combining the better points of numerous experimental sets and the elimination of all difficult methods of construction and undependable circuit designs. The receiver is so smooth in operation that even those who are as yet uninitiated in the art of short wave tuning can enjoy the thrill of listening to foreign programs. The reception on the broadcast band is surpassed by no other receiver I have had the privilege of testing.

It is usually customary to print a long list of stations that have been received on any new receiver, but it is my contention that a receiver of worthwhile design does not require any such superfluous statements. Practical design and choice of efficient component parts determine the ultimate performance of any receiver.



ONE of the most common prejudices regarding short wave receiver design is that concerning wave band selector arrangements. Many contractors or designers while vehemently denouncing some particular arrangement, can give no definite reason for such action, and if any discussion concerning such problems arise, there is usually some vague remark about the losses incurred, and yet he can not explain why the losses in such a circuit are greater than those in the system he prefers.

Another generally accepted idea is that a small tuning condenser must be employed for satisfactory short wave operation. However, such has been definitely proven to be a mistaken idea, and in fact the use of a larger condenser allows a degree of selectivity in the signal tuning circuits that is impossible when a smaller capacity is used, the added selectivity being due, of course, to the fact that less inductance and consequently less resistance is in the circuit at any particular frequency.

It is also a generally accepted fact that to be efficient at short waves, a receiver will of necessity prove inferior on the broadcast band, or vice verse. Here again we find this to be an error and, in fact, there is absolutely no reason an all wave receiver can not be as efficient on one band as another.

The receiver shown in the accompanying photographs is the result of many months of exhaustive tests in the laboratory and in actual short wave and broadcast distance reception. The construction of the receiver is comparatively simply, and if due consideration is given the problems involved, there is no reason the home constructor should not experience the same excellent results obtained not only by the writer, but also by a great number of custom set builders in all sections of the country who have constructed receivers to the specifications as given in this article.

THE most important items in a short wave receiver or, for that matter, in any receiver, are the coils employed. First-class performance can be obtained only when the coils are especially designed for the particular receiver desired, and if purchased in manufactured form they should be the highest quality product available. The J. W. Miller Company of Los Angeles have prepared a kit of coils for this receiver, which also contains the oscillator padding condensers and other parts as listed at the close of this article.

The short wave fan or custom radio builder who has purchased a kit of parts for constructing the receiver described in this article is naturally quite anxious to complete it as soon as possible. On the other hand, he is just as desirous that when completed the results will compensate him for his time and labor.

Therefore, before a wire has been soldered or

a part mounted on the chasis, close attention should be given the following details:

The parts selected should be of first quality and should correspond in physical size as nearly as possible to those shown in the photo.

The parts employed should be laid out in the manner shown on the chassis layout.

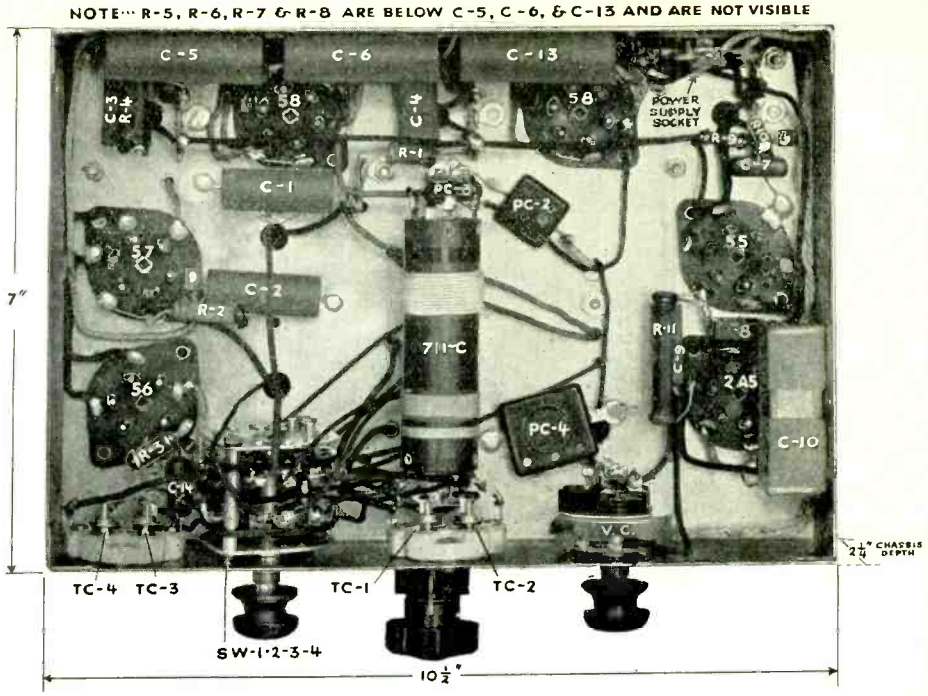
In wiring the receiver, solder each joint carefully, using rosin core solder only.

All leads in the wave band switch must be kept as short as possible, and all wires separated in order to reduce the stray capacities between them. This is of utmost importance.

All coils when disconnected from the tuning condenser have a natural period of resonance. As a general rule, it is the next high frequency band, as for instance, the broadcast detector coil will probably resonate at approximately 3000 K. C., due to the stray capacities in the wiring and switch leads. If the stray capacities are only from the coils and wiring to the ground, there is no particular disadvantage. However, if an appreciable capacity exists between this circuit and the other tuned circuits, dead spots will occur at points in the tuning range. This is the main reason switching arrangements have had such a black eye in the past.

However, if the coils and switch are mounted in the positions as shown, these capacities are reduced to a minimum and no dead spots will occur. It must be remembered that inductive coupling must also be avoided. You will observe from the photographs the only coils in inductive relation are those whose natural periods do not fall in the following tuning range. For instance, the broadcast antenna coil is always tuned to some point in the broadcast band as it is never disconnected from the variable condenser. Likewise, the 75 to 200 meter coils do not resonate within the 12 to 35 meter band. Furthermore, it is important that all leads in the tuned circuits correspond as nearly as possible in length to those shown in the chassis layout. Otherwise, the oscillator and detector circuits will not track. This is particularly true of the high frequency band. No particular lengths will be given, the important thing is to keep the chassis layout as nearly as possible to that shown, and then place each wire in such a position as to keep it at a minimum length. Another important item is to make all ground returns as short and direct as possible. If these precautions are taken, there will be absolutely no dead spots at any point.

While this may sound complicated, it is really very simple. As may be observed from the photographs, the leads to the No. 711B and No. 711C Coils, which are mounted on top of the chassis, do not pass through the chassis directly below the coils, **but are passed through individual holes drilled in the chassis** near the variable condenser. This simple precaution adds greatly to the efficiency of the completed receiver, by reducing the stray capacities between these leads and coil No. 711C, which is mounted below the chassis.

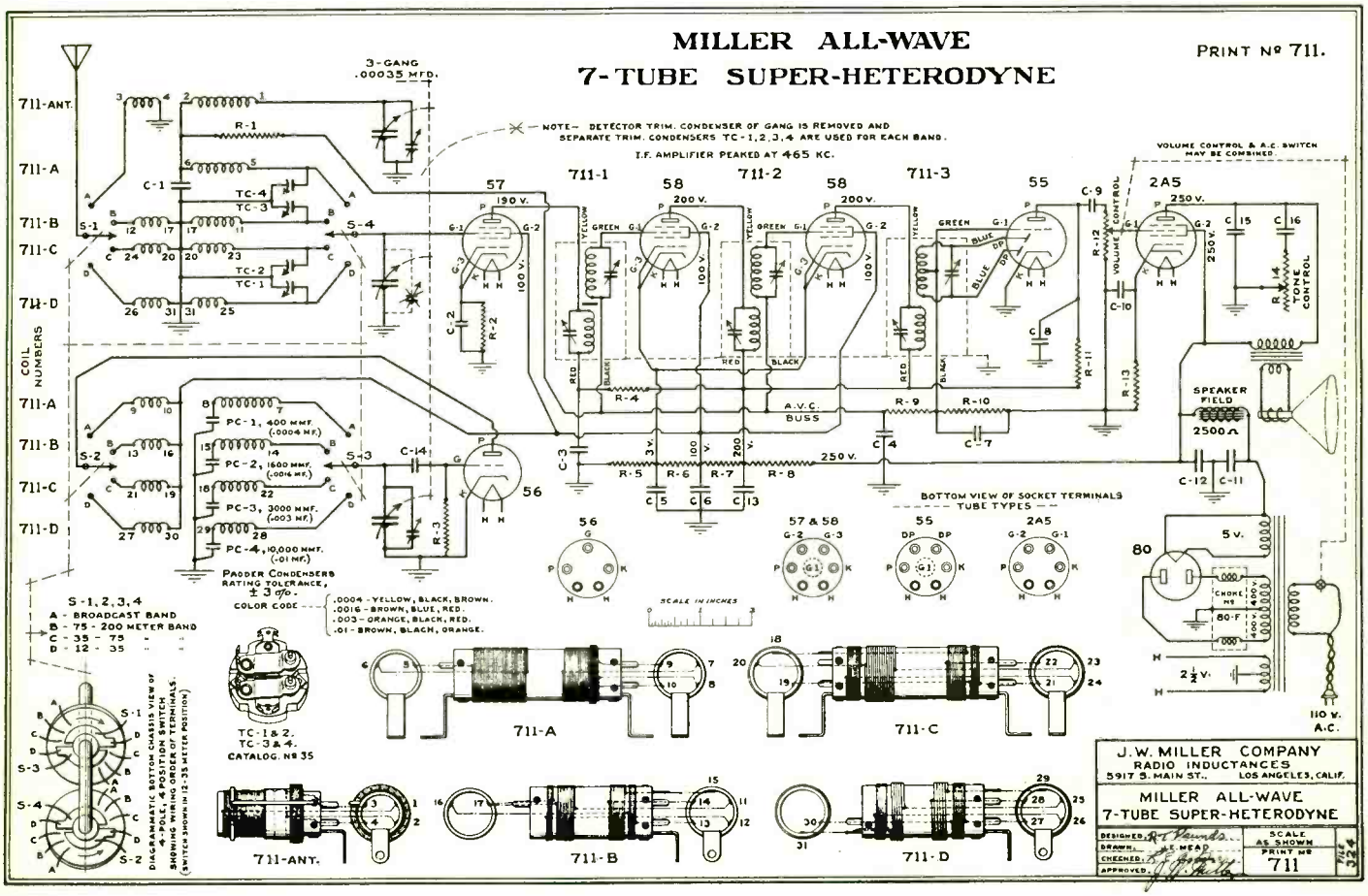


ONE of the most advanced features incorporated in this receiver is the use of high-impedance coupled antenna coils on all bands with the exception of the 75-200 meter band. This type coupling offers distinct advantages inasmuch as it allows the oscillator coils to be padded and each band individually trimmed, eliminating the necessity of a panel-operated trimmer. This will be recognized as a definite step in the direction of making short wave reception really efficient and practical.

It is next to impossible to attain perfect oscillator tracking when using the more conventional type antenna coupling, that is, a small capacity from antennan to the grid of the first detector. When using this method, the added capacity of the antenna circuit is directly parallel with the tuned detector circuit. However, this parallel circuit contains not only capacity but also the inductance of the antenna, forming a series resonate circuit. The effect upon the detector circuit is a greatly distorted tuning curve. As the oscillator circuit has no such influence upon it, the sensitivity is reduced and image response is quite prominent at various points in the tuning range.

The disadvantages of this system are entirely removed in the new Miller All Wave receiver. The antenna primary is designed to form a resonate circuit whose natural period is well

(Continued from page 28)



FROM ONES TO NINES

DOINGS OF THE AMATEURS IN ALL U.S. DISTRICTS

Edited by W. E. McNatt, Jr., W6FEW

THIS department would appreciate a W4, W2, W3 and a W5 volunteering their services in supplying some "dope" from their respective districts. Write this department, care of W6FEW, 557 N. Fourth Street, Covina, Calif.

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W1DBP and New England

New England had its worst snow in years this time two months ago. Up to date we have had no reports of heroics in the ham racks . . . but the storm made a good excuse for missing skeds, hi.

W1CKF is a perfect preserving 10 meter fan. He reports, "W1CKF has been on opproximately 28,400 KC. phone and CW DAILY from 1:30 to 2:30 p.m. No 10 meter hams have been heard." W1CKF will be on the lookout for any 10 meter signals and would like to sked anyone anytime.

There's your chance, boys.

Anyone hearing the signals of W1XJ experimental station at Harvard University is requested to inform the boys here at Yale who want to know what a "fist" with a Harvard accent sounds like. W1XJ has been reported on X, X1, 2—and 3494 kcs.

The Maine gang seem to have hibernated this winter. We did hear from W1CFO, however, who reports motion of his rig about the house . . . also from W1AWY who has put in a tri-tet oscillator. We also mislaid a report on reception of VK's and ZL's on 80 meters, not once but several times, up in "them thar woods."

W1YU increased power input to 1 kw during the "tests". If, sometime, the noise from W1YU gets worse, you will know that the boys lifted the 204-A that the "lab" bought.

W2CZO Remarks, From New Jersey

After hibernating through the DX wx, W2GIN **(no cracks now!)** of Jersey City decided to put the old peanut whistle on 160 meter fone again. The new rig is a pair of the new 800's in PP. Evidently Roy must have a pretty good receiver in his shack—we hear him calling and working all sorts of DX lately.

The boys up in Leominster, Mass., claim to have the most active ham town in the states. We believe it, b'gosh—one can tune on any of the ham bands at almost any time of the day and be certain to hear five or six of them on at the same time, hi.

W2EKM complains about the lack of traffic on the 40 meter band and is seriously considering pulling coils to go down to 80 meters again where he can be sure of piling up a good score almost any night. Incidentally, Johnny is using crystal control and what a sock that boy has.

Mac, W3AUC, Baltimore, Md., received a second-harmonic report from an SWL about a mile distant and, being a conscientious ham, decided to end it all—the second harmonic, of course—soooooooo, he put some sort of "doohickey" in his feeders—said "doohickey" was supposed to exterminate the second harmonic. After the operation, Mac ups and yipes a **"see-kew"**, the rig apparently working OK, having lost none of its output with the same input. Time passed—**(If you don't believe it, try it sometime—just sit down and see if time doesn't pass)**—and nothing was heard of Mac. Finally, one day, we QSOed him—with **"down-in-the-dumps"** being registered perfectly over the air. It seems as though Mac ran afoul of an **R. I. back in Nebraska somewhere—said R. I. sent him a pink slip for having a bad SECOND HARMONIC IN THE COMMERCIAL REGIONS.** Mac is unable to estimate just how far he threw the little "doohickey".

One of the most consistent 75 meter fone signals which reaches our ears emanates from that very fine low-power station W1DVR of Attleboro, Mass., —one can generally hear him coming through with more strength than some fones using 10 times his power. We would like to have the dope on how to get so much audio out of a pair of 250's.

Not many fones have a linear amplifier which works as it should, but there is one on 75 meters which sounds very fine. W3BFK, or Reading, Pa. Doc is using a '52 as a linear amplifier and has quality which is well nigh on to perfect.

We can't vouch for the reliability of the information, but the rumor comes to our ears that WALTER WINCHELL, OF KEYHOLE, ONE-SOCK-FIGHTS AND WHAT HAVE YOU FAME IS SOON TO JOIN THE HAM RANKS—HE HAS, YOU KNOW, BEEN IN THE HAM RANKS FOR YEARS—BUT HE IS SUPPOSED TO BE JOINING THE RADIO HAM'S RANKS. BOY! IF THIS RUMOR IS WELL-FOUNDED, KBW HAD BETTER WATCH HIS STEP—CAUSE MRS WINCHELL'S BOY WILL SURE GET TO THE BOTTOM OF IT "ALL". heh-heh.

It'll be hard for him to sign the secrecy oath, we bet.

Mebbe he'll get mixed up in his traffic reports and his column . . . or, when he steps up to the NBC mike, he'll yipe, "Hello CQ, hello CQ, OKAY AMERICA, this is Walter Winchell."

But . . . we'll see.

Sponsored by the EASTERN RADIOPHONE ASSOCIATION, a hamfest of a new order—(I almost said "odor") was held at Rich's Inn, on the Boston Post road, between Grenwich and Stamford, Conn., last April the seventh . . . a great crowd was expected to attend—including the New Jersey mob.

New Radio Club

The Newark College of Engineering will soon have a rig on three bands . . . they've been organized just a short time.

Wanted, Reward, Etc.

For a few feeder spreaders is offered by W2ABX. Varying plate and antenna current decided that for the old maestro. Ed is using xtal control, but the meter reading variations don't look so good to him, hi.

The Eastern Radio League of Kearny, N. J., would like to hear a little more activity on 10 meters. One member of the club will always be on the air from 11:00 a.m. to 3:00 p.m. Sundays and some evenings. Experiments are being conducted with the new "53" tube for ultra-high frequency work and the results to date have been gratifying. C'mon, you 10 meter hounds—here's opportunity for research.

W3CCF-SI-WKBO and the W3 Gang

That ever-present evil, "key-click", invaded the sanctum of several of our newly-licensed hams—the result taking the form of a personal visit to the "infants' by R. I. Davis. Happily, all cases were satisfactorily adjusted; the hams, R. I., and BCLs now in a state of peace. Some of the old timers might be guilty of the same thing, but are hardened enough to withstand the onslaughts of the BCL's, hi—they gave up complaining yars and yars ago.

It is our prediction that Tommy Hall, W3ZJ, is high scorer for the entire world in the recent International Relay Competition.

After scoring 11,000 points in the first five days, our good friend, Roy Corderman, W3ZD, was forced to drop out of the contest because of a bad power leak; W3ZD, as you will no doubt remember, was "high" for the U. S. last year.

Also, W3BXI piled up a nice score.

W3TC is kicking over to Europe FB on 14 mc. phone from his new QRA in York, Penna.

Youse guys what hev ambitchions to QSO the "hard-ti-get" countries, hyar's a few furriners on 14 mc.: **ON4CSL in the Belgian Congo, (**If you don't like "20" you "CONGO" to 40.5—pee-yew!) **PX1AA in Andorra, and SU1EC in Egypt**—guess that will keep a few of you 20 meter hounds away from your day-time work for a while. We might also add that J2GX and J2IN are pounding in on the East Coast on the same band (20) in the afternoons. (West-coasters—that's around noon for you, so geeve a listen.)

W3BBB, Reading, is still working WAC "occasionally" on 7 mc. Some "occasion" says we.

Parke Cassidy, W3AQR, and one of the real old timers, recently tore down his rig, stored away all the parts and announced that he was permanently finished with radio. Sezzoo!!—we expect to hear his new rig on the air by late summer.

The East Coast gang are anxious to hear of new developments in the DX contest that will put the West Coast stations on a fair scoring basis.

W3BLG works ZL's and VK's with 300 volts on a 210 on 7 mc.!

W3UR is messing ((righto!) with grid modulation and threatens to work some 3.9 mc. phone as soon as he finishes with a new speech amp.

The Williamsport gang have announced their intentions of staging a 56 mc. "hidden transmitter" hunt in the near future.

The "dope" on your friends or interesting facts that you might have are socilited by W3CCF. All "3's" are asked to send in their "done" to W3CCF **48 West Main St., Mechanicsburg, Penna.**

W5BMI, "EF", Yoo-Hoos

W5IQ/WLUB keeps up the Army Amateur Radio System in Arkansas. He is State Net Control Station for Arkansas—in his idle hours he operates at KLRA.

W5BXM, another AARS member, is getting along great with a new 800 in the final stage and gets out very nicely. He's DNCS for the Arkansas "first" and the net is one that is worth listening to.

NOTE—Continued next month. No room on this page to tell more. Hi.

The Ladies Again

W9LW is the station of Miss Lucia Mido of Chicago, Ill. Miss Mida is rather distinctive among other YL's because her interest in radio was not brought about by any outside influences. As she says, she had always had a great fondness for mechanical things, so that the jump into radio was not as difficult as it might have been for other young ladies. Radio had always intrigued her, but her other activities took up so much of her time that this ambition to become a YL operator remained just an ambition for a long time. It might be said in explanation of these other activities, that she is a real, genuine champion golfer and has played in a great number of tournaments.

Activities at W9LW are not confined to any one branch of radio. Rag chewing, traffic handling, (ORS) and DX, all get their proper share of attention. Her DX record of 35 countries worked would do credit to some of her friends of the opposite sex. A great many photos of DX stations and operators, in addition to those closer to home, are kept in nice order in albums.

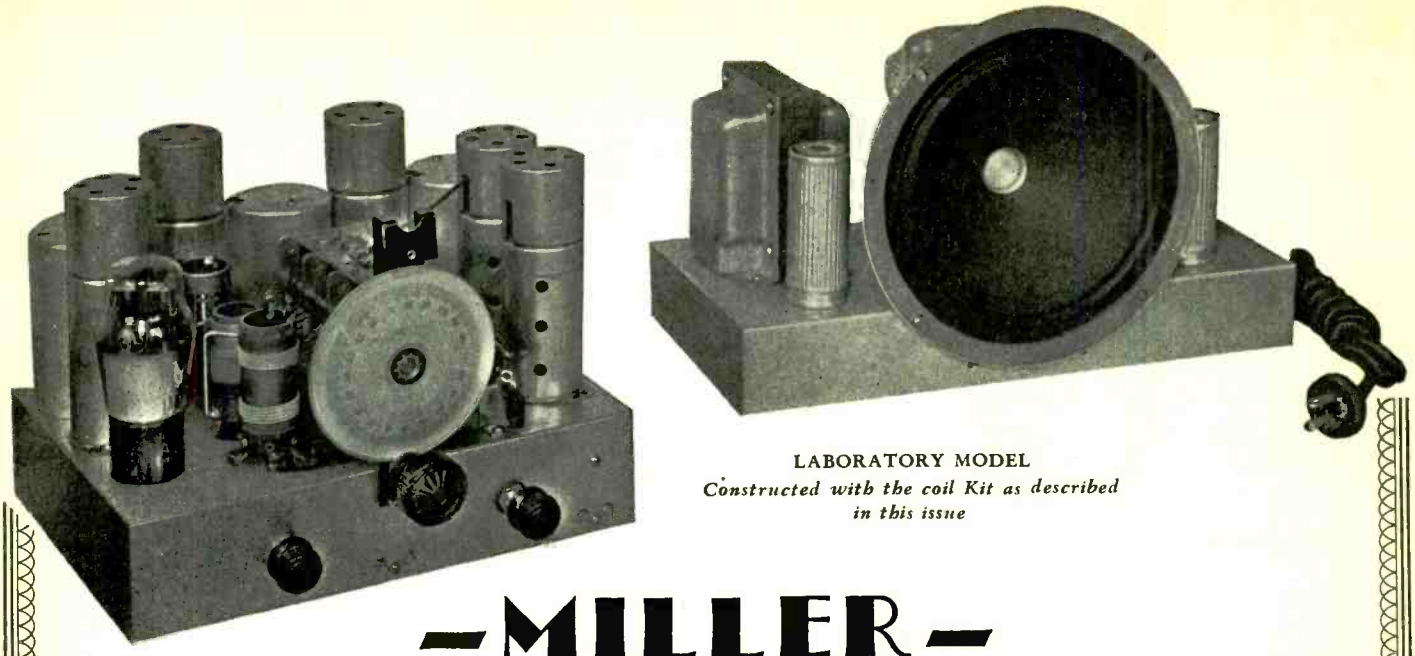
The transmitter at W9LW is built in a welded iron rack with a walnut panel. The three shelves of this rack all house a separate unit of the transmitter. The lower shelf contains the entire power supply which, in turn, also consists of three separate power units. The first uses an 82 which furnishes current to energize the time-delay relay. This relay is in the plate circuit of a slow heater type 227. As the tube draws plate current, the relay closes, this operation taking about 30 seconds. The time delay is in the 110 volt line to all of the plate transformers, thus allowing ample time for the filaments of the '66's and the '83 to heat. The second power supply uses a full-wave rectifier (83), with 800 volts on the plate, and is adequately filtered. The large power supply using a pair of '66's, delivers about 1200 volts, also adequately filtered. The transmitter proper consists of a 47 oscillator, a 46 doubler, a '10 buffer and a 211 final amplifier. This final is run at inputs in the order of 300 watts. Center-tap keying is used in conjunction with a good key click filter. The antenna is a 7 MC zepp with quarter wave feeders, and is strung between two 25-foot wooden towers which are in turn supported from the roof of a 50-foot building. The receiver is a Comet Pro, used with a tuned doublet receiving antenna.

Miss Mida is to be congratulated on her very fine station, to say nothing of the fact that her knowledge of code and theory was gained solely through her own efforts, there being no helpful amateur friend at hand during her early career.

W9LW will be very glad to QSO any of the gang and can usually be heard on the air nightly after 10:30 p.m. Here's a splendid chance to start your "Worked YL's in all continents." WYLAC!

W 9 L W

Miss Lucia Mida, Chicago



LABORATORY MODEL
Constructed with the coil Kit as described in this issue

—MILLER—
All-Wave Super-Heterodyne
COIL KIT—Model 711

Even the novice can build an all-wave super-heterodyne of advanced design by following the instructions supplied with the New Miller No. 711 All Wave Coil Kit. Prepared with the usual thoroughness for which all Miller kits are noted, it contains the essential parts required to insure proper results of the completed receiver.

OUTSTANDING PERFORMANCE ASSURED

NOTE THESE FEATURES:

Sensitivity: High sensitivity provided by the two stage intermediate frequency amplifier insures consistent reception from weak distant stations.

Selectivity: The Intermediate Frequency Transformers of the tuned grid and tuned plate type have been especially designed for use in this circuit to provide the proper selectivity and gain. The name MILLER is sufficient assurance they are the best available.

Low Noise Level: Every precaution has been taken in the design of the coils and circuit to assure the greatest amplification with the noise level reduced to an absolute minimum.

True Tracking: All bands are individually trimmed and padded. No panel operated trimmer required.

Low Image Response: The use of highly efficient signal tuning plus a high frequency intermediate amplifier (465 kilocycles) practically eliminates undesirable image response, and at the same time increases the sensitivity.

Full Wave Detection: The 55 type tube serving the triple purpose of detector, automatic volume control and first stage audio is fed from a specially designed full wave I.F. transformer, providing greatest efficiency in demodulating the carrier wave thus allowing the high quality of present day transmitters to be reproduced with excellent fidelity.

Simplicity: To be really successful any product must be fundamentally sound and simple. Complete absence of complicated circuits to confuse the constructor and cause difficulty in proper alignment of the completed receiver.

The following items are supplied in the Miller No. 711 Coil Kit:

1 B.C.Antenna Coil No. 711 Antenna
1 B.C. Translator Coil No. 711 A
1 75-200 Meter S.W. Coil No. 711 B
1 35-75 Meter S.W. Coil No. 711 C
1 12-35 Meter S.W. Coil No. 711 D
1 Input I.F. Transformer No. 711-1
1 Inner-stage I.F. Transformer No. 711-2
1 Output stage I.F. Transformer No. 711-3
2 Dual detector trimmers (TC-1-2-3-4) Catalog No. 35
4 Accurate Padding Condensers PC-1-2-3-4
1 Rectifier plate filter choke assembly No. 80F
1 Oscillator coupling condenser C-14
1 Wave Band selector switch
1 Full size blue print (12x18 inches)

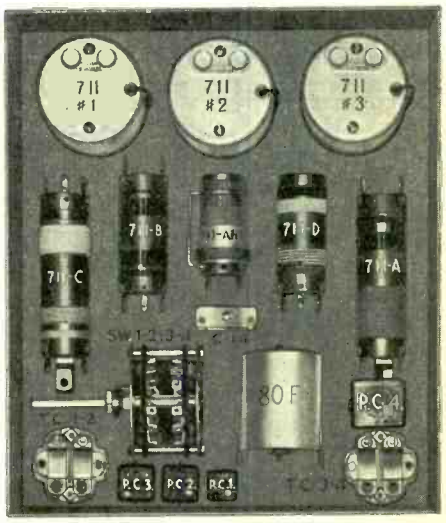
We can also supply the two unit chassis as pictured above, at the following prices:

Receiver Chassis, list price..... $2.50
Power Supply Chassis, list price..... $2.50

Jobber's Proposition Available in Some Localities

J. W. MILLER CO.

5917 S. Main Street, Los Angeles, California



Miller No. 711 Coil Kit, List Price, $16.00

All-Wave Superheterodyne

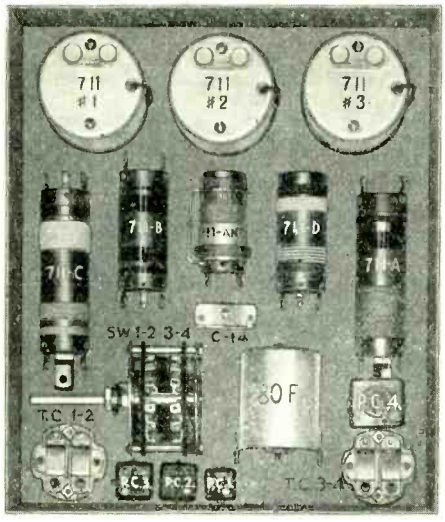
(Continued from page 25)

below the received frequency. A small capacity is also provided so the effective energy transfer is equal at all frequencies. This capacity is so small as to have negligible dampening effect upon the tuned circuits.

This capacity, which is in the form of an open-end turn of wire wound at the grid end of the detector coil, is not shown in the circuit, for reasons of simplicity. It is already connected to the proper lugs on the coil form, so as far as actual wiring is concerned, it need not be considered.

The 75 to 200 meter band is the only one in which high impedance antenna coupling is not employed. However, as the frequency range of this band is well below the natural period of almost any antenna installation, best results were obtained by using an aperiodic antenna primary for coupling. A high inductance primary on this band would of necessity resonate somewhere within the broadcast range, and if a powerful local station were operating on or near this frequency, severe cross-modulation would result. Furthermore, the band of received frequency is low enough at this point that image response is negligible. The same high efficiency of oscillator tracking is retained on this band.

THE broadcast band coils are of Litz bank wound construction, providing exceptional selectivity ahead of the first detector. Two such coils are used in a pre-selector circuit having a low degree of mutual coupling. This is not to be confused with the usual band pass circuits



MILLER NO. 711 KIT

which are designed for a flat top selectivity curve. The selectivity of this arrangement is equivalent to a stage of radio frequency ahead of the first detector, and yet eliminates the disadvantages of switching encountered with a radio frequency stage. Coupling between the preselector coils, is accomplished through the condenser, C-1 in the common ground returns of No. 711 Antenna Coils and No. 711A. It is important that no other coupling exists between these two coils.

The resistor R-1 serves to isolate the preselector coils from the intermediate amplifier.

The use of the 57 type first detector provides a degree of sensitivity impossible with other type tubes. The type 56 oscillator has been chosen as the best type to obtain sufficient oscillator output on the high frequency band where the L. C. ratios are of necessity quite high.

It is well to note at this point that many different type mixer circuits were tested before this combination was selected. Inductive coupling between the oscillator and first detector assures the home constructor of proper operation of his completed receiver due to the fact that this coupling is a fixed value and will not vary in individual cases as will other types, as, for instance, electron coupling circuits.

There has been some inquiry as to why the pentagrid converter type oscillator and detector was not employed in the construction of this receiver. This type tube while offering certain advantages has proven to be quite critical, especially at the higher frequencies and in fact some constructors have found it impossible to obtain satisfactory results anywhere below 40 meters. Some of this difficulty is, no doubt, due to irregularity of tube characteristics as well as variations in individual receiver construction.

If a panel-operated trimmer is used with inductive coupling, it is difficult to obtain resonance at the higher frequencies, due to the fact that trimming the detector circuit affects the oscillator frequency. Inasmuch as this receiver does not employ a panel-operated trimmer and as the circuits track without adjustment, after once being trimmed at the high frequency end of the band, there is no disadvantage in using inductive coupling.

THE intermediate amplifier transformers supplied with the kits have been especially designed for use with this receiver, and afford a degree of sensitivity and selectivity seldom obtained. The Miller Company has long enjoyed a reputation of supplying THE BEST in intermediate frequency transformers, and the units supplied with this kit represent the result of several years' experience in manufacturing quality products. Excellent frequency stability is obtained due to the use of a well balanced L. C. ratio in the tuned circuits and coil windings of remarkably high "Q". These coils are Litz wound and are thoroughly protected against the effects of moisture by a process known as flash dipping in a special compound of highly refined vegetable waxes. As a further assurance of obtaining a product of uniformly high quality, each intermediate frequency transformer is peaked at the proper frequency and the gain checked before packing.

The balance of the receiver is not critical, but we would suggest the wiring be placed as nearly as possible to that shown in the photographs. It is not strictly necessary to adhere to the chassis layout as shown, WITH THE EXCEPTION OF THE COIL, SWITCH and CONDENSER LAYOUT, otherwise, the performance will be impaired.

However, the choice of a two-unit type chassis was chosen as the most popular type after considering the pros and cons of the many requests and suggestions submitted to us during the past few months. The separate tuner is admirably suited to rebuilding old type radios, which are equipped with a high quality audio amplifier, or as the tuning unit for any type power amplifier you may desire to construct. Furthermore, it is simply necessary to substitute the 6.3 volt series tubes of corresponding type and provide the proper B supply, and an All Wave battery set for the mountain cabin, seaside or motor launch is the result. No hassis layout is shown of the power supply, as this will vary in individual cases. The unit as pictured also incorporates a speaker mounted upon the power supply chassis, but this is not strictly necessary. Connection between the two units are most conveniently made by use of a 7-prong plug and cable of the type commonly used for speaker or battery connections.

The tone control is located on the power supply and speaker chassis, although this may easily be placed at the rear of the receiver chassis. As this control is seldom adjusted it is not placed on the control panel. This would complicate the panel layout and detract from its appearance by the addition of another control.

AFTER the receiver is complete, all wiring checked and the proper tubes in the sockets, the voltages of the various circuits should be tested with a good high resistance voltmeter (1000 ohms per volt or over). If these correspond with those marked on the blue print, you may proceed with the balancing of the IF amplifier in the following manner:

First, open the cathode circuit of the first IF tube and insert an 0-1 milli-ammeter.

Second, with the set "On," the oscillator tube removed from the socket and the variable condensers fully meshed on the broadcast band, connect a test oscillator to the cap of the first detector tube (57), leaving the cap of the tube on. Set the test oscillator at 465 KC. Beginning with the first IF transformer, adjust the trimmers for minimum current on the milli-ammeter, continuing with the second and third IF transformers. It is a good idea to repeat this procedure in order to prevent error.

Third, replace the oscillator tube and adjust the test oscillator to 1500-KC. Set the receiver dial at approximately 10 (on an 0 to 100 division dial) and with the test oscillator connected to the antenna post, adjust the trimmer condenser on the oscillator section of the variable condenser until the meter dips as before. Now proceed by adjusting T'C 4 (this is the small trimmer condenser which replaces the regular gang trimmer as explained on the circuit diagram) for still further meter deflection. It is recommended that the receiver now be connected to an antenna before the antenna circuits are adjusted. With the antenna connected, tune in a station at the highest frequency end of the band and adjust antenna trimmer for minimum meter current, continuing by retrimming T'C 4.

The variable tuning condenser should not track over the broadcast band. If any further trimming is required it may be obtained by a means of split sections on the gang condenser. However, do not bend the plates any more than is absolutely necessary, otherwise difficulty will be experienced in the balancing of the short wave bands. Do not readjust trimmers for other parts of the band other than the original settings.

The short wave bands are adjusted by the following procedure: Set wave band switch to the band desired, turn the receiver dial to the highest

frequency end, or with the condenser plates out. Now adjust T'C, 1'2' or 3 (depending upon which band is being received) for the highest noise level. There should be a definite point at which resonance occurs, which point should be readily apparent.

NOTE: When adjusting the 12-35 meter band it is possible to reach resonance at two points with the trimmer. If this occurs, use the setting requiring the highest trimmer capacity. This band should be adjusted with the dial at approximately 20.

Important: While adjusting the short wave bands do not disturb the oscillator trimmer setting. This is adjusted only on the broadcast band. Furthermore, it is necessary that the receiver be connected to an antenna during the procedure of trimming the short wave band.

In conclusion, if you have deferred the purchase of an All Wave Kit because you have felt reception on the short wave band is not practical, or you have perhaps been prejudiced by the attempt to sell the idea of short wave reception by offering a 3 or 4 tube receiver, you need wait no longer.

This is to be the greatest year of radio activity since the often lamented "Old Days," and it may be traced directly to short wave interest. However, to realize the maximum benefit resulting from this interest the receiver you build, whether for yourself or for a customer, must be good, and such a receiver is easily constructed with the new improved Miller Model 711 All Wave Super-Heterodyne Coil Kit.

The following items are supplied in the Miller No. 711 Coil Kit:

No. 35.

1 B. C. Antenna Coil No. 711 Antenna.
1 B. C. Translator Coil No. 711A.
1 75-200 Meter S. W. Coil No. 711B.
1 35-75 Meter S. W. Coil No. 711C.
1 12-35 Meter S. W. Coil No. 711D.
1 Input I. F. Transformer No. 711-1.
1 Inner-stage I. F. Transformer No. 711-2
1 Output stage I. F. Transformer No. 711-3.
2 Dual detector trimmers (TC-1-2-3-4) Catalog No. 35.
4 Accurate Padding Condensers PC-1-2-3-4.
1 Rectifier plate filter choke assembly No. 80F.
1 Oscillator coupling condenser C-14.
1 Wave Band selector switch.
1 Full size blue print (12x18 inches).

COLOR CODE of Oscillator Padding Cendensers supplied with Kt.

400 mmfd. Yellow, Black, Brown.
1600 mmfd. Brown, Blue Red.
3000 mmfd. Orange, Black, Red.
10,000 mmfd. Brown, Black, Orange.

All other parts as listed below are standard units, and may be obtained through your local jobber.

PARTS LIST

1 Miller No. 711 Kit.
1 Receiver Chassis.
1 Power Supply Chassis.
1 3-Gang Condenser .0035 mfd. per section.

NOTE: Most variable condensers now on the market have a maximum capacity of .0036 mfd. to .0037 mfd., rather than the usual range of .00035 mfd., the operation of the completed receiver is not affected by using the higher values found in the newer condensers. The effect is simply to cause the wave bands to overlap a slight bit more.

5 Tube Shields.
1 Power Transformer.
1 Dynamic Speaker, 2500 ohm field, 245 output transformer.
1 4-Prong Wafer Socket.
1 5-Prong Wafer Socket.
5 6-Prong Wafer Sockets.
1 7-Prong Wafer Socket (for power supply connection).
1 7-Prong Plug (for power supply connection).
5 Screen grid clips.
1 Dial.
2 Knobs.
A. C. Cord, Plug and miscellaneous hardware.

RESISTOR LIST

All resistor wattage ratings are one-half watt, unless otherwise specified.

R1 —500,000.
R2 —10,000.
R3 —100,000.
R4 —10,000.
R5 —150.
R6 —15,000—2 Watt.
R7 —10,000—2 Watt.
R8 —1,000.
R9 —1 meg.
R10—100,000.
R11—100,000.
R12—500,000 Potentiometer.
R13—500 Ohms—1 Watt.
R14—50,000 Tone Control.

CONDENSER LIST

C1 —.05 mfd. Pre-Selector coupling condenser.
C2 —.1 mfd. 200 V.
C3 —.1 mfd. 400 V.
C4 —.25 mfd. 200 V.
C5 —.25 mfd. 200 V.
C6 —.25 mfd. 200 V.
C7 —.001 by pass cond.
C8 —.0005 Plate by pass.
C9 —.01 mfd. coupling cond.
C10—10 mfd. electrolytic by pass cond. 25 volt.
C11—8 mfd. electrolytic filter cond. 450 volt.
C12—8 mfd. electrolytic filter cond. 450 volt.
C13—.25 mfd. 400 volt.

(Continued on page 30)

Sumner B. Young's Address

(Continued from page 7)

capable publicity department whose business it will be to see that the public hears of our exploits and that it does not forget them.

The results produced by such a department may at first be discouragingly slow to appear; but such a department should be regarded as a "long-pull" investment; and it should not be abolished when hard times appear, or when some of the editors decide that they would like to have their salaries raised.

I believe firmly that legislative matters should be left in the hands of a special legislative committee to be composed of specially-qualified members or directors, together with able and experienced counsel. It is foolish to allow one man to be Editor of "QST," General Manager of the League, Secretary and a self-styled "International Lobbyist" at one and the same time.

Furthermore, this legislative committee should not act on the defensive at all times, but should turn aggressive; with the commercial interests in a position where their business is by no means too good, and with a democratic administration in power at Washington, the present seems to be as good a time as any for taking positive steps to obtain more frequencies. I have a feeling, too, that the commercial would have more respect for us if we fought back more than we have in the past.

Warner's Dismissal Asked

THE next thing to do is to fire Warner. It is my firm opinion that no real changes of policy can be successfully carried out so long as he remains.

We should see to it that the directors whom we elect are able men, and we should then insist that they actually direct.

It has been my observation, in practising law, that the directors of many business corporations do not direct. Many times one big sotckholder fills the board up with his nominees, and has everybody buffaloed.

When it comes to banks, many directors are placed on their boards in order to attract business to the banking institution. They are not expected to direct. An executive committee runs the bank. I even heard a director of one of the largest banking institutions in Minneapolis testify in a hearing before a Referee in Bankruptcy that he had been placed on the board in order to bring in business to his bank, and that that was what bank directors were supposed to be for.

Keep "stuffed shirts" and incompetents of the Board of the American Radio Relay League. Put in men who will not allow the Executive Committee to "run wild on the bases." See that the board keeps the Executive Committee within proper bounds, and do not allow it to decide major questions of policy.

Furthermore, I would move the headquarters of the League out to Chicago, or to St. Louis, or Kansas City. Compared to any one of these cities, West Hartford is provincial. It is not central. It is inconvenient for directors' meetings. It is not a centrally-located mailing point.

Although I was born near Cape Cod, and lived in Boston many years, I believe that the atmosphere of the West and Middle West tends to give a man a broader outlook than the atmosphere of New England.

By all means, get rid of all possibility of commercial influence in the League. Allow only licensed "Hams" to be members of the League. **Why give League membership to anyone who will pay $2.50?**

Make membership data available to all members. In the present state of affairs, nobody, **not even the Board of Directors,** knows just how many of our members are licensed "Hams." This is a ridiculous situation.

The legal difficulties of re-organizing so that only licensed "Hams" may be members of the League, and be entitled to vote, are not insurmountable. They could be solved if the will to solve them existed.

More Confidence Needed

ANOTHER very important step in our program of self-preservation is to build up the morale of the members of the League.

There are several steps to be taken, not all of them pleasant.

First of all, I would get rid of any officers and editors who have out-lived their usefulness.

Second, I would insist that the officials of the League take the members into their confidence and "come clean" in "QST" as to what the League is doing, and as to what is going on from time to time.

I would most certainly open the pages of "QST" to "Vox Pop" ideas. Good ideas can stand the racket of honest thinking and of honest discussion.

Quit "talking down" to League members. Many of them have grown up, although the present regime in West Hartford apparently has failed to recognize this phenomenon.

Pay the members of the League a nominal price for articles published in "QST" and encourage them to participate in this way in the work of the League.

Last, but not least, build up "QST." Much dust seems to have been thrown into the air as to the net circulation of "QST"; but there is no doubt at all of the fact that the magazine has not grown as fast as the "Ham" population has grown. Furthermore, many of the "old-timers" have lost interest in it, and maintain that it has lost its "punch."

In conclusion, I want to say this:

I hope that what I have said has made you do some thinking.

Furthermore, I hope that you will feel like doing something about it, because the situation is critical, and stagnation at a time like this is suicidal.

●●●

All-Wave Superhet

(Continued from page 29)

C14—25 mfd. (.0025 mfd.) cond. (supplied with Kit).
C15—.001 Plate by pass.
C16—.05 400 volt condenser.

TUBES REQUIRED

1 Type 56 tube oscillator.
1 Type 57 tube first detector.
2 Type 58 tube intermediate frequency amplifier.
1 Type 55 tube detector AVC.
1 Type 2A5 tube power amplifier.
1 Type 80 tube retifier.

If it is desirable to use batteries instead of AC operation as shown, the following types would replace those listed above.

1 Type 37 tube oscillator.
1 Type 6C6 tube first detector.
2 Type 6D6 tube intermediate frequency amplifier.
1 Type 85 tube detector AVC.
1 Type 41 tube power amplifier.
No rectifier tube is necessary.

Any first-class make of tube may be used. Do not, under any circumstances, jeopardize the excellent results possible with this coil kit by using tubes of unknown quality.

NOTE: If you are interested in receiving data and information sheets of this type in the future, communicate with us at once, giving your correct mailing address. Simply address J. W. Miller Company. Attention Engineering Dept., 5917 Main St. Los Angeles.

NOTICE! Those who wish to advertise in these RADIOADS columns and who do not desire to divulge their names and addresses can use BOX NUMBERS, and all inquiries will be mailed, unopened, to the advertisers.

MOTION PICTURE CAMERA—Wilart newsreel camera. Standard 35 mm. professional (theater) size; all metal construction, footage counter, visual focus, 200 goot outside detachable magazine, fitted with F-5 Wollensak lens. Taken in trade. Camera is used but is in first class condition. Hand cranked, but can be silenced in a blimp for sound pictures. Cost new about $250.00. Will sell for $55.00, with 200 feet of unuseal, late dated panchrimatic film. D. B. McGown, 1247 Forty-seventh Ave., San Francisco, Cal.

THE SHORT-WAVE MANUAL, by W6AAM. Over 300 circuits and sketches. Low-power grid modulated phone circuit. Complete data for building modern equipment. $1.00 postpaid. Don C. Wallace. 4214 Country Club Drive, Long Beach, Calif.

NEW 1934 ARRL HANDBOOK. Get this new book by subscribing to "RADIO" for 6 months. Total cost, Handbook and subscription, $1.95. "RADIO", San Francisco, Calif.

"WANTED" OLD RADIO MAGAZINES, ALSO ENGINEERING SUBJECTS. WRITE LIST AND PRICE. Jacques A. Kurtz, 100 E. 18th Street, Brooklyn, N. Y.

Back copies of "RADIO". Few only available. 25c each, postpaid. Edw. J. Byrne, 253 West 128th St., New York, N. Y.

BARGAINS: Five kilowatt water cooled tube, practically new, guaranteed, $90.00. Commercial shortwave receiver, RCA Model AR1496-D, licensed for commercial use, cost about $350,000, sell for any reasonable offer. Motor-generators, cheap, DC generators, to 2000 volts, also 500 cycle generators ,too many to list, write your needs, for example—2 k.w. General Electric 500 cycle generator only, $20.00; 120 Volts DC to 220 volts 500 cycles 2.5 KVA AC, motorgenerator, with shaft extended for drive by 1750 RPM induction motor, $35.00. Navy SE143 receivers CHEAP. Five likowatt General Electric Co., 120 Volt DC generator, direct connected to 4 cylinder G. E. gas engine; cost about $1800.00 sell for $200.00; good operating condition; no use for same. (F.O.B. San Jose, Calif.) Can supply 90 cells Edison battery for use yith this unit, making complete power plant, batteries 150 A.H. capacity, for $250.00 extra. Navq CW 936 and Signal Corps SCR 67 radio telephones no p(ower supply or tubes) $25.00 each. Fine for 160 meter phones with slight alterations. Lathe—small woodworking bench type, new, $4.50, fine for small shop. 1 k.w. Poulsen Arc, (arc only) $50.00 Large quantity of transformer core punchings, silicon steel, for large or small transformers. CHEAP; winding data is desired. Poulsen Telegraphone (steel wire recording machine) $75.00 used. Western Electric, 205D tubes, new, $5.00 each. Some used Amertran transformers and Weston meters, CHEAP. View camera, 6½" x 8½", less lens, with back extension, plate holders and carrying case, used, fair condition; takes good pictures; $17.50. Can supply lens if desired. Several power supply units for power amplifiers or small transmotters, 350- 450- 500- 600 volts, sell for cost of parts. D. B. McGown, 1247 Forty-seventh Ave., San Francisco, Calif.

QSL AND SWL CARDS, 200, $1.00, W8ESN, 1827 Cone, Toledo, Ohio.

866's—1000-hour guarantee, $1.49. Heavy duty corrugated mesh filament. Full-sized tubes; standard characteristics. First quality, not seconds or "phoney" make; 825's, $4.95. Money back if not satisfied. Howard Radio, 314 Pine Ave., Chicago, Illinois.

TRANSMITTERS manufactured to order. Transmitters reconstructed. Holmes C. Miller, Box 105. Palo Alto, California.

Banehawk Super

(Continued from page 11)

F THE IF transformers are all mounted on a common base, even though thoroughly shielded above and on both sides, intercoupling is still possible. This is because the coils induce a field in the common sub-base, which field induces a current in the other transformer by cutting the lines of force of its field. This can be avoided by shielding each coil on all sides, as was done in our unit, by mounting a small plate to the bottom of the shield can and in turn mounting this to the common base on a two-point suspension by means of studs. This type of shielding is used on the first two transformers and the BFO only; it is not considered advisable to so mount the other two transformers. These shield plates serve as a mounting plate for the trimmer condensers and the coil assembly. The shield cans are fastened to this base by means of spade bolts.

Variable bias is provided for both the IF stage and the second detector. In the case of the IF stages, this variable control is standard practice for controlling volume. In the detector circuit it is rather a refinement, but is considered very essential in obtaining the optimum adjustment of bias for the proper operation of the bias detector.

Variable adjustment of the resistance from grid to ground in the 2A5 stage also offers a nice control of the audio volume. Many times it is highly adyisable to set the cathode resistance in the IF stages for maximum gain and adjust the volume solely by means of the audio control. This feature is particularly effective in reducing the loud crashes common in sensitive supers, and is only fully appreciated when using the earphones on weak signals.

Tone control, while not a necessity, is really an excellent addition to any receiver and is to be recommended when using a pentode in the output. It will effectively cut-off the high frequency hiss, common to this type of tube, without materially reducing the gain.

The Beat Oscillator

IF THE beat oscillator is completely shielded it will reduce the terrific increase in noise usually experienced when the oscillator is switched on. Again, as in the IF stages, the coil, condenser, gridleak and grid condenser are enclosed in a shield can which has its own base mounted by means of studs to the chassis. Several methods of coupling this oscillator to the detector were tried, but the simple expedient of coupling from the oscillator plate circuit to the detector grid gave the best results. The coupling condenser should be a small one, and can usually be of the twisted-wire or sleeve type. Adjust this condenser to give the best beat note, being careful that no more energy is coupled than is needed. If the oscillator is properly shielded, only the very weakest of beat notes should be heard with the lead from the plate circuit entirely removed. By-passing the plate and screen resistors at the power supply end will usually reduce stray coupling through the power supply.

Both the plate and screen leads of the IF stages have series resistors and by-passes. This is a really-good way to avoid coupling back through the supply leads.

Instead of the usual RF choke in the plate lead of the detector we use a resistor. This resistor does the same work as the choke, and is very much cheaper. The by-passes on either side are absolutely essential to avoid a peculiar sort of trouble. On strong signals, a bias power detector is very apt to act as a doubler. With a strong signal on the grid, it is very probable that the generated harmonics will be strong enough to give a peculiar bunch of "peeps" down on the higher-frequency bands. The choke-condenser, resistor-condenser will eliminate this trouble by its filtering action.

(To be concluded in next issue)

Osockme, Japan.
March 23, 1934.

Sir Editor Impersonator of "RADIO":

State of war become existing at Scratchi abode since you make publication my letter from last month in whichforth I berate broadcast program makers for contemptible advertising which they splatter into air waves. I have just open morning male in which come letter from Hon. Health Inspector who inform me unless such letter writing to you shall stop and cease without further continuation it will become necessary for Board of Health authorities to take me to city dumps where I shall be buried without benefit of music. I make assurance that such kind of letters will no longer reach you. I have hanging on meat hook here some 378,000 other letters, many which I cannot fully understand because such are written with foreign accent. My brother, Itchi, ask me to request you make publish all these letters in magazine, so will send them to you collect as soon as I can find suitable expressman who will take chance on sending them to you in such manner.

I have make unusual progress with receiver engineering since you come into possession of my last letter. It no longer become necessary for me to hear six stations at every point on tuning dial; I now hear only four. Results of great experimentation prove that most all good receiver give about alike splendid performance. I have built great Wallace Receiver with two tubes in circuit, with slight modification which I find give better results. I have installed crystal detector in place of first tube and use no tubes in audio stages. Otherwise the circuit remain the same.

I have also make eleven large Banebuzzer stupidheterodynes which have spanking oscillator to beat incoming signals into audibility and insibility. I then also construct some of Gainer receivers except I use knee-action principle for tuning dials because only kind of variable condensers available here come equipped with square bearings, which make condensers sometimes difficult to turn.

I take all of my receivers to radio club meeting last week ago, and give profound speech on "Receivers with tubes vs. receivers without tubes." Most of club members agree that receiver with tubes give more volume than such which use no tubes. Dehate on such matters will continue at next meeting.

After technical speeches become closed at meeting, Hon. President make announcement that discussion become thrown open to politicians. One member say that Kernel Foster have right slant on Treaty. Another member say, "I take instructions from H.Q. which inform me that Treaty make no difference if person forget to read one paragraph from text. Another member say he never heard of H.Q. and ask what means such abbreviation. Hon. President smash gavel down on table and say with great wrath—"Sillyarss, don't you know what H.Q. mean?—that, my friend, mean Hind Quarters."

At such moment tension become quite tight until one member from back row take large brick out of pocket and threaten to throw through any person who make further mention about how amateurs get treated with treaties.

Meeting come to adjournment with mention from Hon. President that all members deposit 10 cents for dues in tin can which Hon. Treasurer will hold at door as members file out. Visitors who enjoy free use of clubrooms and who have attended more than three meetings in a row are requested to deposit nine dollars instead of only ten cents which fully-fledged members pay.

Great argument over such proposition flare up which delay adjournment of meeting so long that power company turn off electric lights and all members quietly sneak out of window in darkness instead of going through door to pay membership fees. Hon. Treasurer remain standing at door, waiting for members to come back to pay fees, and six days after I write you this letter he are still standing there with tin can in his hand, waiting for people to bring money to him.

Hoping you are doing the same, I am,

Your astounded Reader,

Scratchi

The Decibel

(Continued from page 21)

have we succeeded in getting, over and above the pair of 45's?

The nominal power output of 10 watts is approximately 32 d.b. level, or actually we will JUST BE ABLE TO NOTICE THE DIFFERENCE; generally this is about 1 step on a control pontentiometer. If 10 watts is not enough and we must have more power, the largest triodes available (the 2A3) must be used. These will give a maximum undistorted power output of 15 watts, or a level of plus 34 d.b., which is but two d.b. above the output of the pair of UX-250 tubes, and only 5 d.b. above the output of the pair of UX-245 tubes.

By dint of terrific struggle, buying new apparatus and rebuilding the system, we have gained just a noticeable increase in power. But is this actually true? The answer may be both yes and no . . . and still be entirely truthful. The larger tubes are more desirable because they will function satisfactorily on ALL low level conditions without distortion or overloads. It is much better practice to run tubes at least a little below their ratings; then the peaks of high-level sound will carry through without distortion.

If we are trying to fill a theatre or auditorium with sound, the volume to be covered also becomes a very important factor. Many people who will put-up with a terrible sounding broadcast set at home are super-critical when they pay admission to a theatre or other place of entertainment. The sound level required for theatre and auditorium use is also greater than is necessary for a residence or small room, due to the various noises unavoidably present, such as ventilator systems, audience noise, etc.

Average Sound Levels

WHILE the acoustical conditions, personal preference, type of music, or program and similar matter must be considered, the following average sound levels can be taken as quite satisfactory to determine the proper energy levels for loudspeaker units:

Hotel rooms, plus 7 d.b.; hotel lobbies and public rooms, general entertainment plus 5 to 10 d.b.; paging and calling systems, plus 10 to 15 d.b. (averaging one speaker to each 500 feet of floor area, in multi-speaker installations). Factories, noisy, plus 35 to 45 d.b.; average plus 20 to 25 d.b. Residences, quiet, 12 to 15 d.b. Noisy locations, 20 to 30 d.b. Theatres, small 1200 seats, plus 30 d.b.; 3000 seats, plus 35 d.b. Large (to 5000 or 6000 seats) plus 40 d.b. Outdoor installations, general entertainment, plus 25 to 30 d.b. Public speaking, plus 30 to 45 d.b.

Usually it will be found that a reasonably low level will suffice for multi-speaker installations, with a proper control to gradually reduce the level to zero. Occasional individuals with poor hearing sometimes demand extra loud reproduction, but rarely do they need more than plus 30 d.b., or thereabouts. The table (Fig. 5) shows a theoretical set-up which will be of help in planning a loudspeaker installation. Obviously, it is rather flexible, the results depending upon the judgment, experience and personal preference of the user.

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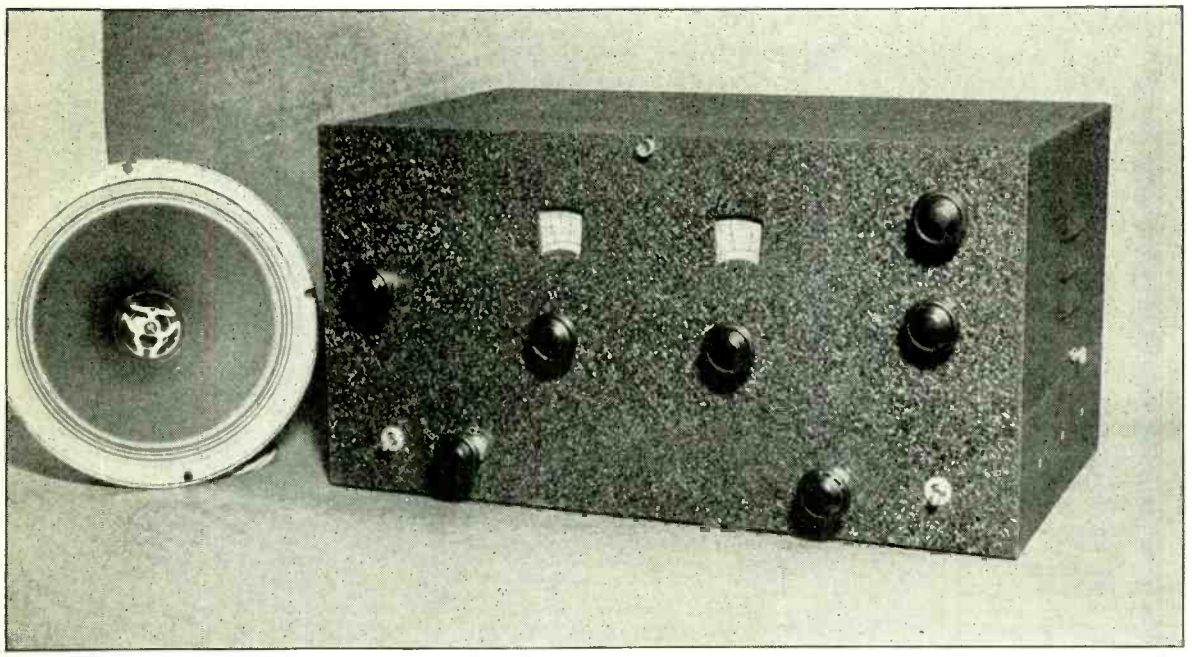
Standing Electric Waves and Transmitting Aerials

MANY interesting analogies can be drawn between sound and electricity. Among these is that between stationary or standing sound waves and stationary or standing electric waves. Sound waves are waves in the literal "air," while electric waves may be in a wire, or in the "ether." The motion of the particles of the gases in the air carry the wave from one point to the next, while in the case of standing waves in wires, it is the motion of the electrons in the wires which carries the disturbance from point to point.

McMURDO-SILVER

5B SUPER . . . *choice of those who know!*



From a western publisher comes the following comments as a result of test and operation by Colonel Clair Foster (W6-HM) on the new 5B Single Signal Super:

"Colonel Foster liked that 5B so well that, when KA1LG asked him what super was best to buy, the Colonel told him to buy the 5B."

Among many other enthusiastic comments from users of the 5B the following from Mr. L. P. Stowe, W4CEI, is representative:

"Your 5B receiver set up here last week and working very fine; the more I use it the better I like it. I was interested in the receiver only as a ham receiver and it's the best set that has ever been my privilege to operate, both on phone and on CW. The selectivity on phone is almost unbelievable with the xtal in the parallel position, and on code the variable pitch OSC and the S.S. xtal filter makes solid copy more the rule than the exception."

SEND 3c

stamp for new complete catalog describing above items, E. C. Frequency Meters, New Airplane Dials, Relay Racks, RF Chokes, Audio, Power and Filter Transformers, and a host of new and interesting amateur and commercial apparatus.

—SPECIFICATIONS—

Circuit—Eight-tube superheterodyne.
Tubes—'58 tuned RF, 2A7 1st detector—E.C. oscillator, two '58 tuned IFS, '58 audio beat oscillator, '56 second detector, '59 output, 5Z3 rectifier.
Range—1550 to 30,000 KC—five amateur bands on 1 dial.
Tuning—One main illuminated vernier tuning dial, smooth and easy, directly calibrated in megacycles. Band spread tuning anywhere in range—amateur, broadcast, commercial. 100 degree band spread 20 and 40 meters—200 degree spread 80 and 160 meters.
Wave Length Change—Same, positive, 6-gang wave change switch approved by Admiral Byrd and used in his four MASTERPIECE IIs.
IF Amplifier—Dual air tuned, Litz wire . . . 465 KC.
Beat Oscillator—Electron coupled '58. Beat note pitch adjustable from front panel.
Sensitivity — Better than one microvolt absolute.
Selectivity—Circuit designed, built and adjusted for crystal resonator, without crystal, band width 21 KC 10,000 times down. With crystal, absolute single signal (50 cycles wide).
Power Output—3 watts undistorted. Supplied complete with Jensen dynamic speaker, and head phone jack on front panel.
Shielding—100% perfect, all parts individually shielded. Overall cabinet shield easily removable with 6 thumb nuts.

Price $59.70

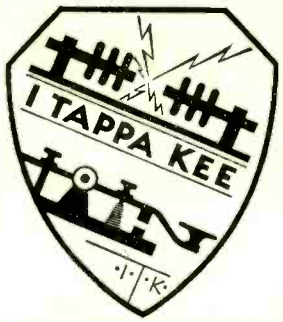
net to amateurs with eight guaranteed and tested Raytheon tubes. Each set complete with selectivity control, crystal switch, phasing condenser and crystal socket—ready for insertion of crystal. Add to above price $9 net for Bliley crystal with holder, and complete crystal alignment—complete price, ready to go single signal with crystal, $68.70.

McMURDO-SILVER, INC.

1741 BELMONT AVE. CHICAGO, U. S. A.

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, 1302 "M" Street, Bakersfield, Calif.

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, 1911 Forest St., Bakersfield, California.

MAY Low-Power Contest

NO ONE seemed to have any luck in the February Speedometer contest. This was partly caused by an error in the dates and the fact that those who did get on okay couldn't induce their 230 tubes to qso anyone. Avoiding previous mistakes, here's a new low power contest for you to shoot at with a good prize to the winner.

Time: Saturday, May 12 and Sunday, May 13, Pacific time.

Power: Input to your final stage must not exceed 10 watts.

Object: QSO as many stations as possible (any amateur station) and at distances that will win you the greatest number of points.

Scoring: Use a good map and count the sky-miles (air distance) between your station and the station you QSO. Add up the score for each contact after the contest is over and obtain your total points or mileage just as a speedometer would do on a trip. Example: IRF station QSO's station "A" at 500 miles distance and station "B" at 600 miles distance. Total score for these two contacts 500 plus 600 equals 1100 miles or 1100 points. Example: IRF station contacts a station at 7000 miles distant. Score for this one contact 7000 points or miles.

Finally: In order to qualify for a chance at the prize, send in your total score showing stations contacted to IRF headquarters immediately.

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Division and State Chiefs

THE following have been added to the complement of DC's and SC's in order to fill vacancies: Chief of the Southern Division W4AFM, Illinois State Chief W9KA, Idaho State Chief W7AVP, Washington State Chief W7AHQ, Nevada State Chief W6BPO, Montana State Chief W7BNU, Minnesota State Chief W9DCM, Connecticut State Chief W1CNU, New Hampshire State Chief W1SK. Congratulations, men! We are proud of you!

●●●

New Members

WE EXTEND welcome to these new brothers: W9RO, W3GS, W5AMK, W8DHU, W8EGI, W8BBL, W1BZC, W6BPO, W6BNH, W9KG, W9EPX, W6FIT, W9DCM, W9AYP, W1DUK, W2ATG, W3CGU, W2AIZ, W9GMV, VE5AG, W6GXV, W6DUY, W8BFG, W8BTK, W6FFU, W8EVC, VE3HP, VE5BJ, VE5KS, W2GOT, K6AJA, K6COG, W7CFE, W6BVD.

●●●

Ottention, IRF Members!

TO THOSE of you who are also A.R.R.L. members it is our sincere wish that your membership in this Fraternity will not in any way detract from your loyal support of all good principles of that organization. At all times let your actions be in support of things that are for the betterment of amateur radio, whether this progress comes through the medium of the A.R.R.L., the International Radio Fraternity or any other society.

●●●

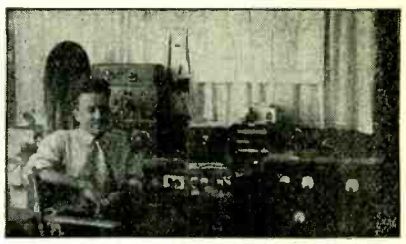
Trunk Lines

ALL brothers who have obtained crystals ground to the o¾cial IRF frequency of 3645-7290 KC please report same to Chief of Communications W6ETJ in order that you may be organized into trunk lines and fitted into the IRF Traffic Network.

●●●

I Tappa Kee

SEVERAL plans are being submitted whereby the old ITK name may be used as a part of this International Radio Fraternity. The present name could be indicated by the Greek letters Iota Rho and the Sorority branch of Iota Rho Sigma. These ideas will be discussed thoroughly in the official news bulletin "The Lightning Jerker".



I.R.F. Radio Station W7AHQ

OPERATING probably the oldest active station in the Northwest, Lightning Jerker Raymond Naser of Anacortes, Washington, has for the past fourteen years made the signals of W7AHQ familiar ones to the ears of amateurs everywhere. For back in 1919 he became the proud possessor of "wireless" equipment to the extent of a Gilbert toy set consisting of a sliding coil and crystal detector. A Duck navy type loose coupler was the next step and this in conjunction with a pair of old Brandes "cans" and a spark coil (formerly owned by a Detroit millionaire), Brother Naser took to the ether signing his initials "RN" for a call. Not content with this "elaborate" layout of equipment he soon acquired a set of honeycomb coils, a Moorhead detector valve and a pair of W.E. fones. All of which he still keeps, in fond memory.

On August 20, 1920, he secured an amateur class license and in the year to follow was fascinated by the crash of his ½-KW spark. Ah! those were the days when you could hear the rig work. Then came CW which, after being viewed with much suspicion (as did we all) was accepted and taken into the fold and W7AHQ was heard on 160 meters by reason of several UV202's. About 1924 fone came in for a little consideration and then in 1926 Raymond entered the YMCA Radio School in Seattle resulting in his acquiring a piece of paper on which was enscribed "Commercial License", etc. Then work at KPQ broadcast station and service work.

Today W7AHQ looks back on a record of constation has undergone the many changes identified sistent operation in his home town since 1920. His with the rapid progress of radio and is now using a pair of '10s in PP Hartley with a National FB7 receiver. Power supply is 866's, 750 V. 8 mfd. in filter. Normal operating frequency is 3630 KC. Time: 2-4 p.m., 7:15 to 8 p.m. and 9 to 10:30 p.m. Brother Naser is Secretary o fthe Radio City Amateur Club, member of ROWH, age 29, single, and interested in all phases of amateur radio. Other hobbies are sports, boats and photography and attending ham conventions. He hasn't missed an important convention for the past nine years! He will take an important part in ITK affairs in the Olympia Division. Keep an ear open for ITK Nr. 148 for that's Brother Naser!

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Single-Wire Hertz Antenna

(Continued from page 23)

tively and efficiently. The lone advantage over other systems is that there are no line or feeder spreaders which will leak in wet weather, no matter how fine or how expensive the insulators may be.

Matching the Feeder to the Amplifier

WE HAVE now only the problem of matching the feeder to the tank of the final amplifier. This has always been a source of loss and inefficiency—not only with this type of antenna but with any other. The method of accomplishing a good match at this point recently described by Arthur Collins of the Collins Radio Company very neatly dispatches this difficulty. It is especially of value because it attenuates harmonics which are so profusely generated by using a hard-driven, very low-C, high-efficiency final amplifier.

The circuit for his suggested impedance matching array is shown in Fig. 1. It will be seen that it looks much like the circuit of a brute-force filter such as is commonly used for plate supplies. The coil L2 can be any type of low-loss coil, and the condensers should of course be low-loss, also. The point at which to clip onto the amplifier tank will have to be determined experimentally. It will not be especially critical, as the im-

(Continued on page 35)

Single-Wire Antenna

(Continued from page 23)

pedance-matching array will take care of most of the matching necessary.

C2 should be set at a rather high value, the tank of the amplifier having been tuned to resonance with the clip off the tank. With the clip attached to the tank, C1 should be rotated rapidly, until the amplifier plate milliammeter again dips sharply to a minimum, indicating resonance. C2 is then adjusted for a maximum reading in the feeder ammeter with the lowest possible plate current in the amplifier circuit. It may be necessary to readjust C1 slightly to obtain this condition.

A ground for this antenna-system is essential for best performance, although the majority of amateurs aren't using a ground with the system at all. It should likewise be the best ground-system you can arrange.

The feeder must run at right angles away from the antenna for at least a quarter wavelength or you never will get the standing wave off it. Measurements with a field-strength meter will show an immediate increase when the feeder is running at right angles even though it may have been only slightly off a right angle formerly.

The length of the feeder can be any convenient figure. Sharp bends at any point should be avoided, however, and as a precaution it is wise to cut it to some non-resonant length. If it is so long that you cannot readily measure it accurately to determine whether it happens to fall into a resonant length, and if you can't get the standing wave off it, try inserting mica condensers of a suitable value and voltage rating, or small coils, in the line, as the natural response period can frequently be varied in this manner.

This antenna works well on its harmonics, although it is wise to check the impedance match of the line and the antenna on the harmonics in the same manner they were checked for fundamental operation. Frequency changes may alter some of the constants, and it may well be that the attaching point will be different for a doubled frequency. If the difference is considerable, make a clipping arrangement at the determined points on the antenna, and haul the wire down to change the feeder point if you are going to go after dx on a different band.

Those of you who really give this old friend a real trial will be pleased with what it can do with a minimum of fuss once its kinks have been ironed out.

●●●

5 Or 10 Meter Transceiver

(Continued from page 8)

inch. For coupling into a single wire feeder a condenser spacing of about 1/16 to 1/8 inch is usually correct. An antenna that I've had excellent results with in a car, is a quarter wave rod mounted on one of the front fenders with a stud bolt. The fender acts as the ground plate to which the bottom of the quarter wave rod should make good electrical contact. The single wire feeder should then be connected to a sliding clamp ring for final coupling adjustment. This point is always about one-fourth of the way up from the base of the rod. An insulated guy clamp should be mounted towards the top of the rod and fastened to the side or top of the car body.

For five meters this antenna rod should be four feet long with the feeder connected one foot up from the base. For 10 meters the rod should be 8 1/3 feet long with the feeder connection up about 25 or 26 inches from the base. The feeder can be a No. 14 rubber covered wire running through the car to the set. A seperable battery plug and cable are a great convenience because a 25 foot extension cable can be made up so the set can be used with an antenna hung to a tree near the automobile. The car storage battery may be used to supply the 1.6 amperes for filament drain and 2 to 4 amperes dynamotor drain.

Col. Foster's Comment

(Continued from page 5)

without finding a single critical reference to a commercial radio company.

When the ARRL became the owner of "OST" the members were all amateurs. They were the owners of "QST" and of the League's assets. Just from the start of "QST" there were subscribers who were not members of ARRL, but they had no part in the ownership of the assets. Then, it seems, after Warner took charge, it was conceived that a greater profit could be made by giving each subscriber, whether an amateur or not, membership in the ARRL and making him a part owner of the assets.

The records are hazy as to when this plan was made, but it was within a few months after the purchase of "QST". In "QST" for March, 1920, page 24, there appears among the editorials, "An Announcement". It says that while merbership (including "QST") had theretofore been $2.00, and subscription alone $1.50, "that policy seems inconsistent now that the ARRL owns "QST." "And so", continues the announcement, "the separate subscription arrangement is going by the board as outgrown". It is announced that the yearly rate will be $2.00.

"To start off the new system and reconcile the differing dates of membership and subscription expirations now on our books," says Mr. Warner, "we will issue membership certificates to our present non-member subscribers up to the date of expiration of their subscriptions, without charge, so that thereafter the two will expire simultaneously.

The announcement ends, "The 'QST' reader who is not enthusiastic for ARRL organization and what we can do through teamwork is a rare bird. Of course 'QST' will be available separately on the newsstands but we'd like to have him as a member and make a believer out of him. Let's build up our membership".

And thus the admirable concept of a league of licensed amateurs "went by the board as outgrown", too. After that nobody had to prove that he was an amateur and owned a station in order to obtain membership in the ARRL. Officials of radio communications corporations, radio manufacturers, radio dealers and other non-amateurs flocked in, until by 1923 one director—who was also Communications Manager of the ARRL—asserted at a meeting of the board that of a membership of some 14.000 less than 20 per cent were licensed amateurs.

But all the old, "Of, by and for the amateur", "Non-commercial organization", "The sole representative in legislative affairs", "The only amateur organization recognized by the Government", "Practically every worthwhile amateur in the world is a member", "Our high standard of ethics", "Lovalty to the League", "Fraternalism", "The ARRL spirit"—all of this old stuff has been retained right down to the present day to give the impression that the ARRL is made up of amateurs.

The President of the ARRL in his recent annual report to the directors urges them to adopt means for "unmasking' the amateurs who are causing the present "agitation" against the policies and practices of the League. Just here would be a good place to suggest that if there is any unmasking to be done the process would better be applied to an organization that has for years masqueraded as an amateur association while it is composed far more of commercial people than amateurs.

Presumably the acceptance of commercial people as members of the ARRL and part owners of its assets was approved by the then Board of Directors, but I find no record that the sanction of the owners was ever obtained, or even asked. Officers or directors of a corporation cannot legally make a present of a part ownership of the corporation's assets to anyone whatsoever. Only the owners themselves can do that.

Now Draw Your Own Conclusions

SO NOW the commercial people not only are in position to influence the policies and actions of the ARRL through their advertising support but they are members and part owners—and by far the larger part. And the ARRL is substantially a commercial publishing business, using amateur radio for profit. That the amateurs have got something from the ARRL goes without saying. The exploiter always has to give the exploited something; otherwise the crop of suckers would give out and there would be no more supporters to exploit. But if anyone wishes to see how the amateurs have fared with the ARRL "acting as spokesman in amateur affairs" let him look at what the amateurs had when the ARRL began its career and what they have now.

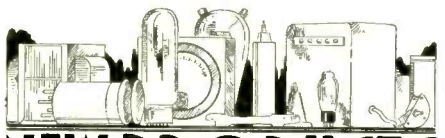
The amateurs of the United States most certainly need an organization of their own. The ARRL could be that organization if the directors were willing and able to clean house (as urged by that intelligent and forthright group in Minneapolis), divorce the League of all commercial and other non-amateur elements, remove it from all semblance of profit motive and from all commercial influence. If the ARRL will clean house in this manner, and then tell nothing but the plain truth about itself, it may yet survive and become a useful adjunct to amateur radio. If it does not, then, unquestionably, the amateurs of intelligence, experience and integrity will group themselves for their own advancement and for protection against exploiters.

CLAIR FOSTER, W6HM.

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

Special Duty Na-Ald 50-watt Adapters and Plugs

These new products will appeal to the independent radio service man; many now handle calls for service on Talkie Equipment. With this new field open they will be interested in the several new ALDEN products announced here, new products which will enable them to use their present equipment for analyzing fifty-watt tube circuits of Talkie, Public Address, Transmitter Equipment, etc.

No. UX-50 adapter accommodates any tube with a 50-watt base in the UX panel socket of Set Analyzers.

The adapter necessary to change the Analyzer Plug base to the 50-watt base is the **No. 50-7AS** when supplied with the small-seven-contact socket-top with locking stud, although any type top with or without stud is available.

Two more new items are the De Luxe Insulated Tube Cap Lead **No. 91** for standard receiving tubes, and **No. 92** for the large cap used on transmitting tubes such as the 866, 872, etc.

Another new item is the **No. 967DSA** which permits the use of six prong Latch-Lock Analyzer Plugs in the sockets of the small based seven-prong tubes for analyzing their circuits.

Elements of Engineering Acoustics, L. E. C. Hughes. 8s. 6d. Published by Ernest Benn, Ltd., Fleet St., London, England.

A very complete and modern book on Acoustics and the principles involved in making the necessary corrections to rooms, auditoriums and other acoustical chambers. The treament is modern and is from the viewpoint of the sound technician. A very valuable book for anyone in the radio broadcasting, public address, sound recording or allied fields.

* * *

Radio Construction and Repairing, James A. Moyer and John F. Wostrel, $2.50. Published by the McGraw Hill Book Co., New York, N. Y.

As the name suggests, a book devoted to construction and repairing, with a minimum of theory, except where theoretical explanations are needed for the sake of exposition. A book adapted for anyone who wishes a complete story of the principles involved in repairing and constructional work, without the need of lengthy expositions and theoretcal discussions.

Streamline Beauty

Captivates American housewives and brings quick, easy profits to Crosley dealers . . .

Ventilated Front

This feature of all Crosley models permits cool air to be drawn from the front and warm air expelled from the rear, properly ventilating power unit even when refrigerator is placed in limited space or close to wall.

THE NEW CROSLEY SHELVADOR

provides about 50% more "*usable*" storage capacity

ALL of the new Crosley models — both Shelvador Series and Tri-Shelvador Series — feature the now famous Shelvador. When the Shelvador—an exclusive and patented Crosley feature—was first presented to the American housewife over a year ago, it created the greatest sensation in the history of home electric refrigeration.

Increases "Usable" Capacity About 50%

Shelvador increases the "*usable*" food storage space about 50%. It provides a definite place for small items. As an example: in the Shelvador, an orange occupies exactly the space that an orange should—not the space of a bottle of milk.

Now Comes "Streamline Beauty"

All of these new Crosley Shelvador and Tri-Shelvador models are *streamlined*. They fulfill the dream of every woman for a refrigerator that does justice to her home, her kitchen, and can be a daily source of pride—can be "lived with" as well ten years from now as today.

Compare These Features

First comes Shelvador, then the ventilated front, automatically illuminated interior, no-stop defrosting control (defrosts while refrigerator is operating), chromium plated stamped brass hardware of modern design, thorough insulation throughout (including door), round cornered porcelain interior, white lacquer exterior with black trimming, ample tray capacity for quick freezing of ice cubes.

$99.50

MODEL EA-35

This Crosley Shelvador has a NET capacity of 3.5 cubic feet with a shelf area of 7.5 square feet. It is equipped with two 21-cube ice trays—42 cubes in all. It incorporates all of the Shelvador Series features described to the right. Dimensions: 48 11/16" high, 23 7/8" wide, 24 7/16" deep.

Model EA-43

4.3 cu. ft. NET capacity, 9.15 sq. ft. shelf area, 2 ice trays—42 cubes—one double depth tray.

$117.00

Model EA-55

5.5 cu. ft. NET capacity, 11.6 sq. ft. shelf area, 3 ice trays—63 cubes—one double depth tray.

$145.00

ALL MODELS HAVE AUTOMATICALLY ILLUMINATED INTERIOR

ADDS THREE ADDITIONAL EXCLUSIVE FEATURES TO THE FAMOUS SHELVADOR

CROSLEY TRI SHELVADOR

IN addition to all of the outstanding features of the Crosley Shelvador Series described above, the Crosley Tri-Shelvador Series incorporates three additional features never before combined in a home electric refrigerator.

1—THE SHELVATRAY . . . When articles are wanted from the refrigerator, place Shelvatray in a horizontal position, place the articles on it and carry them, Shelvatray and all, to table, range or cabinet. Shelvatray (patent pending) is an exclusive Crosley feature.

2—THE SHELVABASKET . . . Handy for greens, carrots, cabbages, canned goods and the like. Another exclusive Crosley feature. Swings with the door. Shelvabasket is not refrigerated. (Patent pending.)

3—THE STORABIN . . . A place for potatoes, onions and other bulky items. Exclusive with the Tri-Shelvador. Storabin is not refrigerated. (Patent pending.)

In addition to these, the Tri-Shelvador models are equipped with a self-closing porcelain door to the freezing chamber. Model E-55 Tri-Shelvador (right) has 5.5 cu. ft. NET capacity, 11.6 sq. ft. shelf area, 3 ice trays—63 cubes—one double depth tray. You must *see* the new Crosley Shelvador and Tri-Shelvador electric refrigerators to appreciate fully the advancement in refrigerator design, convenience and performance that they represent. See your Crosley distributor—ask him to show you both series—make every comparison that occurs to you—your good judgment will then dictate which electric refrigerator to handle. ***All models available in full porcelain at slight extra cost.***

Model E-43

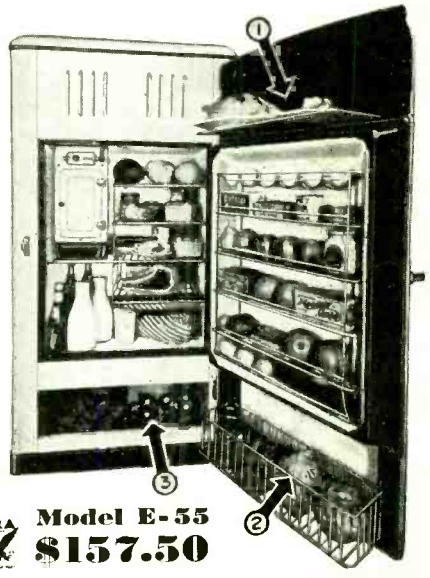
4.3 cu. ft. NET capacity, 9.15 sq. ft. shelf area, 2 ice trays—42 cubes—one double depth tray.

$135.00

Model E-70

7 cu. ft. NET capacity, 14.9 sq. ft. shelf area, 4 ice trays—84 cubes—one double depth tray.

$185.00



Model E-55

$157.50

Montana, Wyoming, Colorado, New Mexico and west, prices slightly higher.

The Crosley Radio Corporation - Cincinnati

(Pioneer Manufacturers of Radio Receiving Sets)

POWEL CROSLEY, Jr., *President*

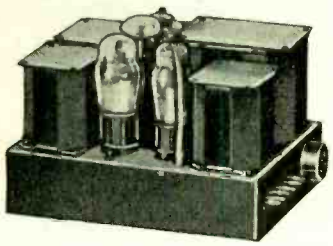
Home of "*the Nation's Station*"—WLW

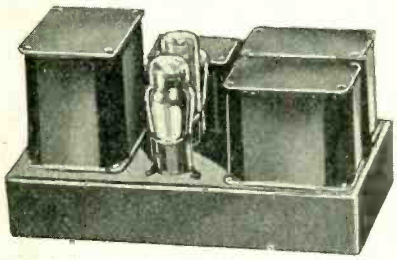
ALL PRICES INCLUDE DELIVERY..INSTALLATION..ONE YEAR FREE SERVICE

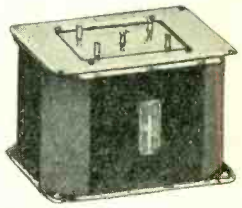
UTC

presents

New CLASS B AMPLIFIER Circuits







High power output — vastly improved performance — excellent regulation—in tested, accurately designed class B amplifiers for the 800, 830B, and 203A tubes.

- Class B 800's will deliver 100 watts audio to a class C RF stage using 852's or a single 203A, 211, 242A.
- Class B 830B's will deliver 180 watts audio to a class C RF stage using 203A's.
- Class B 203A's will deliver 225 watts audio to a class C RF stage using 852's, 860's, 203A's, 211's, 242A's.

CIRCUIT FEATURES

- Driver stage may employ either 42's in A prime triode connection or fixed bias 2A3's.
- Highly filtered stable C bias supply is used—separate bias adjustments balance plate current of each output tube.
- Class B output transformers carry plate current of class C stage. Trap resonant filter increases filtering efficiency of rectifying system.

UTC Components Used in the 800, 830B, and 203A Class B Amplifier Circuits

INPUT DRIVER TRANSFORMERS TO CLASS B GRIDS

Type	Purpose	List price	Net to Dealer-ham
PA-53	Push-pull 42, 45, 50, or 59 plates to two class B 242A, 800, 830, RK-18, or 210 grids.	$7.50	$4.50
PA-54	Push-pull 2A3 plates to two class B 203A grids.	8.50	5.10
PA-57	Push-pull 2A3 plates to two class B 830B, 800, RK-18, or 210 grids.	7.50	4.50

CLASS B OUTPUT TRANSFORMERS TO RF LOAD

Type	Primary Load Impedance	Will Match	Secondary Load Impedance	List price	Net to Dealer-ham
PA-60	6000 ohms plate to plate	Class B203A's	3000, 2500 ohms	$30.00	$18.00
PA-62	10,000 ohms plate to plate or 6000 ohms plate to plate	For 10,000 ohms: Class B 830B's For 6000 ohms: Class B 203A's	10,000 ohms or 2500 ohms	32.50	19.50
PA-80	12,500 ohms plate to plate	Class B 800's, RK-18's	5000 ohms, 3000 ohms	20.00	12.00
PA-82	12,500 ohms plate to plate or 8000 ohms plate to plate	For 12,500 ohms: Class B 800's, RK-18's For 8000 ohms: Class B 242A's, 211E's	20,000 ohms or 5,000 ohms	25.00	15.00

CLASS B INPUT SWINGING CHOKES

Type	Swinging Action	Current Range	DC Resistance	List price	Net to Dealer-ham
PA-101	5 to 25 henrys	15 to 150 MA	115	$5.00	$3.00
PA-103	5 to 25 henrys	20 to 200 MA	110	8.00	4.80
PA-105	6 to 30 henrys	25 to 250 MA	90	12.00	7.20

TRAP RESONANT SMOOTHING CHOKES

Type	Inductance	DC Output	DC Resistance	List price	Net to Dealer-ham
100	8 henrys	150 MA	115	$5.00	$3.00
102	10 henrys	200 MA	110	8.00	4.80
104	12 henrys	250 MA	90	12.00	7.20

FILAMENT AND PLATE TRANSFORMERS

Type	Purpose	List price	Net to Dealer-ham
PA-34	Filament transformer—2½ V.C.T. 10 amps for two 866's—5000 volt insulation.	$7.50	$4.50
PA-111	Plate transformer—750 or 900 volts each side of center at 200 MA—for class B 800's.	15.00	9.00
PA-112	Plate transformer—1250 or 1400 volts each side of center at 400 MA. For class B 203's and 830B's.	35.00	21.00
PA-106	Filament transformer—2½ V.C.T. at 10 amps. 10,000 V. insulation. 2-10 V.C.T. 3.5 amp. windings for 203A's.	15.00	9.00
PA-102	Filament transformer—7½ V.C.T. at 6.5 amps for 2-800's, RK-18's, 825's, 210's. 5000 V. insulation.	11.00	6.60
PA-115	C bias plate transformer for 203's, 830B's, or 800's using one or two 82 rectifiers.	10.00	6.00
PA-116	Plate transformer—1250 or 1400 volts each side of center at 200 MA for class B 800's.	25.00	15.00

The new 1000-B Bulletin is ready

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