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RADIO

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No. 216

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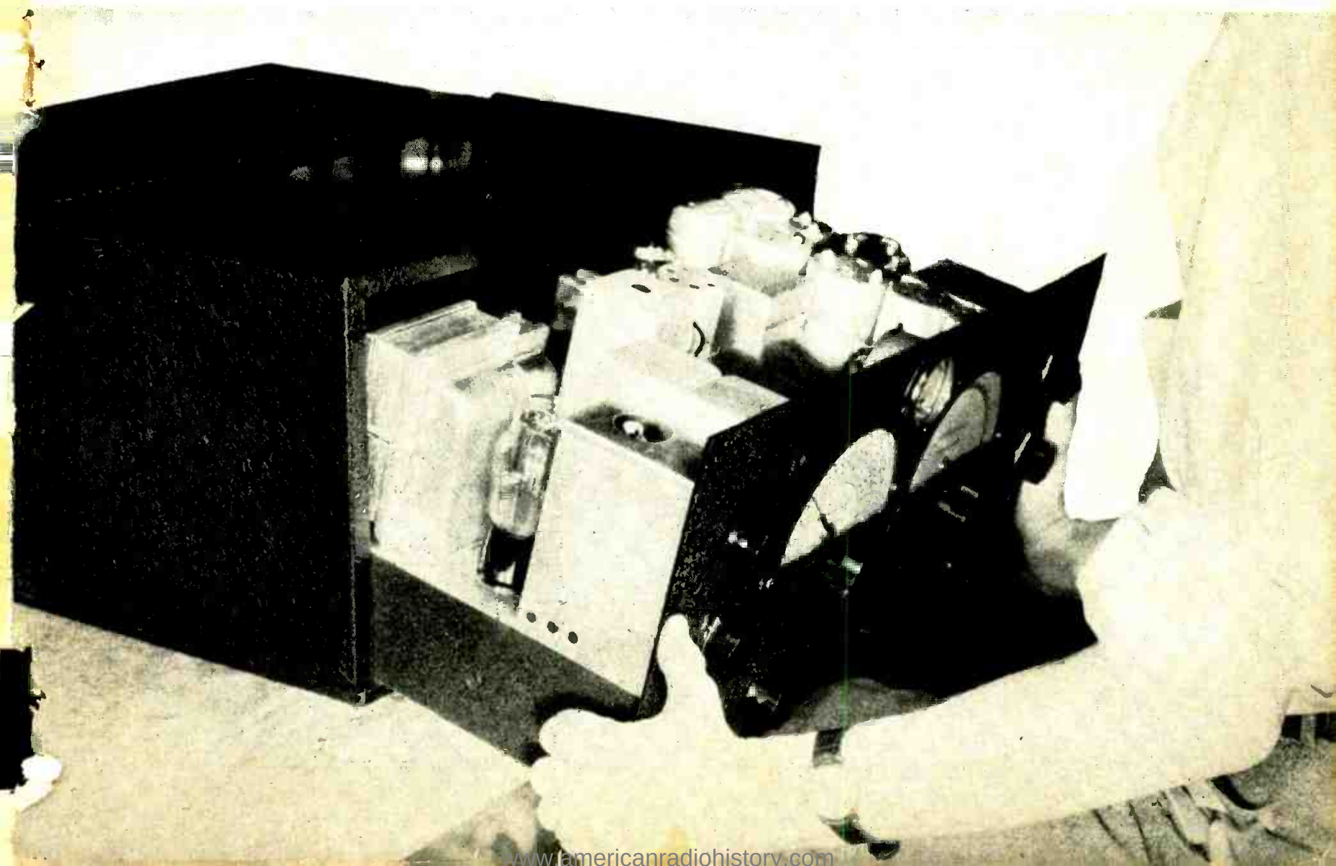

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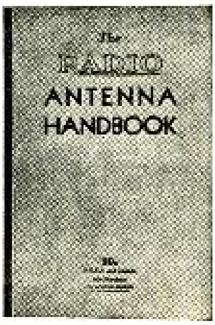

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORT WAVE AND EXPERIMENTAL RADIO

RADIO

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Since we regard current "chiseling" policies as decidedly unfair, a small payment will be made, usually upon publication, for accepted material of a technical or constructional nature. Freehand, pencilled sketches will suffice. Good photographs add greatly to any article; they can easily be taken by the layman under proper instructions. For further details regarding the taking of photographs and the submission of contributions see "Radio" for January, 1936, or send stamp for a reprint.

Audio Selectivity with "Selectophones"

By F. Malcolm Gager*

The "selectosphere", the highly selective transducer (loudspeaker) described by Professor Gager in the October, 1936, issue, created international interest. The many advantages of this device can be incorporated in a headset device as well. In this article the new "selectophones" and their characteristics are described in detail.

For several years the author has been actively engaged with the merits of high selectivity in general and audio-frequency high selectivity in particular. Feeling that the communications art had missed an excellent opportunity to increase its overall efficiency by not investigating and applying the full benefits of audio frequency high selectivity, several models of both active and passive transducers were evolved in various shapes and forms. One, namely the selectosphere, was recently described[1]. This article, detailing considerations of noise vs. signal along with the very high selectivity and amplitude-limiting characteristics of the device (the first as a function of frequency and the latter the driving force) revealed the selectosphere as a practical filter-speaker, yet not a common loudspeaker in the ordinary sense of the term.

The problem of the selectosphere's design was a jigsaw puzzle with the three principles of electrical, mechanical, and acoustical resonance involved. In addition were economic considerations, which usually temper such combinations in the production of a physical entity. However, since the design of a filter-speaker can be expanded in dimensions just so long as one does not require an additional room to house it in, no severe difficulties were encountered. This statement might cause one to infer that the selectosphere is large. On the contrary, its overall height is about seven inches.

Concurrent with the development of the selectosphere, a companion problem of somewhat similar character was undertaken. This problem entailed the production of a device within the confines offered by a head telephone and one which would bring about a device which would preserve the two main desirable characteristics of the selectosphere which are graphically indicated by figures 4 and 5 of the aforementioned article[1]. With all the problems of the selectosphere encountered in this research, it was considered of importance to add that the new device should perform indiscriminately, as far as possible, in detector output circuits as well as voltage or power audio amplifier circuits. One form of the result of both mathematical speculation and experimental confirmation about to be described received the name *selectophone*—like the *selectosphere*—for want of a better one.

The Selectophone

The selectophone's internal mechanism (shown in figure 1) makes it very evident that Nathaniel Baldwin's type C receivers were seized upon for their suitable case and magnet, inasmuch as the writer was not in the business of carving magnets or molding whatever they mold when they mold head telephone cases.

Figure 1 specifically indicates the internal parts of two selectophones. The upper center unit is completely assembled, i.e., the magnet is attached to one end of the elastic member about which the exciting coil is fixed, while the other end of the elastic member is fixed to the anchor plate. The anchor plate is the sole means of support for the unit, and it is held firmly to the case by the screw cap of the receiver itself. Surrounding the assembled unit are seen the permanent magnet, anchor plate, and coil elastic member combination of an unassembled unit.

In principle, figure 3-A indicates the arrangement of these devices. Like the selectosphere, the selectophones have an elastic member around which the exciting coil is firmly mounted. In addition they contain a permanent magnet which is assisted by the ampere turns of the exciting coil in order that the equivalent spring and mechanically suspended mass will elongate in frequency harmony with the exciting coil's alternating voltage driving component even when the plate current is small.

One end of the permanent magnet is attached to the free end of the elastic member and floating thereupon, free of any constraint from the molded receiver case and the anchor plate. The other end of the elastic member acts, along

*Dept. of Physics, Boston College, Chestnut Hill, Massachusetts.

[1] "Audio Selectivity With The Selectosphere", Radio, Oct. '36.

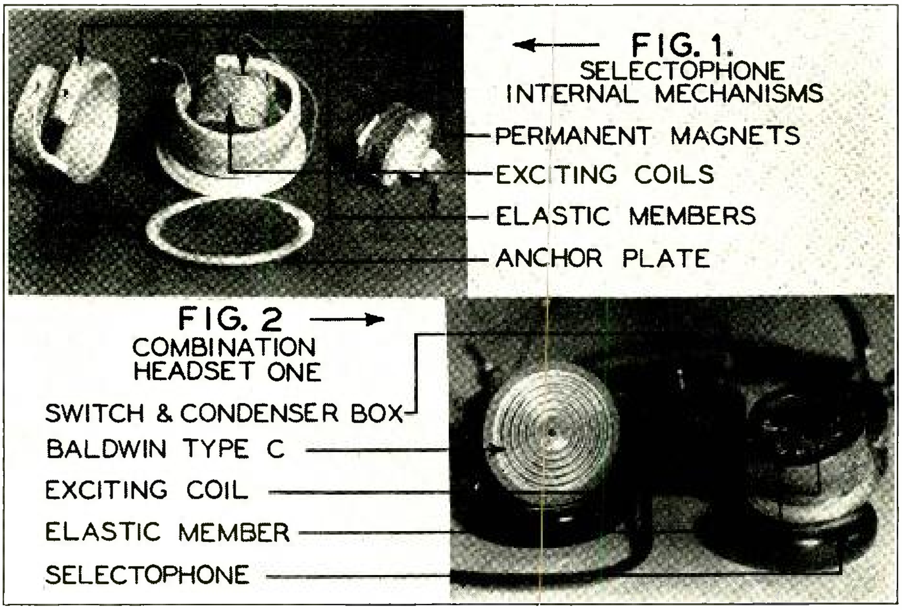


FIG. 1. SELECTOPHONE INTERNAL MECHANISMS

FIG. 2 COMBINATION HEADSET ONE

with the mass of the exciting coil in this model, as the effective mass loading of the mechanical-resonance system. Similar to the selectosphere, accoustical resonance in the selectophones is derived from an internal air cavity and a combination of orifices. Electrical resonance is accomplished by shunting the exciting coil with a suitable condenser, which can be attached directly at the coil for added mass. In the phones here shown they are located in the switch box located at the Y portion of the regular telephone cord.

In describing these devices the terms *equivalent spring, elastic member, mass loading,* etc. are used. Inasmuch as these terms were treated in detail along with the magnetic action of the equivalent spring in the paper describing the selectosphere, and they are technically applicable to the devices of this article, the reader is referred to the former paper for the sake of brevity.

The dynamic characteristics of the selectophone in its several forms are similar to figures 4 and 5 of the aforementioned article, and are for the same reason not repeated here. It should be mentioned, however, that the selectivity of the selectophones is not as high as that obtained with the selectosphere, because of weight limitations. But they still offer selectivity which cannot be duplicated by electrical means alone. It must be remembered that selectivity curves of any device do not tell the entire story, and only by actual operation can the transient response of a device be appraised. The latter is due to the fact that such curves are taken in the steady state. For the time being let us confine the discussion to combination headsets where the unique properties of the selectophones are utilized in practical models.

Combination Headset One

The head telephones shown in figure 2 indicate that one receiver is an unaltered Baldwin type C while the other is a selectophone as previously described. This headset is provided with a light aluminum box (a truncated shield can, much larger than actually necessary) located at the Y portion of the telephone cord. This box contains a s.p.d.t. switch and the electrical resonance condenser for the selectophone circuit in accordance with the wiring diagram of figure 3-B. This arrangement displays a practical means of switching from the standard Baldwin type C unit to the high-selectivity noise-reducing selectophone by the snap of a switch. The versatility of this combination headset cannot be overestimated, because both telephone quality and high selectivity are available at will for telephonic or c.w. reception.

Combination Headset Two

For the ardent c. w. listener or the phone man who has accustomed his aural senses to the English language with a major portion of the sideband energy clipped, the headset of figure 4 is helpful and distinctively advantageous. This particular headset combines two selectophones of dissimilar characteristics having different peak response frequencies and noise-interference background eliminating capabilities. Like the combination headset two, figure 2, this pair of receivers has a switch box containing a s.p.d.t. switch and condensers in

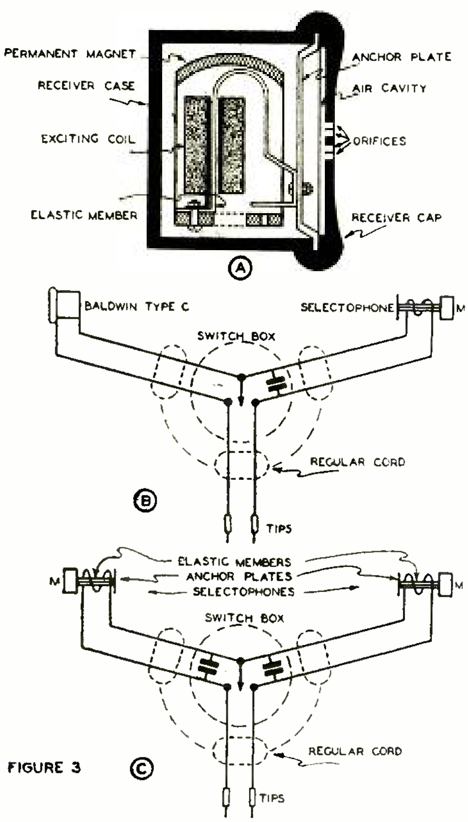


FIGURE 3

accordance with figure 3-C and located at the Y junction of the telephone cord. The wearer can thus shift from one high selectivity selectophone to the other and utilize the characteristics of either one at will.

Reception Tests

The high selectivity and noise-reducing qualities of the selectophones in their several forms are similar to those attributed to the selectosphere, and as such they also rival crystal filter reception as backed by laboratory tests and communications use at WIPR. In addition, like the selectosphere, they can as a practical matter be used to advantage in conjunction with a crystal filter, although a crystal filter is certainly not necessary to their performance.

The sensitivity of the selectophones on peak frequency response is comparable with the regular Baldwin type C as long as one operates below the point of deformation saturation of the equivalent spring. In other words, under the *usual reception sound levels* employed with head telephones, the response of the selectophone compares with the Baldwin type C, indicating no appreciable loss or gain by insertion. This information is not linked with an ear test only. All amateurs should be aware of the fact that of all the senses the ear is perhaps the most unreliable on loudness tests. When a signal is strong and the background noise is reduced by high selectivity, the loss of the noise power appears to drop the intensity of the signal more than is actually the case. On the other hand, with the same high selectivity device if a signal is just above the background noise level, the reduction of the background noise level by its insertion appears to make the signal much louder. The response of the ear to total sound power and the intricate effects of masking produce some curious results. One should not forget on the other hand that the ear is also a very wonderful mechanism. We can hear a pin drop on a carpeted floor and the same ear is still intact after the firing of a large caliber gun (provided one opens his mouth!).

Quite naturally the statement on sensitivity is tempered by the actual peak response frequency of the selectophone, since the steady-state frequency-response of most head telephones resembles the contour of a mountain range. Due to weight and space limitations set by the confines of the Baldwin type C receivers, it is possible conveniently to arrange peak responses between 1000 and 3000 cycles. This is accomplished by different elastic member lengths and loading masses. The identical volume offered by the Baldwin type C in different geometry would allow other response characteristics.

The headsets described here, as well as several others, have been tested in detector circuits where the d.c. plate current is small; as the plate load circuit-impedance of tubes such as the '56 where plate current is moderate; and as the load impedance for power pentodes such as the 59, 42, 6F6, 2A5, etc. with satisfactory performance.

Use and Experience

Not every listener financially able to own a crystal filter receiver appreciates or knows how to operate a crystal filter to its fullest capabilities. This statement is supported by such articles as the recent one by Conklin[2], and the numerous advertising efforts of the receiver manufacturers. Likewise the user of selectophones and the selectosphere, even though these devices are readily attached to existing receiving equipment, must accompany his reception efforts with sound reasoning.

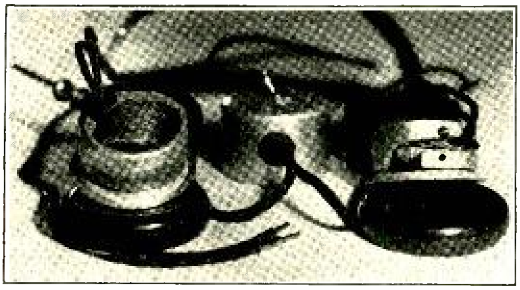


Figure 4

Combination headset two, showing selectophones of different peak frequencies and noise-interference eliminating capabilities. Switch and condenser box in background.

Due to their high selectivity one must use a receiver which has a band spread tuning rate which is comparable to, or better than, the National FB-7 for example. Otherwise signals will be tuned past without the operator's knowledge of their presence.

The selectophones and the selectosphere have been used on a modest, three-tube t.r.f. receiver[3] as well as such receivers as the RCA-175, HRO, NC-100, etc., and the versatility of both these electro mechanical accoustical devices indicates wide adaptation as to receiver types and audio output equipment.

The writer wishes to acknowledge the patience and careful conformance to detail of A. F. Graham, who assisted in carrying out the development of the selectophone under the author's direction.

◆

In our January issue we offered *W9HP* as the most powerful call in the call book. W9COW takes issue with us, and suggests *9KW* as the most powerful call. Check.

◆

Wonder if Gracie Allen thinks *plate* dissipation is over*eat*ing?

[2] "Notes On Receiver Performance", RADIO, Oct. '36.
[3] "A Modern Three Tube TRF. Amateur Band Receiver", *Radio Amateur's Handbook*, 1934 and other editions

THE NEW TUBE PRICES

Many amateurs wonder why, when tube prices take a jump, they sometimes take a drastic one. Paradoxical as it may sound, this is necessary in order to stabilize the industry. Too many complications arise when the prices are revised every time there seems justification for either an upward or downward change. Imagine what a sad state of affairs would exist were the prices to jump around like the stock market.

When prices in general show a steady upward trend, tube prices are kept at the same level for as long as possible, sometimes at an actual loss to the manufacturer. Then, when a change is made, if prices show promise of continuing to rise, tube prices are substantially jumped to a level not necessarily justified at the moment. In this way the manufacturer, over a period of time, is able to realize a reasonable and fair profit without making more than an occasional revision in his price schedule.

Another question that arises in the minds of many amateurs is why the price of a certain tube will steadily drop when it first comes out, and then increase in price each time prices are revised until after a few years it may cost several times the original price. This, and many other puzzling questions regarding tube prices are explained by Hygrade Sylvania as follows:

"The new price structure is based on several sound principles. First of all, costs of materials and labor have advanced substantially. Obviously, from the standpoint of the manufacturer, a new tube, or a tube passing into obsolescence, is far more expensive to make. Therefore, in the higher brackets of the new price schedule you will find not only many new tubes, but also many of the tubes which have not been used in equipment for some years. In addition, tubes which are of more recent origin and which were never very popular in original equipment, are included. Also in this catagory are tubes of more complex construction, which naturally are more costly, regardless of quantity or time in use by the industry."

◆

Between thirty and forty of Boston's five-meter stations congregate on the air each Monday evening for a *round robin* QSO.

◆

A half-mile distant ham phone pounded through a p.a. amplifier running on a 110-volt d.c. line in Boston recently.

A Truly Portable Receiver

By JOHN HUNTOON, W9KJY*

Now is the time of year to work on portable gear, so that when the bees start buzzing and the open road calls, one need not stay cooped up with soldering iron and pliers of a week-end afternoon constructing something "to take along". This receiver is really portable, in the strictest sense of the word. It is compact, light, sturdy, and works from batteries.

Away back in June, 1933, a couple of radio nuts who thrilled to the smell of green grass and fresh air mingled with the aroma of bacon and eggs packed up a little food and clothing and a lot of portable (?) radio apparatus and sallied forth into the cow-infested wilds of northern Illinois to see what could be done in the Field Day project. This trip and several succeeding ones left one impression above all others on the minds of the participants—the need of a really good portable receiver.

" . . . the smell of green grass and fresh air mingled with the aroma of bacon and eggs."

Two years ago, upon return from a particularly discouraging expedition, it was decided to construct just such a receiver. Requirements were listed as follows, not necessarily in order of importance:

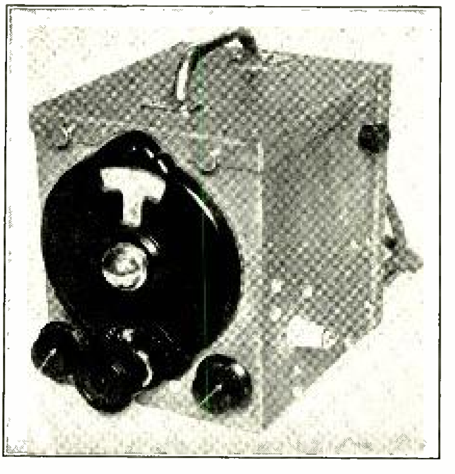
1. Rigid mechanical construction.
2. Minimum power requirements—battery operation.
3. Light weight—compactness.
4. Ease of operation, smoothness, selectivity, etc.
5. Minimum antenna requirements.
6. Headphone operation with comfortable volume.

With these ever in mind, work was begun. Since then, the design, construction, operation, improvement, and re-improvement (coupled with the usual loss of sleep) took place in the builders' limited spare time. The result is shown in the illustrations.

The top view of the midget receiver is self-explanatory in revealing the location of the various parts above the sub-base. The rear compartment houses a two-stage audio amplifier (19), one impedance- and the other resistance-coupled. In the front section is the r.f. portion, with detector (32), coil, tuning condensers, and antenna coupling in plain view.

The Metal Case

It was necessary that the receiver be thoroughly shielded, not only electrically but also from inclement weather. The case is made from 16-gauge "electralloy" metal, and measures 4½ across the front x 5½ x 5½. The top cover, easily detached by removing three knurled-head screws, includes a handle for ease in transporting. A sub-base, partition, and bottom cover of the same metal complete the structure. All joints are riveted for mechanical strength and soldered for electrical quietness. As a test of its strength, the case easily withstood the weight of a two-hundred pound man; and the builders (though of slightly smaller stature) in the excitement of working their first VP (with 5 watts



Front View of the Receiver

*The receiver was designed by Cyrus B. Stafford, W9KWP, who was assisted in the construction by the author and Mr. Don F. Hayworth.

on a 201-A) found they could jump up and down on it without disastrous results.

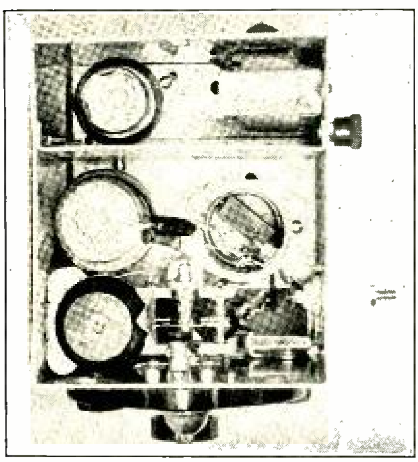
Coils

The coil construction is similar to that of the SW-3, with space-wound turns for the higher frequencies, and having the grid lead at the top, with grid condenser and leak separate for each band. In addition, to insure minimum lead length, the first plate by-pass condenser is contained inside each coil form. Bandspread is obtained electrically by the use of a small condenser shunting the main tuning tank. A greater bandspread on 20 meters is had by tapping these condensers across part of the coil; this connection is automatically made when the coil is plugged in, as shown in coil illustration. On 40 and 80 meters this tapping system is not used, and the condensers (prong no. 3, "P" connection on coil socket) are connected to the grid end of the secondary.

The Tuning System

The main dial operates only the bandspread condenser, and in spite of its size in proportion to the case, was chosen because of the variable vernier, smoothness of operation, and extra vernier ratio not obtainable in the smaller type. A pilot light, drawing almost negligible current, comes in very handy during night operation.

C_4, used only as a band set condenser, is mounted on the side of the chassis as shown,

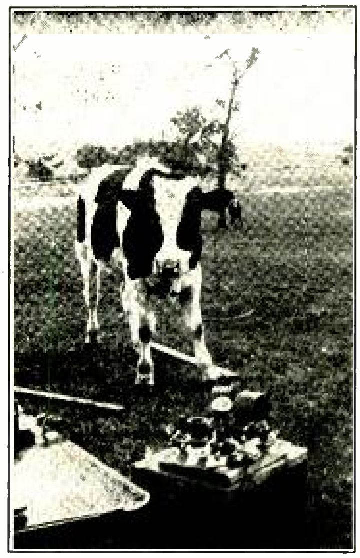


Looking Down into the "Works"

dial upwards. A home-made metal pointer and the gouge-scored dial settings allow simple yet accurate resetting when coils are changed or to move to a commercial band. The chassis is not relied upon as a conductor; the usual bus wire connects this condenser to the common ground.

The coil socket is mounted on long screws so as to be located above the sub-base, allowing short connections to the r.f. points. One of these mounting screws is also used as the common r.f. ground, facilitating connections both to upper and lower portions of the unit.

Operation is principally on the 20-meter c.w. band, comparatively free from QRM,* but the inherent peaked characteristic of the impedance-coupled audio stage makes possible copying through plenty of QRM on 80 and 40 meters when those bands are used.



A VP was worked; five watts input to this 201-A. That's no bull, either.

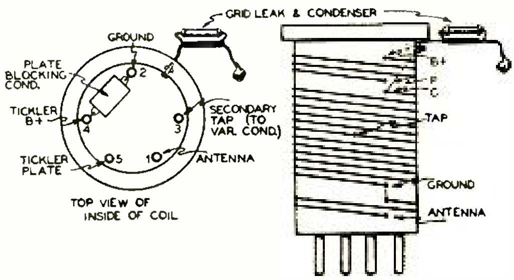
Now let's have a look under the base. The switch and regeneration control are behind the two small front-panel dials. A tip-jack unit in the rear provides for the phone connections. Placement of parts was not found critical, and sub-base wiring was done on the usual "shortest distance between two points" theory, without regard for specific location of condensers, resistors, etc. Values, however, were quite critical, and the plate blocking and coupling condensers were finally determined by experiment.

It should be understood that (especially in such an unorthodox instrument) oftimes a juggling in values of components will be beneficial. After all, the most efficient receiver is not the mass-production model, manufactured exactly according to the blue-print, but the experimental one which has been all tuned up, values juggled, to suit that one particular unit, etc.,

*Editor's Note: ????

COIL DATA

Band	R_1	L_1	L_2	L_3
80 M.	5 meg. 1/5 watt carbon	9 turns no. 28 d.c.c. close-wound	27 turns no. 28 d.c.c. close-wound	15 turns no. 28 d.c.c. close-wound
40 M.	3 meg. 1/5 watt carbon	4 turns no. 28 d.c.c. close-wound	15 turns no. 28 d.c.c. close-wound	8 turns no. 28 d.c.c. close-wound
20 M.	2 meg. 1/5 watt carbon	2 turns no .30 enam. spaced 7/64"	8 turns no. 28 d.c.c. spaced 7/64" tapped 4 turns from ground	5 turns no .30 enam. interwound at ground end of L_2



COIL CONNECTIONS

A binding post near the top of the 20-meter coil form provides the grid-end connection for the secondary coil, L_2, and also mounting for the grid leak and condenser. In the 40- and 80-meter coils, no tap is made on the coils, but the grid-end connection for the secondary, L_2, is also made to prong no. 3 on the socket, thus providing connection to the tuning condesers.

until it reaches a peak operating efficiency not obtainable in quantity production.

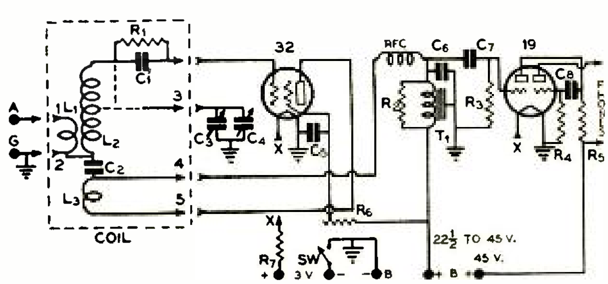
In such a "low-powered" job as this one, the use of a good r.f. dielectric was deemed a requisite to much-needed efficiency; isolantite is used throughout, excepting the equally effective "R-39" for the coil forms. Mechanical noise was eliminated by soldering a flexible braid pigtail between the rotor and the frames of the variable condensers, and by insulating the dial from the chassis. No microphonic trouble was experienced. A slight fringe howl was cured by the juggling of the values of the plate blocking condensers and coupling resistors.

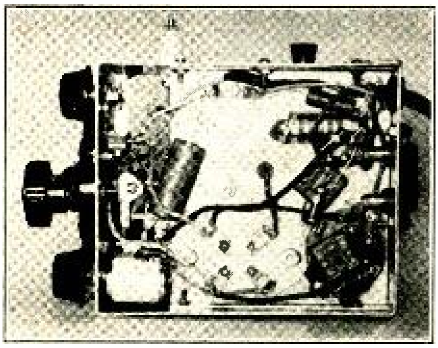
Wiring

The usual care should be exercised in keeping r.f. leads and grounds short and direct; use *bare* wire, no. 18 or larger. (Exclusive of the filament wiring and power cable, the total length of all hookup wire in this receiver is about 14 inches; most connections are made using the pigtail leads of the various components.) Be sure that soldered connections are good electrically, and also strong from a mechanical standpoint, anticipating the various occasions when the unit will surely be dropped, stepped on, or accorded some similar rough treatment.

The General Wiring Diagram

C_1—50 μμfd. mica
C_2—100 μμfd. mica
C_3—20 μμfd. midget variable
C_4—50 μμfd. midget variable
C_5—.05 μfd. tubular
C_6—100 μμfd. mica
C_7, C_8—.004 μfd. mica
R_1—See coil table
R_2—0.5 meg., 1/5 watt
R_3—1 meg., 1/5 watt
R_4—0.5 meg., 1/5 watt
R_5—0.25 meg., 1/5 watt
R_6—0.5 meg. variable
R_7—4 ohms, 1 watt, wire-wound
RFC—2.5 mh., pie wound
T_1—500 hy. audio choke
R_1, C_1, and C_2 are integral parts of the various coils





Under Chassis View, Cover Removed

For power supply, a pair of 1½ volt midget "A" cells and a 45-volt "B" block are compact, yet sufficient to last a surprising length of time. The filament drain is only 310 ma. and the plate about 10 ma. Nevertheless, signal strength is sufficient for phone stations to be plainly readable in a moderately quiet room with the headphones lying on the table. (On a wind- and rain-swept prairie, however, the phones are kept on the head, not only to facilitate copying but also to keep the ears warm and dry.)

Antenna

Anything from a two-foot self-supporting rod to a hundred-foot length of wire—low, high, or lying on the ground—works with approximately equal results for an antenna, although, naturally the more convenient fifteen or so feet of wire is more easily strung up, and works as well as any. A binding post is provided for connection to ground, but in field work, a simple counterpoise has been found most effective and convenient.

While primarily designed for operation in the field, many uses can be found for it in the ham shack between portable expeditions, such as monitoring, standby receiver, beat oscillator, etc. It is an ideal emergency unit for use in time of disaster.

This receiver cannot be built with a pair of pliers and a Boy-scout knife, as many construction articles seem to claim for their subjects; but if the builder takes time and patience, he will find that excellent results can be had when using this little unit, and the pleasure to be derived from its operation on portable expeditions is well worth the effort.

A Good Word for the "Vee"

By E. H. Conklin, W9FM

Last summer we visited M. H. Eichorst, W9RUK, to check up on claims made for his "V" antenna. We found that he had tried a number of antennae, finding a horizontal "double-zepp", supported in a North-South direction on 34-foot poles, to be quite effective. However, he was unable to hear or work an Asian for his 'phone w.a.c., so was not satisfied.

In order to concentrate upon Asia, it was decided to put up a V beam pointed about at Tokyo. The vertex was 49 feet high, on a short pole above an apartment house roof. The far end was held up on 26-foot poles made by sawing a 2" x 6" on a taper to make two poles 2" x 4" at the bottom and 2" x 2" at the top. These were guyed with only two wires holding against the antenna. To change the angle of the beam, it was only necessary to undo the guy wires, carry the pole to the new position, and attach the guys to stakes already provided. The sides of the antenna are about 268 feet, or four wavelengths on 14 Mc. The angle is 52° as given in the ANTENNA HANDBOOK.

From this location, Tokyo is about 36° west of north, VK6 is about 20° north of west, while VK2 and VK3 are roughly 14° south of west. The V-beam was aimed about 45° west of north. On the second morning, J3FI was heard and raised—for an R8 report and w.a.c. He was not audible above the noise level on the double-zepp. KA1BH was later worked for 40 minutes, while a short contact with VS6AQ was had. KA1ME could be heard R7 on phone as late as noon, on July 30. VK2 and VK3 stations were not heard, however, although they were R8 on the double-zepp. VK6MW was two R points better on the V than on the other antenna.

In the reverse direction, the antenna points to Venezuela and Brazil, and gives good results in spite of the tilt in the opposite direction. PY2BA and LU6AP were raised, although the latter was inaudible on the double-zepp, which of course was most unfavorably placed for working south. We had an opportunity to check reception from South America when YV5AA in Venezuela was tuned in. With the V-beam, loud speaker reception was satisfactory, but with the double-zepp, no voice was heard above receiver noise.

ZS6T in South Africa, about 20° south of east and midway between the "nose" of each antenna pattern, was received better on the V.

Directional effects are noticed mainly on the longer distances. At 2000 miles and less, little directivity is noticed—possibly due to higher signal level and the fact that the relatively low amount of high-angle radiation present is more effective at short distances.

To be sure, the feeder system on the V was superior, but was no more than a tuned two-wire feeder. The double-zepp was several hundred feet away with a long feeder, although the total wire involved was no more than in the V antenna plus feeder.

Large claims are made by some users of beam antennas, while the authorities say that the gain should not be many R points. However, don't overlook the fact that when you are competing with QRM or receiver noise, a slight increase in strength may make a world of difference.

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56 MC. RELAY CONTEST

In order to stimulate more interest in the ultra-high frequency bands, find out more about their possibilities, encourage their use for local and short-distance communication, determine their suitability for emergency work and to try and "recover possession from the bootleggers", the Buckeye Short Wave Radio Association of Akron, Ohio, will sponsor a 56 Mc. relay competition the 6th and 7th of March. Worthwhile prizes will be awarded to:

1) The station outside the greater Akron area that turns in the most outstanding piece of work in connection with the relay.

2) The station making the longest direct contact with any Akron station.

3) The two stations bridging the longest distance in any net, providing the message arrives in Akron.

4) The station located farthest from Akron that participates in any net that gets a message into Akron.

5) The station outside of Summit county whose call appears in the greatest number of messages arriving at Akron.

6) The first station outside of Ohio that gets a message through to Akron.

Amateurs who are interested may get further information by writing the chairman of the contest committee, Harold E. Dinger, W8KG-YC, 905 Berwyn Ave., Akron, Ohio.

Incidentally, the contest should furnish ideas for similar contests in other parts of the country. It is well planned and should create much interest.

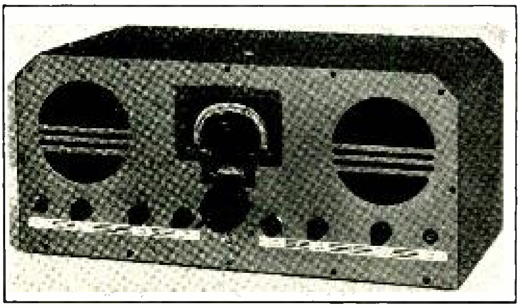
◆

Kay, the most welcome girl on the air: ("Come in, Kay, please.")

The New ACR-155 Superheterodyne

A new, medium-priced R.C.A. Amateur Communication Receiver, Model ACR-155, supercedes the Model ACR-136 receiver introduced more than a year ago.

The Model ACR-155 is larger than the illustration would indicate; it is 25 inches long, 11 inches high, and 13 inches deep. The modernistic design is undoubtedly a reflection of the modern interpretations given the new R.C.A. transmitter units. The metal cabinet, with hinged lid, has a dull black crystalline finish, while the front panel has a similar finish in medium aluminum gray. The dial escutcheon and the large tuning control knob are of a darker gray, while the double grills balancing the weight of the design are covered with a black fabric with a rough surface. The smaller control knobs are also black and the two nameplate strips are white with black lettering. The R.C.A. insignia under the tuning control knob has raised letters with nickel finish on a red background.



The New ACR-155 Presents a Very Striking Appearance

The "speaker grill" on the left of the panel is a blank. The controls on the left side are, from left to right: beat oscillator switch, beat oscillator heterodyne control, power and standby switch, and volume control. The controls on the right side, reading from left to right, are: range selector switch, tone control, sensitivity-a.v.c. switch, and phone jack. A 6-inch dynamic speaker is mounted behind the right-hand grill.

The beat oscillator pitch is controlled by the movement of a magnetite core in the b.f.o. transformer. This provides adequate variation of pitch on either side of zero beat (450 kc.).

The power-stand-by switch has three positions, viz: left, power off; middle, power on; right, filament power on but plate and screen voltages off.

The tuning control knob is of molded aluminum and is 2 inches in diameter. There is a crank on the knob for rapid tuning from one scale extreme to the other. This is a convenience as the dial-drive ratio is 100 to 1. The entire tuning mechanism is a fine example of "feather touch" operation; the weight of a finger on the knob is sufficient to set the gang condenser in motion. Moreover, the mechanism is free of play, which gives accuracy to the vernier scale.

The "Selector Dial" used in this receiver brings each scale separately into the dial opening by a turn of the range selector switch knob and gives calibrations for the range in use only. The "Calibration-Spreader" scale or mechanical band-spreader beneath the main dial scale provides vernier readings adequate for logging purposes.

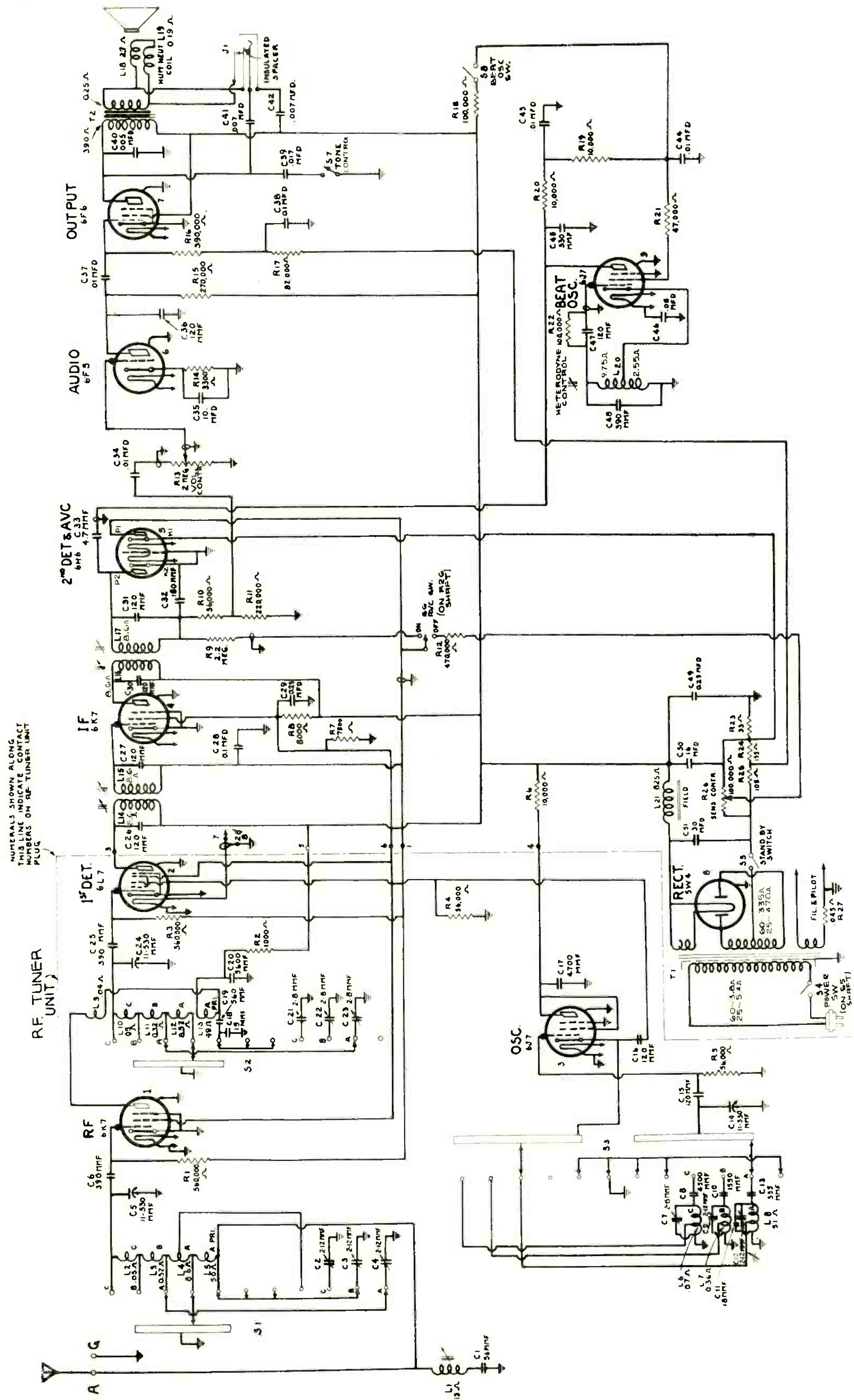
Any one of the three tuning ranges may be brought into play by the range selector switch. Range "A" extends from 520 to 1720 kc., range "B" from 1720 to 6300 kc., and range "C" from 6300 to 22,000 kc. The 20- and 40-meter bands appearing on scale "C" are in the same relative positions as the 80- and 160-meter bands on scale "B"; that is, if the pointer rests in the 20-meter band on scale "C", it will rest in the 80-meter band on scale "B" when the range selector switch is turned.

The 20-meter band is spread over 16 degrees on the scale of the vernier dial. The 40-meter band has a spread of 42 degrees. The 80-meter band is spread 77 degrees, and the 160-meter band 198 degrees, or nearly two complete revolutions of the vernier scale, which reads from zero to 100 in a 360-degree rotation.

The tone control has two positions. Full-range reproduction is obtained with the knob turned clockwise. The counter-clockwise position introduces a condenser in the primary circuit of the output transformer, which attenuates the high-frequency response. This setting reduces background noise.

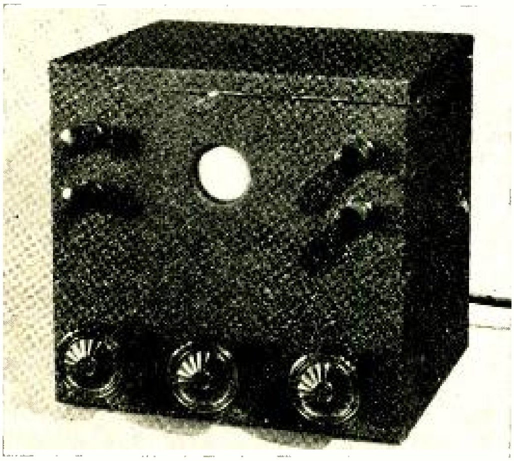
The sensitivity-a.v.c. control is a combination switch and potentiometer. When in the full clockwise position, the a.v.c. is on. When turned counter-clockwise, a.v.c. action is eliminated and thence on the r.f. gain of the receiver

[*Continued on Page 83*]



THE R.C.A. TYPE ACR-155 COMMUNICATIONS SUPERHETERODYNE

A Practical, Low Cost Oscilloscope



The Front View of the 913 Midget 'Scope

The advent of the new 913 tube will undoubtedly change the amateur's viewpoint of the oscilloscope situation. In many cases where a cathode ray oscilloscope would previously have been a luxury, one now becomes almost a required piece of station equipment. Heretofore the least expensive 'scope, using the (then smallest) 3" tube, necessitated a cash outlay of from thirty to forty dollars. The new 1" screen tube makes identical results (except for size) available for approximately $12.50.

The 913 operates on exactly the same principle as the larger models. Electrostatic deflection in two planes and a grid to control the intensity of the spot make the tube also suitable for use in inexpensive television receivers. However, to the majority of hams the primary use of a cathode ray tube is in an oscilloscope to check transmitter and receiver performance; the television applications can come later.

Since the primary object of the 'scope to be described was low cost, due consideration was given to the desirability of using inexpensive components of standard manufacture. All the parts—power transformer, potentiometers, resistors, and condensers—are regular receiver replacements. If exact duplicates of the parts given are not available, no trouble should be experienced in making substitutions. Some care must, however, be taken in the selection of the power transformer. The magnetic flux path of the transformer must not come close to the c.r. tube. While some shielding of the tube is effected by its metal envelope, the existence of a strong electro-magnetic field in the vicinity of the tube (as would be caused by a nearby power transformer core) will cause a line to appear on the screen when a spot should be obtained. Then, when this elongated spot is spread out by the sweep voltage, a lop-sided elipse or a complicated Lissajou s figure will be obtained instead of the straight line that is desired.

The circuit is conventional and is almost exactly that given in the RCA bulletin accompanying the tube. There is incorporated, however, a simple power supply and an arrangement for obtaining line-frequency sweep at the electrodes of the tube. Neither of these is included in the diagram shown in the bulletin. Line-frequency sweep is used primarily for the sake of economy and simplicity. Only about 75c worth of additional equipment is required over the bare minimum for a 'scope, as compared to the considerable investment necessitated by a linear-time-axis sweep. For those desiring a more versatile oscilloscope, a future issue will show a 913 'scope complete with linear-time-axis sweep and vertical deflection amplifier. However, for the majority of routine measurements around the ham shack, the sine wave sweep obtained from the a.c. line is satisfactory. Actually this voltage is obtained directly from the high voltage winding of the power transformer. A .05 μfd. condenser is placed in series with the high voltage to isolate the a.c. from the unwanted d.c. potential existing on this winding. The a.c. then passes through a 100,000 ohm resistor to the 50,000 ohm sweep potentiometer.

The power supply uses an 80 connected as a full-wave rectifier feeding a pair of 8 μfd. electrolytics in parallel as the filter. This simple arrangement was found to give more than ample filtering.

As far as the mechanical construction is concerned, pains were taken to make as compact a layout as was consistent with reasonable design principles. The complete unit is built in a standard 5 x 5½ x 6" shield can made of cadmium plated steel. The power transformer and rectifier tube are mounted on a 3 x 5" sub-

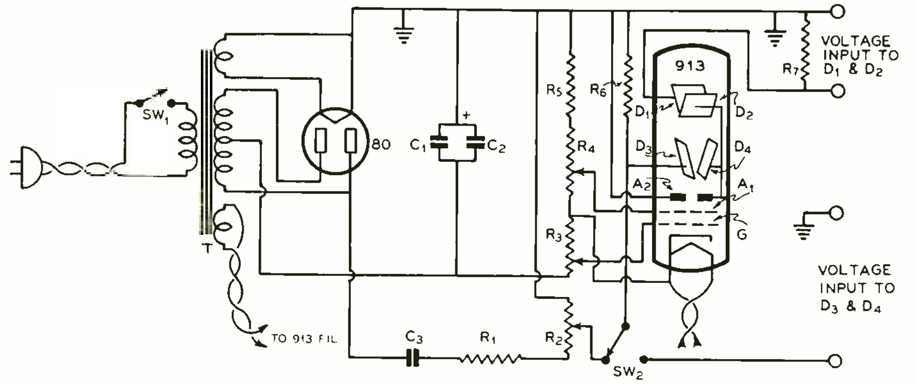


Figure 1: The General Wiring Diagram

R_1—100,000 ohms, ½ watt
R_2—50,000 ohm linear pot.
R_3—25,000 ohm linear pot.

R_4—50,000 ohm linear pot.
R_5—150,000 ohms, 2 watts
R_6, R_7—10 megohms, 1 watt

C_1, C_2—Either single or double section 600 peak volt electrolytic (8 or 16 µfd.)

C_3—.05 µfd. tubular
T—Midget b.c.l. transformer, 5 volts, 6.3 volts, and 700 volts c.t.

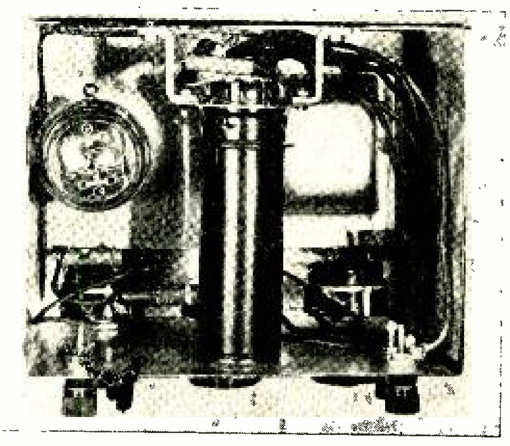
chassis mounted 1″ above the bottom of the box. Under this chassis is mounted the filter condenser and the coupling condenser for the sweep circuit. Looking at the front panel we see the 913 tube mounted in the center, the vertical and horizontal deflection binding posts on either side, and the three potentiometer knobs mounted below. The first knob, looking from left to right, controls the switch to throw the horizontal deflection plates either to the external binding posts or to the potentiometer, mounted on the same shaft, that adjusts the amplitude of the sweep. Thus, with the control thrown counter-clockwise the horizontal plates are connected directly to the binding posts mounted on the front panel with only a 10 megohm resistor in shunt; when thrown the other way the SPDT switch, mounted on the back of the pot., throws the active plate to the center arm of the pot. on which it is mounted.

The center pot. controls the anode no. 1 potential, thereby making itself the focusing control. The one on the right controls the on-off switch and the intensity of the image produced.

Some mention might be made of the manner in which the tube is mounted. Since the tube will probably have to be rotated to secure proper alignment of the planes of deflection with respect to the box, provision was made for this in the socket arrangement used. By filing the "locating pin" from the metal disc part of the Amphenol socket that is used, then reassembling the socket and mounting it by means of a pair of brackets to the back of the box, a very simple and inexpensive rotatable mounting is produced.

Operation

If the diagram is carefully followed no difficulty should be experienced in getting the unit in operation. The procedure is as follows: First, rotate the knob on the right until the switch snaps. Give the tubes time to warm and then turn this control further, until an image is obtained on the screen. Then turn both this and the center knob until a clearly defined spot is obtained. Turn the knob on the left (past where the switch snaps) to about half open. By jockeying all three controls it should be easily possible to obtain a well defined line



Top View, Cover Removed. Note Method of Mounting the 913 C.R. Tube

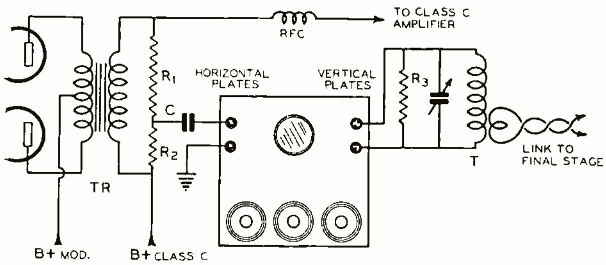


Figure 2: Connections for Trapezoidal Patterns

R_1, R_2—Audio voltage divider (described in text)
R_3—10,000 ohms, 1 watt
TR—Modulation transformer or choke feeding modulated stage
T—Tank circuit resonant at operating frequency of transmitter
C—.01 to .05 µfd. rated at twice d.c. voltage used on modulated amplifier

across the screen of the tube. If the line does not run horizontally the tube should be rotated until it does. However, if it seems to run closer to vertical than horizontal, there is a possibility that the connections to plates D_1 and D_3 have been reversed. If a check shows these to be correct, the tube will have to be turned until the line runs in the proper plane.

The deflection sensitivities of the tube at the operating potentials employed are about 170 volts per inch in the vertical plane and 250 volts per inch in the horizontal plane. So with these values in mind we can figure about how much voltage to put on the tube in making transmitter measurements.

The hookup for making trapezoidal measurements of transmitter performance is shown in figure 2. The resistor network R_1R_2 should be connected across the secondary of the modulation transformer or choke feeding the modulated stage regardless of what type of modulation is used. The values of these resistors should be proportioned so that, with full modulation, there will be a peak voltage of approximately 116 volts appearing across the bottom resistor, R_2. Also, for stability, the sum of resistors R_1 and R_2 should draw about one ma. under full modulation. In other words the total resistance should be about 1000 times the voltage appearing across them. Suppose for a practical example we take a plate modulated class C amplifier running at 2000 volts. The sum of resistors R_1 and R_2 will be about 2 megohms. The peak voltage appearing across their sum will be 2000 volts peak at 100% modulation. Then since we want 116 volts peak across the resistor R_2 and since 250 volts is about all that should be placed across a carbon resistor, if we hook eight 250,000 ohm 1 watt carbon resistors in series for R_1 and place the oscilloscope leads across 125,000 ohms for R_2, all the above conditions will be met.*

The condenser C should have a capacity of about .05 µfd. and should be able to withstand about twice the d.c. voltage appearing across it. The condenser in the above example should be able to withstand 4000 volts.

To obtain the r.f. voltage for the vertical deflection, the hookup shown in the diagram is probably the best method. The tank circuit T can be a small midget condenser and coil that resonates at the operating frequency. This tank is link coupled to the *final* tank circuit in the transmitter. The shunt loading resistor R_3 is connected across the tank to stabilize it and should be about 10,000 ohms. The tank should be tuned to resonance and enough coupling to the transmitter used to give a line about ½ in. long with no modulation on the transmitter.

Then pure sine-wave audio, from an oscillator such as that described in the Nov., 1936, RADIO (p. 36), should be fed into the input of the speech system. An analysis of the trapezoidal figures obtained can be found in many references. RADIO for January, 1937, Sept. and Nov. 1935, back issues of *QST*, the current handbooks, John F. Rider's *The Cathode Ray Tube At Work*, the RCA TS-2 Cathode Ray bulletin, and many others have excellent discussions of the figures that will be obtained. The RCA bulletin is very good from this standpoint, and in addition describes a number of other applications of the oscilloscope.

◆

Latest assignment in the alphabet-exhausting 9th Call Area is W9YZL. With the end of the alphabet now imminent, as far as three-letter calls are concerned, the 9th Area officials have no good guess as to Washington's procedure when the alphabet is used up.

◆

After the junior op had finished his little *say-so* over a well-known 20-meter phone t'other day, the o.m. took the mike with, "Well, that's the dope." We assume he did not mean the youngster!

*An oscilloscope working on a.c. (either a.f. or r.f.) responds to both positive and negative peaks, and therefore reads crest-to-crest voltage, which is twice the peak voltage as ordinarily measured on a v.t. voltmeter. Therefore the voltage across R_2 need be but half what one would first imagine.—EDITOR.

A Neon Bulb Overmodulation Indicator

By George W. Ewing*, W6GM

In quest for an economical overmodulation indicator for the rig here at W6GM it was determined that the negative peak form of indicator would serve the purpose provided the general modulation characteristic was linear. This linearity was checked on a borrowed oscilloscope and found o.k., and therefore it can be assumed that the negative peak indicator actually shows overmodulation.

The versatile ½ watt neon lamp was chosen for an indicator because of its economy and because of its fast action. The lamp will flash on an impulse of such short duration that a meter would not show any deflection.

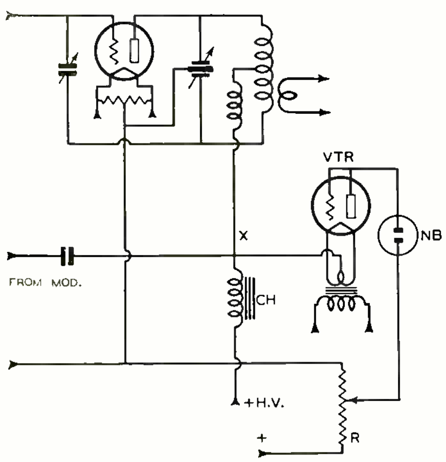


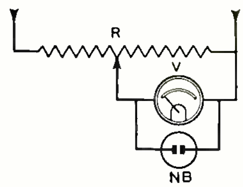
Figure 1: Standard Circuit

CH—Modulation choke (or secondary of modulation transformer)
VTR—879 for high power, 80 for low power
NB—Neon bulb
R—Bleeder on any low voltage power supply of 150 volts or more that is connected to a steady load (such as speech amplifier or crystal oscillator power supply)

The circuit is shown in figure 1 and is quite conventional except that there is usually a meter in place of the ½ watt neon lamp and the return circuit usually connects directly to the B—. This circuit functions as follows:

We have a rectifier at VTR, but since its cathode or filament is connected to the B+ and its plate to the negative side of the circuit, no current flows until the peak modulation voltage exceeds the steady d.c. voltage applied to the modulated amplifier. When this happens, the point "X" is driven negative with respect to the B— of the power supply, or in other words, the plate of VTR becomes positive to its own filament and a current flows through the indicator, showing overmodulation.

Figure 2: Test circuit for determining breakdown voltage of individual neon bulb used.
R—Bleeder on low voltage power supply
V—0-150 or 0-250 volt d.c. meter
NB—Neon bulb under test



A neon lamp requires a certain voltage to ignite it (110 v. d.c. in my case) and if the return circuit were connected directly to the B—, the modulated amplifier would be overmodulated by at least 110 v. before an indication would appear; therefore the return is connected to a point on the power supply bleeder that is 110 v. positive with respect to the B—. This voltage furnishes the necessary potential to ignite the lamp when the modulator voltage peak reaches that of the d.c. from the power supply.

Four different lamps were tried in the circuit of figure 2 to determine the exact ignition voltage, and they were found to vary somewhat. Therefore, the author recommends that the individual lamp be tested in this manner. A tap is then placed on the bleeder of a low voltage power supply as shown in figure 1 and adjusted to give this same voltage. For negative peak indications no further adjustments will be necessary. In the absence of a high resistance voltmeter to determine this point one could, if the bleeder is continuously adjustable, connect one side of the lamp to the B— and slide the other side along until the point is found that just ignites it. Be sure the load is on the power supply so the voltage will be the same as when operating.

With a plate voltage of 600 or under, the receiving type tubes seem to stand up o.k. at VTR (good insulation must be used in its filament transformer). Here at W6GM the mod-

*201 E. 10th St., San Bernardino, Calif.

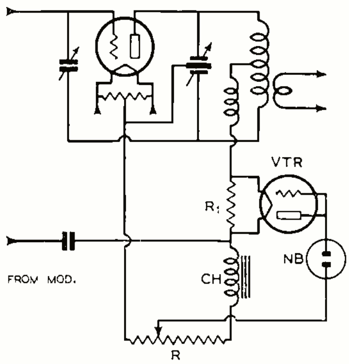


Figure 3: Circuit for Low Power (Under 600 Volts)

No filament transformer for VTR is needed. Constants same as for figure 1. R_1 is chosen to give VTR (in this case a 30 or 71-A) normal filament current at the plate current drawn by the modulated amplifier.

ulated amplifier consists of 4 type tens in p.p.p. with a plate current of 225 ma. at 600 v. Since the filament current of the 71A is 250 ma., the modulated amplifier current is used to light the 71A as shown in figure 3, dispensing with the filament transformer altogether. That is, the filament of the 71A is cut in at "X" in the diagram, the 5 v. drop being of no consequence. Probably very few of the gang will be able to do this since most setups with 200 ma. or over have too high a voltage for a receiving type tube. However, those with less than 200 ma. might try a type 30, using a shunt if necessary to reduce the filament current to 60 ma. With voltages above about 750, one of the 879 cathode-ray rectifiers will work very satisfactorily. This tube has a 2.5 volt filament and will withstand voltages up to about 7500 peak. It must be used in the circuit of figure 1, of course.

This complete indicator was checked with an oscilloscope and high levels of modulation could be obtained without any flash from the neon lamp, but with the slightest signs of overmodulation on the oscilloscope screen, the neon lamp would flare up and give a very definite indication, especially when mounted right behind the microphone in plain sight.

When using the indicator in a high power rig, it will be necessary to avoid stray r.f. and a.f. voltages from being picked up by the leads to the neon lamp and causing the lamp to indicate before 100% modulation is reached.

SHALL WE DISCARD "CQ"?

Phoenix, Ariz.

Sirs:

After lengthy observation of both our traffic and dx bands, we seem yet to have much unnecessary QRM and difficulty in instantly identifying a signal in a desired area with a minimum of time and effort, with directional CQ's seldom heard.

I would like to suggest to amateurs at large, a discontinuance of what I believe is now obsolete—the use of CQ for calling practice, and in its place substitute a continuously identifying type of call, such as the letters of the prefix of the country in which the calling station is located; where a single letter is used, the district number may follow, viz:

W6 W6 W6 de W6FZQ W6FZQ W6FZQ AR
or
ZL ZL ZL de ZL1HH ZL1HH ZL1HH AR
or
VK VK VK de VK3XP VK3XP VK3XP AR
etc.

In this manner, the origin of the station in its general inquiry call is easily known, with little time lost by anyone desiring to contact the area of the caller, or hunting for him over the band. I am sure this would stop the present abuses of long CQ's and "CQ DX", as no one would then have to listen to such rot. The ease with which our English brethren are so easily recognized, is a known fact. We could also then, with the use of this system, tell whether or not we would wish to follow an inquiry call through a barrage of R9 QRM.

I certainly wish this could be published in time to be tried in the coming dx contest, as I am sure it will be successful, and then universally put to good use.

CHAS. E. SPITZ, W6FZQ.

The disadvantage to this scheme is that anyone not familiar with the procedure would naturally think that a station sending "W8 W8 W8" would be *calling* the 8th district instead of indicating the origin. If universally adopted, however, this idea would have much to commend it; but would require the use "CQW8", "CQVK", etc. for directional inquiry calls.

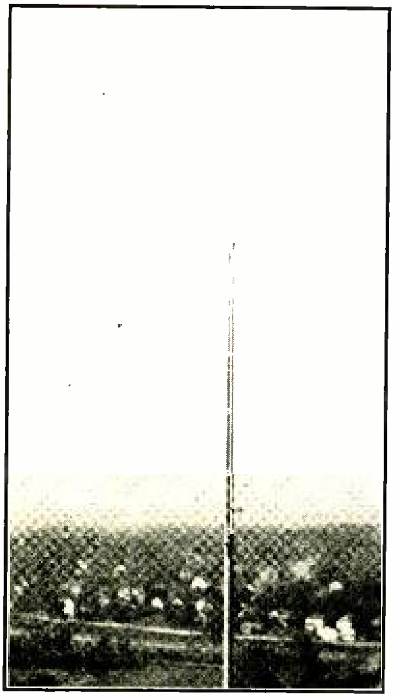
A similar idea would be for different countries to use different inquiry calls, such as "AQ" for France, "BQ" for Canada, "CQ" for U.S.A. (because most hams are in this country), "DQ" for Germany, "EQ" for Argentina, etc.

Still another idea would be to use "WCQ", "VCQ", "GCQ", etc. to indicate origin, and "CQW", "CQVK", "CQG", etc. to indicate directional CQ's.

—EDITOR.

U.H.F. Concentric Line Feeders

By E. H. Conklin, W9FM



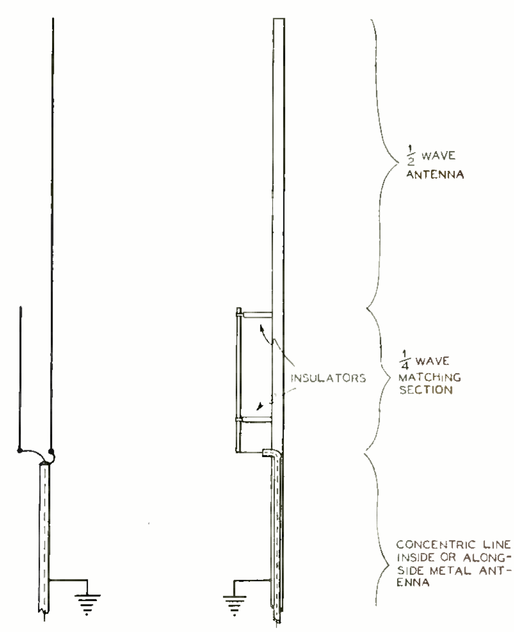
The Wheaton, Illinois, Police transmitter uses this concentric-line-fed "J" type antenna. It is mounted atop a water tower, high above the closest traffic, and used both for transmitting and receiving.

Every year or two, someone calls our attention to the advantages of the concentric transmission line, but few appreciate these advantages, particularly where the antenna is also to be used for receiving.

The dimensions of such lines are usually selected so that the surge impedance is around 65 to 100 ohms, with the inside diameter of the outer conductor usually from three to four times the outside diameter of the inner conductor. Most of the loss is in the copper resistance of the inner conductor and the dielectric loss in the spacers. Price usually determines the size of the outer conductor, after which the proper size for the inner one is calculated for the lowest loss.

The loss in this type of line is not large even at ultra-high frequencies, where other low impedance lines, such as the twisted pair, are practically useless. The loss varies as the square *root* of the frequency. A three-eighths inch line built by Doolittle and Falknor, of Chicago, is said to have a loss of 0.8 db per 1000 feet at 1000 kc. At 100 Mc. (3 meters), therefore, the loss in only 100 feet would be 0.8 db. A two inch line is available at twice the cost (but requires expensive factory-made bends) with a loss of only 0.14 db per thousand feet at 1000 kc. On the usual amateur high-frequency bands, the loss in moderate lengths of the line with either spacing will not be appreciable.

It is possible to end-feed an antenna with a low impedance line, which is most convenient for verticals mounted high above the supporting object. Because the impedance at the end of an antenna is not infinite but is very roughly 3000 ohms (depending upon conductor size, insulators, etc.) a quarter-wave matching section can be used to match this to the (approximately 75 ohms) impedance of the line. The transformer can be a pair of wires or tubes so spaced that the calculated impedance, squared, equals 75 × 3000 (the product of the antenna and



One method used to match a low-impedance line to an end-fed antenna with a matching section.

line impedances). This works out to be a little less than 500 ohms. This same stunt is called the "Johnson Q" when it is used to match a spaced line to the center of a doublet, in which case the matching transformer must have an impedance below 200 ohms, requiring close spacing or large tubing.

Tuning

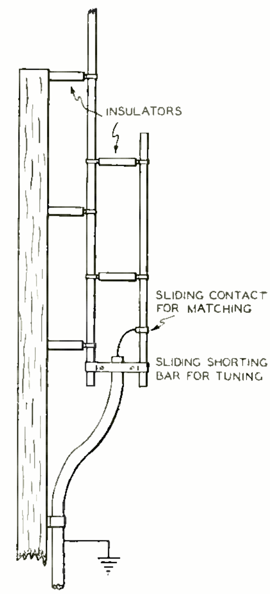
Some care should be taken to cut the antenna to the correct length. The presence of standing waves on the feeder can normally be detected simply by measuring the current at both ends of the line, which should be the same. If the antenna is resonant at the operating frequency, the spacing of the conductors in the matching section can be varied to obtain proper match. The antenna power will, of course, be equal to the line current squared times the line impedance.

Coupling to the transmitter is quite simple. A few turns of wire near the final tank, close enough to load up to the proper input, will fill the bill. A "Collins coupler" is not required.

Advantages on 56 Mc.

A number of five meter stations have placed half-wavelength antennas at the top of expensive towers in order to work greater dx without a beam. These same stations may be troubled with ignition interference when using the high antenna for receiving because of feeder pick-up. The grounded concentric line, forming a well-shielded circuit, would eliminate pick-up below the antenna. The cost of 25c a foot for the small three-eighths inch line, which will handle 5 kw. unmodulated c.w. or 1 kw. phone, does seem large but the advantages of the high and expensive tower are not really enjoyed until the full benefits are available for receiving.

The value of a concentric line is illustrated by the experiences of the Wheaton, Illinois, police on 40.1 Mc. With the receiver at the police station, an automobile running in the block could make it impossible to hear the cars. An eight-element bi-directional beam—two stacks of four elements—helped somewhat when the squad car was in line with the beam, but also brought in the New Rochelle, N.Y., station a bit too well on occasions. Jim Wilson, W9BUK, and Charles Fetweis, W9KJW, suggested placing the transmitter and receiver, remotely controlled, at the base of the water tank, with a concentric line to the antenna high above. With this antenna, cars directly below were some distance away and in the direction of least antenna pick-up; so ignition troubles practically disappeared. The fixed station was able to hear the squad cars anywhere in the city at any time.



"J" or "stub matched" antenna, with concentric line outer conductor connected to shorting bar and inner conductor connected to stub several inches above shorting bar, tuned in a manner quite similar to a single-wire-fed antenna.

At Lower Frequencies

When there is a vacant lot nearby, the "ham" usually can get permission to take advantage of the space if he promises not to make an unsightly installation. A concentric line along a fence or buried would make the vacant space available for an antenna. When this type of line is buried, moisture may collect in it. This can be blown out with dry air or kept out by filling the line with nitrogen under pressure.

Most of us object to untuned lines because of the usual requirements of a separate antenna for each band. Bruce, we understand, uses one of these lines on a diamond antenna operating on various frequencies over about a three-to-one ratio. So, you see, it can be done!

◆

Paul A. Siple, who accompanied Byrd in the Antarctic, was married in December to the girl he courted by radio from the South Pole.

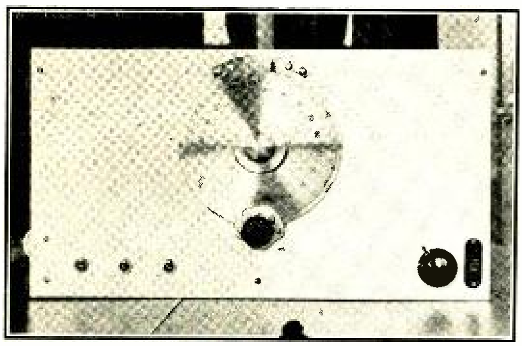
A Multi-purpose Frequency Meter

By John Gluck, W8MYB

This simple instrument may be used as a standby receiver, a very highly accurate frequency meter, an edge-of-band marker, a signal generator of accurate calibration, and for many other purposes. One does not have to worry about age affecting the accuracy of calibration, as a temperature-controlled crystal takes care of that.

There is hardly a ham shack in which a regenerative receiver did not reign supreme at one time or another. With the advent of the high performance supers, the relegation of the faithful regenerative to the attic became inevitable.

Likewise, there is hardly a ham shack in which some rather atrocious form of frequency generator or standard cannot be found. The accuracy of calibration may be quite high but how well this calibration is retained remains a highly debatable question.



Front View of the Completed Unit. A Good Dial Is a Worthwhile Investment.

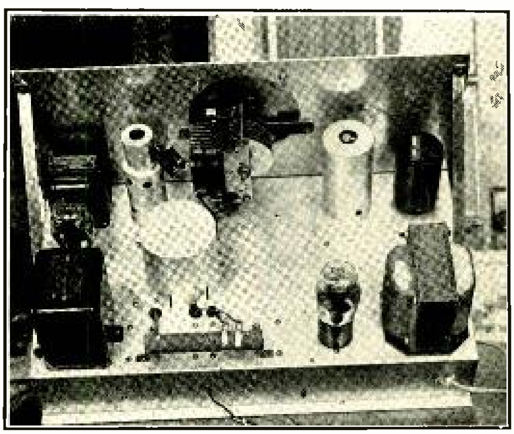
The receiver to be described is intended both for the beginner as well as for the old timer whose equipment already includes the above units (which can be robbed for many of the required parts).

The receiver when completed functions in the following capacities:

1. Straight regenerative detector and two-stage audio frequency amplifier, an excellent "standby" receiver.
2. Highly accurate frequency meter for transmitter checking or for checking incoming signals.
3. Highly accurate generator for tracking and experimental work.
4. As a non-oscillating receiver used for checking or adjusting the oven-mounted 100 kc. bar against WWV.
5. A generator of harmonics—the multiples of 100 kc.

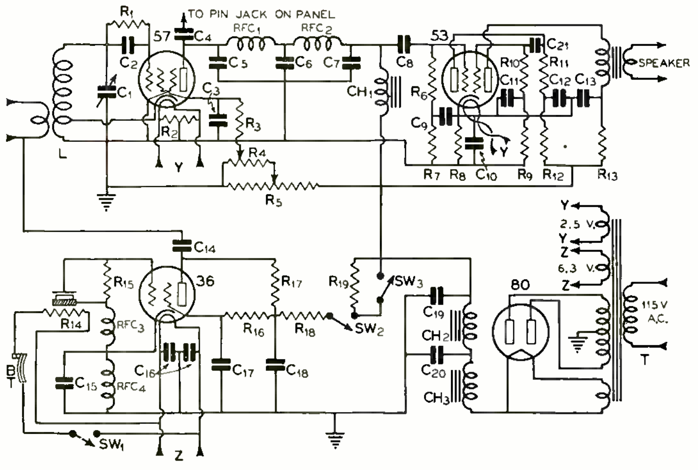
The three units comprising this receiver are mounted on a 10 x 17 x 3" base. The front panel is 10 x 18 x 1/8" aluminum.

The first unit is a standard 100 kc. Bliley crystal mounted in a Bliley oven. All the components of the tritet circuit are mounted underneath the base and are contained in a heavy copper box with the exception of the crystal oven and its associated tubes (the copper box was removed for photographic reasons). On the front panel are located three s.p.s.t. switches for the complete control of the standard oscillator. Switch "A" controls the oven heater circuit. Switch "B" starts or stops the oscillator output by closing or opening the B supply. Switch "C" shorts out a 1/2 megohm, 2 watt resistor so that higher voltage may be applied to the plate and screen of the 36 tube with increased output. This becomes necessary when using harmonics of the order of 150 or higher.



Looking Down into the "Works" from the Back

From the fundamental frequency to about the 50th harmonic, blocking of the 57 detector will occur if too large a coupling condenser is used. About 20 μμfd. will be found correct. The grid circuit tickler will not be found necessary with all crystals. It does help those crystals which ordinarily are lazy, and does no harm in any case.



The General Wiring Diagram

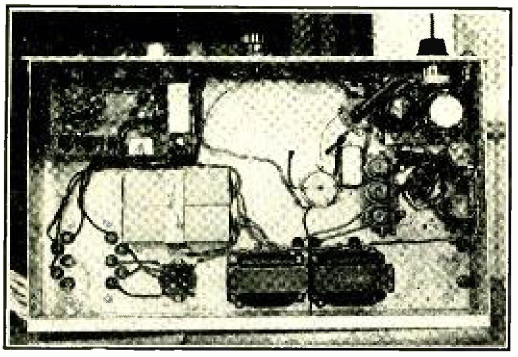
C_1—See text
C_2—100 μμfd. mica
C_3—0.1 μfd. tubular
C_4—50 μμfd. mica
C_5, C_6, C_7—100 μμfd. mica
C_8—.01 μfd. mica
C_9—0.5 μfd. tubular
C_{10}—0.5 μfd. tubular
C_{11}—0.5 μfd. tubular
C_{12}, C_{13}—0.5 μfd. paper
C_{14}—20 μμfd. (or compression trimmer)
C_{15}—250 μμfd. mica
C_{16}—0.25 μfd. tubular
C_{17}, C_{18}—0.25 μfd. paper
C_{19}, C_{20}—8 μfd. electrolytics
R_1—2 meg., 1 watt
R_2—Fil. c.t. resistor
R_3—10,000 ohms, 1 watt
R_4—5000 ohm pot.
R_5—20,000 ohms, 50 watts
R_6, R_{10}, R_{11}—250,000 ohms, 1 watt
R_7, R_9, R_{12}—50,000 ohms, 1 watt
R_8—1500 ohms, 1 watt
R_{13}—10,000 ohms, 1 watt
R_{14}—Crystal "oven" heater (contained in unit)
R_{15}—5 meg., 1 watt
R_{16}—75,000 ohms, 1 watt
R_{17}, R_{18}—50,000 ohms, 1 watt
R_{19}—500,000 ohms, 2 watts
BT—Thermostat (contained in crystal unit)
T—Midget b.c.l. power transformer, 350 volts each side c.t., 50 ma.
CH_1—High impedance audio coupling choke
CH_2, CH_3—50 ma. filter chokes
RFC_1—10 mh. r.f. choke
RFC_2—10 mh. r.f. choke
RFC_3—25 turn choke
RFC_4—300 turn choke
L—Depends upon band to be covered. Use any receiver coil table. (See text)
Note: All 2.5 volt or all 6.3 volt tubes may be used with a transformer with but one filament winding (plus rectifier)

The second unit of the receiver is a regenerative detector using a 57 tube, impedance coupled to the first triode of a 53, then resistance coupled to the second triode, then through an output transformer to a magnetic speaker or phones. Plug-in coils are used; these coils are plugged into a five-prong socket and are contained in Hammarlund shield cans—the same as used on the Comet Pro. The antenna is link coupled to the grid by a two-turn link. The tuning condenser used is an old Cardwell with new plates cut from stock .038 thick. The shape is such that 270° rotation is permitted and the frequency variation is substantially linear. This permits interpolations to be made by means of direct ratio rather than by picking off values from a calibration curve.

The matter of ground returns need be watched. All r.f. returns to ground should come directly to the condenser frame and *not* to any part of the chassis convenient at the moment.

The third unit of our receiver is a power supply using an 80 tube with choke input. It provides 6.3 volts for the crystal oven and the 36 tube as well as 2.5 volts for the 57 and 53 tubes. Good regulation is imperative in this unit. A low resistance bleeder is of considerable help. The 20,000 ohm 50 watt bleeder used has about half of it shorted. The bleeder drain is 30 ma.

The crystal is of the air gap mounted type. Increasing the air gap also increases the crystal's frequency. For the X-cut Bliley crystal a change of 100 cycles per million result for a .001° change of air gap. A less rapid change results from temperature changes. An increase of oven temperature causes a decrease in the frequency of the X-cut crystal. This information is helpful and necessary when the final adjustments are being made to the crystal so that its 50th, 100th, and 150th harmonics may be brought to dead beat with WWV standard frequency transmissions. Dead beating with the 50th harmonic is the simplest and should be performed first. The receiver is thoroughly warmed up. The 36 tube is also started but the crystal oven is kept cold—switch "A" keeping the circuit open. When WWV comes on, the signal is tuned in with the 57 detector oscillating. The screen voltage is now decreased until the 57 detector no longer oscillates. Switch "B" is now closed, starting the tri-tet. The 50th harmonic will now beat against WWV and this beat will be heard unless it is outside of the audible range. Now close switch "A" and listen to the change in beats as the oven heats the crystal and causes



Under-chassis View, Showing Arrangement of Parts

its frequency to decrease. It takes from six to ten minutes for the oven to come up to its operating temperature. The beat notes should decrease steadily and should go into the dead beat range. If the oven temperature is still increasing, the beat notes will be heard again as the crystal's frequency continues to decrease from the continued heating. If the air gap and temperature are correctly set the crystal will drift so that its harmonic and WWV will result in a beat which will remain in the dead beat range indefinitely. The accuracy of this adjustment is easily better than plus or minus 25 parts in 5,000,000. This percentage error may be cut in half, if the above procedure is repeated on the 10,000,000 cycle transmission, or on the 15,000,000 transmission; in which case the accuracy is better than 25 parts in 15,000,000 or 1/6000 of 1%! Once this calibration has been completed, constant reference to our crystal standard may be made.

Since the receiver's variable condenser is of the SLF type, approximately equal angular rotation will result in changing from one harmonic to the next. To set our generator for, say, 1850 kc. requires that we insert the coil within whose range 1800 and 1900 kc. will be found. Beat the generators against the crystal's 18th and 19th harmonics and read carefully the dial settings. By interpolation we find that the reading midway between the two just taken will be the setting for 1850 kc. During the entire operation described in the above paragraph, the screen voltage was not varied. Such variation causes a frequency change.

The condenser at "150" has a capacity of approximately 60 µµfd. At "0" the capacity is approximately 140 µµfd. The ratio of frequency covered by a coil is approximately 1.25 : 1 and results in good spread and ease of accurate readings.

Coils are wound on 1½" Hammarlund forms for the low frequency range. For the higher frequencies, smaller forms may be used. Exact coil data is not given as it will change with the condenser used. However, the cathode tap should be placed so that oscillations start at approximately 40 volts on the screen.

During operation, it is suggested that screen voltage be well advanced into the oscillating range. The 57 detector will then be a very stable oscillator. If the 100 kc. crystal's output is excessive, reduce it. Failure to do so will make it impossible to dead beat accurately the signals, due to detector blocking.

The 57 detector output (when oscillating) is taken from the plate through a fixed mica condenser. Variations in this loading have practically no effect upon the oscillator's frequency.

For highly accurate frequency measuring work, a calibration chart should be made for each coil, as the aforementioned means of interpolating does not give exact readings except when the frequency is close to a multiple of 100 kc. After the curve is made, it is possible to take readings for months afterwards with very high accuracy, as the calibration curve can be checked against one of the 100 kc. points and any deviation compensated for before a reading is taken.

Calibration is quite simple. We have a point at 3500 and 3600 kc., and want some in-between points for our curve. Tune your regular receiver to 14,100 kc. and you will hear the 141st harmonic of the 100 kc. oscillator. Now tune the 57 oscillator condenser slowly up from 3500 until you hear the 4th harmonic beat with the 14,100 kc. harmonic of the crystal. That will give you a point at 3525 kc. for the curve (¼th of 14,100). Similarly, points may be found at 3550 and 3575 kc., and so on up in 25 kc. jumps.

◆

The Mayor says that from the terrific key clicks put out by *some* of the "corn-fed kilowatts", the operators must be using pop corn. He adds that some of the phone QSO's sound as though the operators themselves were corn-fed . . . from a bottle.

◆

A new 15-page booklet is now available from Supreme Instruments Corp. listing more than 300 tube base connections.

Measuring Audio Power

A great many amateurs have, somewhere in their stock of equipment, a current-squared galvanometer. It is, in a good many cases, seldom, if ever, used. As far as checking modulation goes (although they were frequently used for this some years ago) they, under present standards, are not much help. True, they will indicate when modulation is taking place, but as far as indicating the actual amount of modulation, there are too many other variables to make them an accurate indicator. They can, however, under proper conditions, make a very useful and quite accurate power output measuring device. In the RADIO laboratory, we use one quite a good deal to measure the power output of various modulator systems.

Here is how it is done. The manufacturer gives this equation to figure the current flowing in milliamperes from the scale reading:

(1) $I = \sqrt{S}\ (11.5)$ where I is the current in milliamperes, and S is the scale reading. But since the power formula:

(2) $W = I^2R$ requires the current in amperes, we can point off three places in our constant of equation (1) giving:

(3) $I = \sqrt{S}\ (.0115)$. Then, squaring both sides of (3):

(4) $I^2 = S\ (.000132)$ and substituting (4) in (2) we get:

(5) $W = .000132\ (SR)$ or in another form:

$$(6)\quad W = \frac{1.32\ (SR)}{10{,}000}$$

where W is the wattage in watts, S is the scale reading on the galvanometer, and R is the value of the load resistor.

To measure the output power of a modulator the equipment is set up as in figure 1. Across the secondary of the modulation transformer is placed a resistor, equal to the rated secondary impedance of the transformer or the taps being used. This resistor should have a wattage rating somewhat in excess of the expected output power of the modulator under test. Then the meter is put in series with this resistor and *sine wave* audio, as supplied by an oscillator like the one described in the Nov., 1936, RADIO or a similar arrangement, is applied to the input. The gain is then turned up gradually, keeping one eye on the galvanometer, until

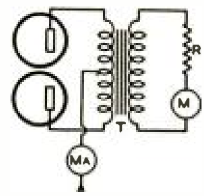


Figure 1

T—Output transformer
R—Resistor to match impedance of secondary winding tap used
MA—Modulator plate milliammeter
M—Current squared galvanometer

the plate current on the tubes reaches the rated value or until further increase in the gain gives no increase in output. The output power can then easily be calculated from equation (5) or (6).

However, if the galvanometer pegs before full power output is reached, (they only take 115 ma. full scale) the meter will have to be re-scaled or a different transformer tap and resistor used (higher impedance). Re-scaling can be done by hooking a 5 ohm slider type resistor across the terminals of the meter, and, with full scale current flowing, adjusting the slider until the scale shows *25* (not 50). The meter is then, if the re-calibration has been accurately done, 230 ma. full scale. Then, because of this current change, equation (5) becomes:

(7) $W = .000529\ (SR)$ and equation (6) becomes:

$$(8)\quad W = \frac{5.29\ (SR)}{10{,}000}$$

The application and figuring is, of course, the same as before.

◆

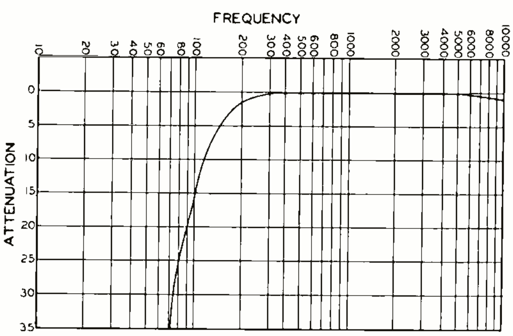
W3ETE writes in that since reading our radioddity about the Canadian working Georgia with no antenna (he doesn't choose to believe it, either) he wonders why he used good firewood for a 90-foot mast.

More Intelligible Radiotelephony

By Ray Dawley, W6DHG

The many advantages attending the use of electric wave filters have long been overlooked by the majority of phone hams. On the other hand, they have had wide application for many years in the communications and broadcast industries.

The reason for the ordinary ham's neglect of them may be attributed to two possible causes. First, their advantages may not have been properly presented, and second, there has been a certain fear of tackling a job that looked as if complicated and expensive measuring and checking equipment were required. Of course,



200 CYCLE CUTOFF HIGH PASS FILTER

in cases where the attenuations and critical frequencies are definitely specified, accurate measurements of both the components and the completed unit must be made. However, there are numerous uses in amateur phone work where the specifications are not at all stringent. In these applications, once the specifications are set down and a set of manufactured components is found that meets them, normal factory variations in the components will not seriously affect the operation of the completed unit. Factory variations seldom exceed 10% either way from the mean values, a small enough amount not to affect seriously ordinary ham applications.

Some years ago a limited application of audio selectivity was made in the old peaked audio and similar types of c.w. receivers. The application, however, was not widespread and soon fell into disuse.

The outstanding application of electric wave filters to amateur radiotelephony would be to limit the frequency response and consequently the band width of the transmitter. This is in direct opposition to the current trend toward the ideal of so-called "high fidelity" transmission. However, long experience and extensive research in telephone practice has shown that wide range transmission is not necessary or even advantageous to good intelligibility. Especially is this true when considered on a cost basis. Attenuating all frequencies below 200 cycles in a normal voice has an almost negligible effect on intelligibility. In addition it has been shown that cutting off the highs at 3000 cycles causes a further reduction of only about 2%. However, this latter cut-off point is primarily resorted to by the telephone companies due to the high cost of maintaining lines and equipment capable of passing frequencies higher than 3000 cycles.

From the amateur's standpoint, however, the greatest advantage comes through the attenuation of the lows. The passage of frequencies lower than about 100 cycles to the present somewhat skimpy amateur type class B output transformers, especially when they are made to carry the class C amplifier plate current, is almost sure to overload them with the consequent production of bad second and third harmonics in the output. Also, because the output transformer acts as a non-linear impedance when saturated by too-low audio frequencies, it tends to cause cross modulation of the higher and lower frequencies with the consequent production of spurious sum and difference frequencies throughout the audio band. This garbling up of the higher voice frequencies seriously detracts from the intelligibility of the signal. From this alone it can be seen that cutting out some of the useless lower frequencies adds to, rather than detracts from, the clearness of the signal.

A very much similar effect to that produced in a small output transformer is introduced by an overload or saturated modulation choke. This, of course, can be produced in a Heising modulated affair with class A modulators or also by the parallel feed choke sometimes used to isolate the plate current from the secondary of a modulation transformer.

Reduction of background noise is another big factor coming through attenuating the low frequency response. This reduction comes from two main sources: first, simply because the band width is reduced; the inherent noise, both from audible sources in the room and from thermal agitation and shot effect in the preceding stages of the amplifier, is reduced proportionately. Second, hum picked up in the equipment preceding the filter will be greatly attenuated due to the cut-off of the filter on the lower frequencies. Incidentally, this last reason indicates that the filter should operate at as high a level as possible in the speech amplifier proper. The reason, of course, is obvious. Since hum pickup is confined almost entirely to the microphone and low level speech amplifier it is best that the filter be placed after these. Usually it is best to operate the filter at about zero level in the amplifier. A 56 tube acting as a voltage amplifier to feed a pair of 45's is a good example. The filter would best be placed between the 56 and the push-pull input transformer feeding the 45's.

Of course it should be remembered that the filter ordinarily attenuates only frequencies below its cutoff point. Consequently, high harmonics of the line frequency, as are often picked up through lack of shielding and long grid leads, will not be attenuated.

Mention might here be made concerning the phrase, "from audible sources in the room". A great many of the ordinary room noises such as transformer hum, persons walking about, conversation, or a radio playing some distance from the mike, have a large low frequency component. Some, such as slamming a door, have a very steep wave front which can easily overmodulate the rig and perhaps put it off the air if the tank arcs over. The installation of a high-pass filter to cut off at 200 cycles greatly reduces this effect and cuts down the room noise appreciably.

One other effect might be mentioned: if the speech amplifier has any tendency to motor-boat or have low frequency feed-back, the filter will, in most cases, completely kill this trouble. In addition, some attenuation of r.f. feed-back, if present, will be affected. However, it is much better to go at these troubles from the source rather than from the effect. Increased shielding and decoupling are the more effective weapons.

If a high frequency cut-off at, say 3000 cycles, is used, some advantages will be obtained. One of these is that, inasmuch as the majority of the present diaphragm type crystal microphones have a peak in the region from 4000 to 7000 cycles, this peak will be attenuated. This would be quite a boon to users of some of the earlier mikes, as many of them have peaks as high as 10 db above the rest of the characteristic. However, the greatest advantage of a low pass filter is that it materially reduces the amount of space taken up by the transmitter in the band. Most ham rigs transmit something, if only hiss from sibilants and harmonic distortion, clear up to 7 or 8000 cycles. This gives a sideband width of (twice the highest frequency transmitted) about 16 kc. Since the common communications receivers seldom pass a band wider than 8 kc., and frequently less, these additional sidebands simply show up as splattering on adjacent channels. Thus, if we do reduce our sideband width to (twice 3000 cycles) 6 kc., our signal will be completely contained in one normal channel on the receiver, greatly reducing splattering. Obviously, however, this expedient will not affect splattering caused by improper transmitter adjustment or overmodulation.

The majority of phone hams, however, will easily be able to detect a different sound to the rig if a low pass filter is installed. There is a slight reduction in "crispness" and a known voice is not quite as easily recognized. Some of the fellows will not like this. But for the high power ham who sincerely wants to reduce the amount of QRM he causes, a low-pass filter will materially help.

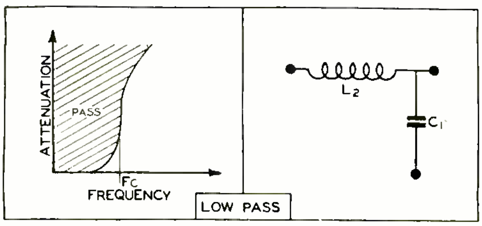
So, for the majority of us who are using medium power, the greatest advantage will be obtained by cutting off the lows. This is apparent from the facts stated before and from the additional fact that, in attenuating all frequencies below 200 cycles (these add little to intelligibility or clearness and require a large percentage of power for their transmission) there is a great saving of power, which is then used in the transmission of the intelligence-carrying higher frequencies. This tends to increase the effective range of the rig by seemingly increasing the modulation percentage. The apparent increase, of course, is due to the greater percentage of *useful* voice frequencies in the sidebands.

There are no theoretical disadvantages as far as operation is concerned. Naturally there is no ageing of parts and once installed the filter can be forgotten. The only real disadvantages seem to be practical ones: the obtaining of the odd values of inductance and capacity, and their accurate measurement. So it is the purpose of this article to describe a few simple filters that might commonly be used and to cite some common and more or less easily obtained parts that answer the specifications.

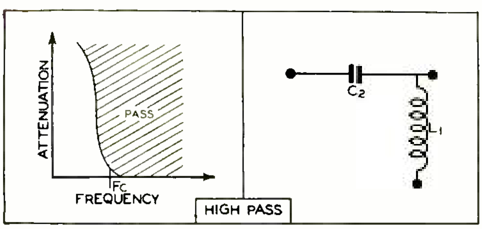
Design Principles

It is far from our purpose to delve into the fundamental design of electric wave filters; much excellent material is available elsewhere.* However, a few simple principles will be explained and examples given.

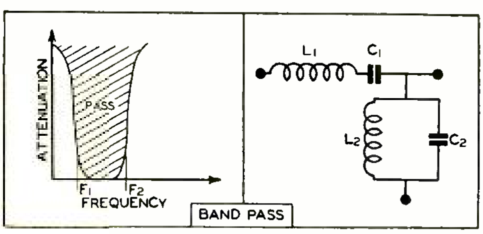
For simple applications such as those cited before, sharpness of cut-off frequency is not at all important; also, the attenuation at cut-off and just outside the pass band does not have to be any definite value, as long as there is attenuation and it does increase rapidly as the frequency gets further from the cut-off point. Consequently, we need not worry about the more complicated "M derived" filters; the simpler and less critical "constant K" sections are adequate for our work. So the only things we need know to start out are the lower and/or upper cut-off frequency and the surge impedance. The following formulae are in terms of these variables:



$$L_2 = \frac{R}{\pi f_c} \qquad C_1 = \frac{1}{\pi f_c R}$$



$$C_2 = \frac{1}{4 \pi f_c R} \qquad L_1 = \frac{R}{4 \pi f_c}$$



$$C_1 = \frac{f_2 - f_1}{4 \pi f_1 f_2 R} \qquad C_2 = \frac{1}{\pi (f_2 - f_1) R}$$

$$L_1 = \frac{R}{\pi (f_2 - f_1)} \qquad L_2 = \frac{(f_2 - f_1) R}{4 \pi f_1 f_2}$$

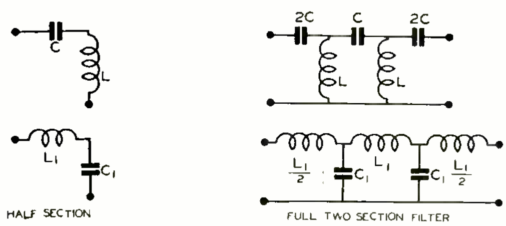
In all the above equations the inductance is expressed in henrys, and the capacity in *farads*. To obtain the capacity in the common units of microfarads the result obtained by calculation must be multiplied by 10^6 or 1,000,000.

The value of R in the above is expressed in ohms. It is numerically equal to the impedance of the line if the filter is to be so used, but it must be computed from the following expression if said filter is to be used in the plate circuit of a tube.

$$R = \frac{R_P \times R_L}{R_P + R_L} \text{ where:}$$

R_P = Dynamic plate resistance of tube
R_L = Plate load resistance of tube

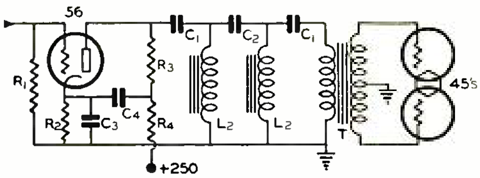
Another thing: the filter diagrams given above are for the so-called "half section"; that means that for a complete filter we must finish it out to one full section or more. We do this by making the input and output values of inductance *half* the calculated value, and capacitance *twice* the computed figure. The inside sections of the filter are not changed. To show this figuratively:



Practical Applications

Suppose we take for our subject a speech amplifier having a 57 pentode coupled to a 56 into a pair of 45's, a common arrangement used with a crystal mike by many hams. We wish to cut off the lows below 200 cycles. So we put in a 200 cycle cut-off, high-pass filter. The best, as well as the most convenient, position for the filter is between the 56 and the pair of 45's. This gives an impedance that is convenient to match and its position is electrically far enough away from the input of the

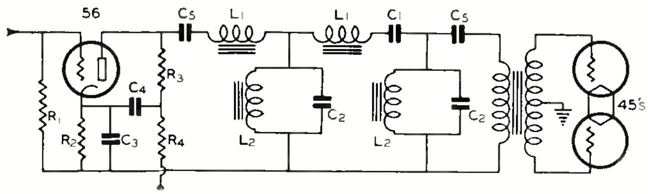
*Examples: Henny (Radio Engineering Handbook), Franklin and Terman (Transmission Line Theory), K. S. Johnson, Shea, etc.



High Pass Filter

R1—0.5 meg., 1 watt
R2—2500 ohms, 1 watt
R3—50,000 ohms, 1 watt
R4—25,000 ohms, 1 watt
C1—.025 µfd. tubular, 400 volts
C2—.05 µfd. same
C3—10 µfd., 25 volts
C4—4 µfd., 450 volts
L2—Thordarson type T-5752 (6.1 hy.)
T—Push-pull input transformer
Note: Use better grade condensers at C1, C2 as they are usually more accurate.

One thing might here be mentioned: in laying out a filter, great care must be taken that the various elements are not magnetically or electrostatically coupled to each other. If this precaution is not taken, the results obtained from the filter may be widely different from the ones expected.



Band Pass Filter

Resistors: Same as in high pass filter
C1—.03 µfd.
C2—.006 µfd.
C3—10 µfd., 25 volts
C4—4 µfd., 450 volts
C5—.06 µfd. (two .03 in par.)
L1—Primary (115 v.) of UTC type FT1 filament transformer
L2—Thordarson type T-5752

amplifier so that virtually all the hum picked up in the low level stages will be filtered out. The tube characteristic data show the plate impedance of a 56 tube, when operating as used here, to be about 10,000 ohms. Since we have a 50,000 ohm plate load resistor for the 56, the resultant impedance would be:

$$\frac{50M \times 10M}{50M + 10M} = \text{about } 8{,}300 \text{ ohms.}$$

Preliminary calculation showed, however, that if this value of R were used, the inductances come out a value not easily available. On the other hand, if we take 15,000 ohms for the value of R, L_2 comes out a convenient value. The only effect this change will have on this type of filter, will be to broaden slightly the cut-off point and introduce a very small additional attenuation. However, filters designed for a sharper or more definite cut-off point must adhere more closely to the calculated values.

With this value of R substituted in the high-pass formula, we obtain these values for our elements: $C_2 = .026$ µfd., $L_2 = 5.97$ hy. Then, since these values are for the "half section", our complete, two-section values will be: input condenser $C_1 = .052$ µfd., center condenser $C_2 = .026$ µfd., and output condenser $C_1 = .052$ µfd., following the laws given before. The inductance remains unchanged, 5.97 hy. for both sections.

To get an idea how much chance an average ham, without complicated measuring equipment, would have in duplicating a simple filter such as this, the components were chosen only by their marked values. The condensers are standard 400 volt tubulars and the chokes are stock Thordarson items. Actually, the input and output condensers used were marked 0.05, the center one 0.025 µfd.

The unit was made up and wired into an otherwise flat-response amplifier. A careful attenuation/frequency run was made and the graph shown is a plot of what was obtained. Using 1000 cycles as the reference level, it can be seen that there is no appreciable drop-off of the highs. The response is substantially flat from 200 to 10,000 cycles. However, below 200 cycles the attenuation increases rapidly; it is down 5 db at 150 cycles, 17 db at 100 cycles, and 35 db at 70 cycles. Beyond this point the attenuation increased still further until it was difficult to measure at 50 cycles. These results are very satisfactory for the use described before, actually somewhat better than we had expected considering the inexpensive parts used.

A listening check further proved our contention; the voices were clearer and more understandable and seemed to stand out better above the background noise level. Incidentally, this feature of a similar filter would make it a valuable adjunct to the phone receiver. Installed in the audio channel, it should make itself very helpful in the reduction of low frequency heterodynes and QRM.

To check our belief that normal factory variations would not greatly affect a simple filter such as this, all the components were accurately measured to see how far off they were from their rated and marked values. The inductances ran 6.13 and 6.6 hy., and the condensers ran from 6 to 10% either way from their marked values. Small changes in inductance and capacity made no appreciable difference to the ear,

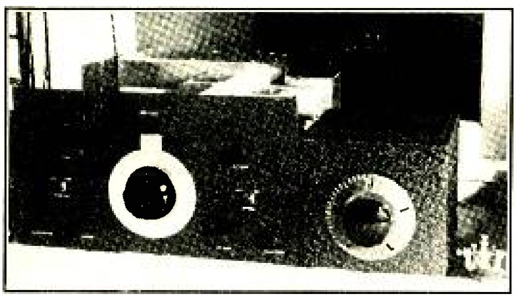
[*Continued on Page 86*]

Stabilizing the S. S. Superheterodyne

By CHARLES D. PERRINE, JR.,* W6CUH

While the improvements described in this article pertain primarily to the superheterodyne described by Mr. Perrine in "Radio" in 1935, they may be applied with highly pleasing results to most any amateur type superheterodyne, greatly increasing the stability (an especially important item when using a crystal filter for 10, 20, and 40 meter c.w. reception). The annoying "warm-up" period is effectively eliminated.

The receiver referred to in the title was built by the writer two years ago and described in RADIO for July, 1935. It was intended solely for dx work and quick band change. Two parallel 954 acorn pentodes in a regenerative r.f. stage gave a very high signal-to-noise ratio; further improvement came from elaborate shielding and effective circuit isolation. No effort was spared in obtaining short leads and making use of every possible stunt to get greater weak signal response.



W6CUH's Two Year Old Deluxe Superhet, and its New "Outboard" Stabilized H.f. Oscillator

But as always happens, troubles developed in spite of all the planning. The oscillator (h.f.) developed a bad case of frequency drift due to temperature effects and a low-C tuned circuit. The temperature rise was pronounced because both the tube and tuned circuit had been arranged for compactness in a small shield compartment. Being a single control receiver, the oscillator was ganged with the r.f. stage and first detector and necessarily used a low-C tank to track with those of the other two stages. The resulting instability made dial settings very difficult to log on 14 Mc., and disturbed the precise tracking adjustments required between the oscillator and the highly selective r.f. stage.

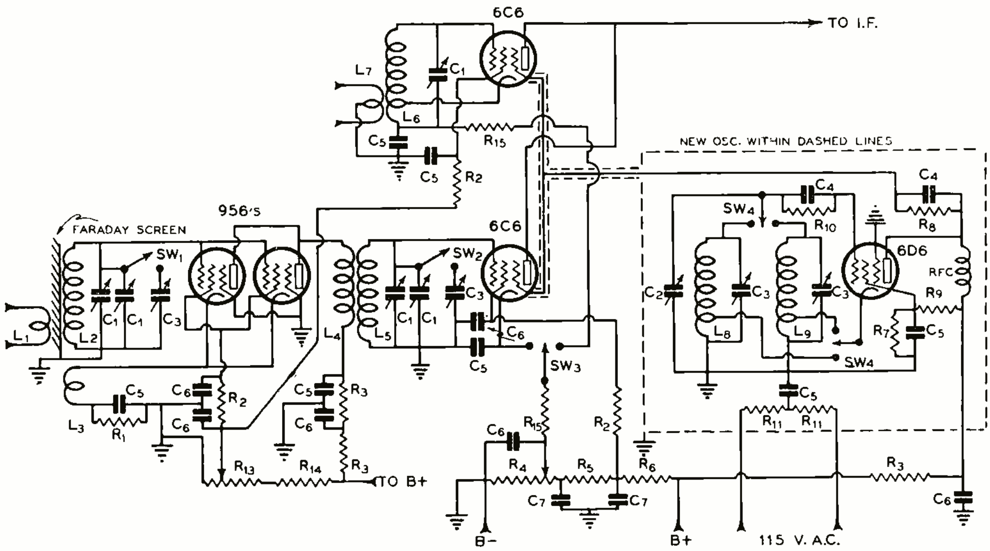
The "Outboard" Oscillator

So with these difficulties and mistakes in mind, it was decided the one way to eliminate all trouble was to use a separately tuned oscillator which could then be designed solely for stability. A two control receiver is not hard to handle, and it had become evident that certain sacrifices in tuning convenience (excluding quick band change) must be made to obtain maximum performance. To this end the new oscillator was built as an entirely separate unit intended to work beside the receiver on the operating table. The old oscillator in the receiver could then be converted to a 28 Mc. regenerative first detector (using the second harmonic of the new oscillator) to give three bands automatically in the receiver.

The oscillator, no longer having to track with the r.f. and detector, can be made high-C for stability. And the r.f. and detector can remain low-C for maximum sensitivity. Temperature effects are considerably minimized with high-C in the oscillator, but to eliminate them completely the oscillator tube itself is mounted externally to the shield cabinet, and continuous operating temperature is permanently maintained within the cabinet by two resistors drawing some 10 watts from the 110 volt power line. Thus the oscillator is always "warmed up", so that dial settings remain fixed at all times. This is a big relief on a cold winter morning when dx is good but takes an hour to settle down as the receiver warms up.

The complete circuit of the new front end is shown in the diagram. Two variable-µ 956 acorns have replaced the 954's, giving smoother regeneration control and less cross-modulation. This combination has twice the gain of a 6D6 or 6K7, with the same plate impedance, and contrary to some arguments, the reduction of grid impedance due to paralleling is not important because in the acorns it is already so much higher than that of the tuned circuit. Regeneration is obtained by the cathode coil L_3, and controlled by varying the screen voltage with R_{13}. The 956's are coupled in conventional manner to the 6C6 mixer tube, which works with fixed bias and suppressor-grid oscillator injection. Both these stages are shifted from 14

*Hermosa Beach, Calif.



High Stability, Modified "Front End" of the Superhet

L_1—5 turns, 1″ dia. no. 28 enamel
L_2—13 turns, 1″ dia. no. 20 bare
L_3—2 turns, 1″ dia. no. 32 s.s.c.
L_4—9 turns, 1″ dia. Interwound with L_5, no. 30 d.s.c.
L_5—Same as L_2.
L_6—5 turns, 1″ dia. no. 14 bare. Tapped one turn from end.
L_7—3 turns, 1″ dia. no. 18
L_8—10 turns, 1″ dia. no. 20 enamel. Tapped at 3d turn
L_9—5 turns, same as L_8. Tapped at 2d turn
C_1—35 μμfd. midget
C_2—150 μμfd. midget
C_3—100 μμfd. midget
C_4—.0001 μfd. mica
C_5—.01 μfd. mica
C_6—0.1 μfd. paper tubular
C_7—1.0 μfd. tubular
R_1—400 ohms, 3 watts
R_2—10,000 ohms, 1 watt
R_3—1000 ohms, 2 watts
R_4—1000 ohm variable
R_5, R_6—30,000 ohm c.t., 50 watts
R_7—100,000 ohms, 1 watt
R_8—50,000 ohms, 3 watts
R_9—40,000 ohms, 3 watts
R_{10}—50,000 ohms, 3 watts
R_{11}—500 ohms, 10 watts, wire-wound
R_{13}—50,000 ohm pot.
R_{14}—10,000 ohms, 3 watts
R_{15}—200 ohms, 3 watts
RFC—2½ mh.
S_1, S_2—Band changers (7-14 Mc.)
S_3—Band changer (14-28 Mc.)
S_4—Osc. sw. (7-14 Mc.)

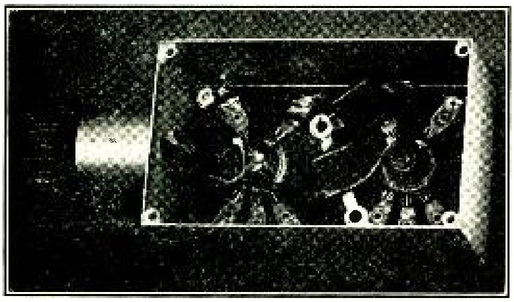
to 7 Mc. by the switches S_1 and S_2 (ganged on the main condenser shaft to change bands at 60 on the dial). S_1 and S_2 cut in the trimmers C_3 that load the two circuits to 7 Mc. Thus far the circuit has been the one originally used.

The new part of the circuit begins with the 6C6 28 Mc. mixer. It is tuned by the third condenser on the main shaft (that originally tuned the old oscillator). Regeneration is obtained by tapping the cathode up on the coil, and is controlled by the same R_{13} that handles the 956's on 7 and 14 Mc. Change-over to this detector is made by switching the d.c. cathode returns with S_3. The plates of the two mixers are permanently connected to the common i.f. unit. The suppressors are similarly tied together and to the oscillator. Since only one mixer is active at a time, this interconnection is permissible.

The most important part is the high frequency oscillator. A 6D6 is used in an e.c. oscillator circuit with a high-C tank on both 14 and 7 Mc. The cathode and grid of the 6D6 are switched from one tank to the other by a d.p.d.t. jack type switch; as minor losses are unimportant in the oscillator, everything can be designed for stability and convenience. Each coil has its separate padding condenser, while C_2 is part of the National PW-1 drive unit. The values of capacity and inductance are such that the band-spread is about 100 degrees (two revolutions of the dial) out of the available 500. A considerable variation in bandspread is possible by changing the padders so as to shift the band to one end or the other of the PW condenser (s.l.f. plates) range. The bandspread is greatest near the low-capacity end of C_2, and least when the band is shifted to the high capacity end of the scale.

Screen voltage for the 6D6 is taken from a divider to lessen the effects of line voltage fluctuations. Both sides of the heater are bypassed, and added filtering of the plate lead is obtained with R_3.

The entire oscillator is contained in a National SRR type cabinet that is placed at one side of the receiver as shown in the photograph. The important oscillator coupling lead to the



The Two Paralleled "Acorns", Used in the 20-40 Meter R.f. Stage, and Their Adaptor

two detectors is thoroughly shielded over its entire length. The PW unit is slightly raised above the sub-panel by heavy spacers so as to bring the knob some 3" above table level, a convenient tuning height. The oscillator tube is actually outside the cabinet, its socket being mounted in the back of the cabinet just below the sub-panel level. This placement brings the plate lead out under the sub-panel and the grid above it, effectively isolating the input and output circuits of the oscillator. The tube thus projects horizontally from the back of the box. Both tube and grid lead are well shielded, though care must be taken to support the grid lead solidly to prevent vibration. The two padders, C_3, C_3 are firmly mounted inside the cabinet. The coils are close wound on one-inch bakelite tubing. All wiring is done with heavy bus-bar.

Eventually a larger panel will be added to include the oscillator and make it an integral part of the receiver.

The Beat Frequency Oscillator

Any story on receiver stability must of necessity cover the beat frequency oscillator, whose stability is particularly important when using a crystal filter. Though not shown in the diagram, the b.f.o. has several features that have proven merit. Using an e.c. 6D6, the tuned circuit is extremely high-C and entirely air tuned. A 95 turn 1" coil is tuned by a 1000 μμfd. air condenser. In addition, a much higher C (4000 μμfd.) tuned plate circuit reduces hiss by eliminating harmonics in the oscillator output.

The idea of a separate oscillator can easily be applied to any existing receiver. The problems involved are essentially those outlined above, and should not prove difficult to solve. It provides a way of improving the tuning mechanism, greatly increasing stability and calibration permanence, and incidentally adding another band to the receiver's coverage . . . all without serious changes in the original equipment.

The result in this case has been almost a new receiver. The new rock-solid stability makes operation a pleasure, as does elimination of the "warm up" period. The positive tuning and permanent calibration have made possible more effective use of the full crystal selectivity. Though an extra tuning control was added, it was entirely justified because everything can now be kept accurately on the nose, especially the unusually sharp r.f. stage.

◆

MESSAGE TOTAL?

Pleasant Ridge, Mich.

Sirs:

An intercollegiate chess game was played by amateur radio Dec. 2, between Wayne University in Detroit and Carnegie Tech of Pittsburgh. W8CUG transmitted the play for Carnegie Tech and my station was used by Wayne U. C.w. was used on the 80-meter band.

Play started at 7:30 p.m. with two games under way. Wayne won the first game at 10:30 p.m. The second game was still going strong at 2:30 a.m. when it was called off, to be finished later—everyone needed sleep.

Except for qrm at times, no difficulty was experienced at either end handling the plays. W8FZ pounded brass most of the evening for me and hopes some of his friends who thought that his right arm had gone dead were listening in.

If any other ham is contemplating a chess game by radio, I would suggest a time limit be set before the game is started. Otherwise, he had better be prepared to lose some sleep.

RALPH H. SUMMERS, W8OQF.

◆

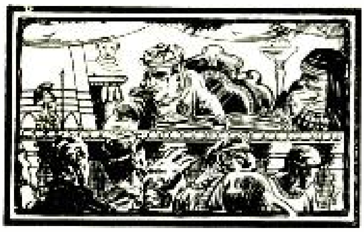
DIT DIT DIT DAH

Irvington, N.J.

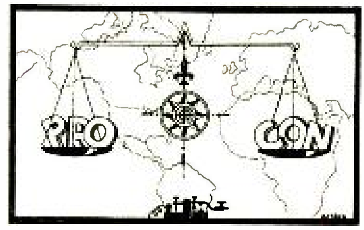
Sirs:

I wonder how many persons have ever noticed that in the very first few bars of the "Hungarian March" by Hector Berlioz there are several perfect V's. I haven't noticed code in any other music I have heard except this one. If Berlioz had been a modern composer, there might be a suspicion he had once been a V-sender for a commercial station.

CLEMENT VAN VELSOR, W2HNX.



THE OPEN FORUM



RUBBER KILOCYCLES

Cumberland, Maryland.

Sirs:

Rockwood, W1IOB, is partly right when he says low power is what we need to clear up this QRM problem.

But along with lower power we should have one of these so-called "rubber crystals". Many times I have wished for such an animal, for I can find dead spots on most of the "ham" bands. If we had one of these "rubber crystals", it would be an easy matter to get on a frequency free of Calif. Kilowatts.

It sure makes me mad the way some of the boys talk about QRM. The way they think about it is that the F.C.C. should give 'em more space every time they open their traps. I have always been taught to make the best of it with what I had. One time you read that the 'fone boys want all the c.w. bands and the next issue the c.w. boys want all the 'fone bands; see-saw all the time. They are never satisfied, the punks.

What good is a kilowatt? About the only people that gain from it is the power companies. A kw. is only grief. I bet a lot of the boys who bust the ether with their one kw. wish they had never tied the money up in it that they have. I know because I have talked with quite a few of them.

Any day I would rather work five bands with 100 watts than I would work one band with a kilowatt. The thrill is when you can reach over from your operating table and throw a few switches and go from 160 to 10.

If I ever begin to think of putting on a kw. I wish someone would give me a kick in the pants.

Robert O. Slemmer, W3ETE.

FOR FLEAS THAT STAY TO HOME

Grosse Pointe, Mich.

Sirs:

I believe too much stress has been laid on "flexibility" and "5 band c.w. and phone transmitters". I am only interested in 80 and 40 (occasionally 20) meter c.w., and I know there are a great many amateurs in the same boat.

I know that it is wonderful to read how, like a flea, one can hop from one band to another, but lots of fleas are content to stay on their own dog.

What is the sense of a string of stages and a flock of tubes when one winds up with but 50 watts? My idea is to use a 6L6 high-output crystal oscillator driving a big tube or pair of tubes with about a half kilowatt input. Why not use separate crystals for 20, 40, and 80 meters and work straight through? The crystals are a lot cheaper than the usual mess of junk used to "save" a crystal or two.

Fred Sutter, W8QBW.

QRT QSP?

Holland, Mich.

Sirs:

Too much space in our present bands is given to traffic work. True, traffic work helps develop the ham in accuracy and speed, but of what use is it to the good name of amateur radio and the public?

The trouble in the present traffic going via hams is that the messages are all, with the exception of about 5 per cent, not important enough to bother about. If 50 per cent of the messages were really worth handling, then traffic work would not only be a greater pleasure but a greater asset to ham radio.

Being a traffic man for several years myself, I can truthfully say that sometimes, in fact *most* of the time, a message is made up merely to help the good old total for the month. The only good way to handle traffic is to eliminate all messages that are of no importance and merely made for totals. This would expedite the handling of important ones.

The best plan would be to keep traffic going on the present ARRL trunk lines and let these stations handle the bulk of the traffic. Handling messages by merely looking over the band for a station near the point of destination is very poor traffic work. This should only be done when you know of a station near the place of destination and when you are quite sure you can work that station. Accepting a message under those conditions is very good traffic work. However, trying blindly to get off a message is usually futile, and inefficient at most.

By cutting down the unimportant messages and keeping only messages that are worthwhile going through the ham traffic lanes, it will cut down the QRM (and nowadays that is a real help).

We cannot eliminate traffic work altogether, because there are many cases where good traffic helps establish the hams' importance in the U.S.A. and also helps the public. Besides, it is very interesting work to the fellow interested in traffic handling. However, more stress should be placed upon the message itself as to its importance, and less on the total number of messages handled.

RUS SAKKERS, W8DED.

◆

TUNED RECEIVING ANTENNAS

Mayor's Office
Moss Landing, Calif.

Sirs:

After takin' the week off for a careful peerusal of your rite smart Jan. issue I find an old trick suggested that was first used in 1917, viz., tuning the wire that goes into the receiver, which, after all, is just as important as the hunk of sky wire tied to the transmitter.

The idea is really an "oldie", and has just been neglected by most of us all these years. Having it brought back to mind by RADIO aroused me to anatomical gyrations with pliers and soddering iron. I thought you might be interested in the surprising findings out.

The antenna is approximately 150 feet long (for 160 meter phone) and is inductively coupled through a faraday screen to the grid coil of a home-made pre-selector for my PR-10. It is series tuned with a 500 μμfd. variable condenser and worked against ground. This gives a gain of 2 "R" points, and greatly improves the signal to noise ratio. I can now read 160 meter phones as far away as 500 miles at 1 p.m.

The first time I turned on the transmitter, things started to happen. The tuned receiving antenna had more r.f. on it than the final tank coil. That was cured by opening the receiving antenna while transmitting.

The fellows prosperous enough to afford relays can probably use their transmitting antennas for receiving and get the same improvement. I know lots of the 20 meter high-hat engineers do this with good results, but for some reason the 160 boys never seem to want to bother with using a tuned receiving antenna.

I have a new invention of my own that I think is too good to be deprived from the world and I am passing it on to you so that all humanity may enjoy my gift to mankind and I will be known as a great human benefactor as well as a 160 meter phone man and a menace to society.

To cure all feedbacks, noise, QRM, QRN, BCLitus, splatter, and other such troubles, start with the gazinta of the receiver and ground the grid; then the next, and the next, and so on till all is quiet.

Hauled a lot of wood home for the stove, but forgot to buy the wife an axe for Xmas, so guess it won't ever reach the stove. Looks like I'll have to hook some diathermy pads to my 210's in order to keep warm.

TOM WHITEMAN, W6DDS.

◆

3.5 MC. DX

Warren, Ohio.

Sirs:

In regards to the article "A $100 Sky Wire, or QRO?", page 35 of the Jan., 1937, issue of RADIO and referring to the latter part of this article it says, "Remember when we raised the height of the 'antenna' portion of our old antenna-counterpoise radiator and our reports went way up—in spite of the fact that the increased spacing between the two halves of the antenna caused the antenna current to drop 30%?" Now, there is a whole lot connected to that little change and it means a lot.

For the past five years I have been using the antenna-counterpoise system for 80 meter work, because due to lack of space in the back yard it's the only system I can get up. A zepp is out of the question because the b.c.l.'s cast a mean eye at me if I step over the line. Well, I began fooling with this system and found that the angle of radiation can be changed by increasing or decreasing the separation between the two halves of this system. The height of the antenna makes no difference at all—the main thing is the separation between the two halves. I have tried the antenna 40 feet high and moved the counterpoise up also and no difference can be noted.

Leaving the antenna portion at 40 feet and the counterpoise at the usual height simply lowered the angle of radiation to such a point that I had a heck of a time trying to QSO anyone. Bringing the antenna down to a height of 35 feet and the counterpoise 8 feet high at the lead-in end and 6 feet high at the free end gives a good low angle of radiation. Signals

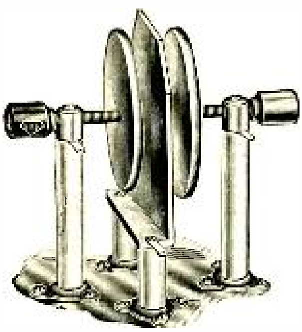
[Continued on Page 76]

What's New

New U.H.F. Tuning Condenser

Bud Radio Inc., of Cleveland, Ohio, has just announced a new ultra-high frequency condenser which is illustrated below.

This condenser is ideal for use in either a split or conventional tank circuit tuning above 56 megacycles. It also may be easily adapted for use in a parallel-plate oscillator.



Bud ultra-high frequency condensers are constructed of aluminum plates with highly polished surfaces. The two round plates are 2 3/16" in diameter and 3/16" thick, with rounded edges to minimize corona effect. Both plates are mounted on Isolantite pillars, and very long, threaded shafts attached to these plates make possible an exceptionally wide range of capacity variation. The center plate is also mounted on Isolantite pillars, but is fixed in position.

◆

Recording Amplifier

The Universal Microphone Co., Inglewood, Calif., offers a new medium-priced recording amplifier which incorporates what is said to be revolutionary ideas in the form of a new phase inverter system, a new low- and high-pass filter arrangement operated by a single control knob, and the use of a neon volume indicator.

The amplifier is extremely small in size and light weight (twelve pounds) for portability and simplicity in operation.

Extreme high gain of 120 db makes it suitable for use with any type of microphone or pickup, and the combination high- and low-pass filter allows the adjustment of the frequency characteristic in any desired manner.

All-metal tubes are used in the new circuit, and the output is eight watts. A switch is provided for changing the output from the loudspeaker to the recording head.

◆

Sectional Cabinet Relay Rack

In order to meet present day demands for a universal transmitter cabinet, Bud Radio Inc. has introduced a new sectionalized cabinet relay rack.

Possessing such desirable features as sturdiness, neat appearance, and all-steel construction, this cabinet can be well adapted to a multitude of uses.

This smart looking cabinet is never out of place, even in the most pretentious surroundings. The basic components of this Bud sectional cabinet relay rack are the rugged mounting base and top cover. There are eleven sizes of side sections ranging from 3½" in height to 21". Each side section corresponds to a standard rack-panel height. Both front and back flanges of the side sections are tapped for Western Electric or amateur type panels. Adjacent side sections are held together by means of an ingenious angle which also serves as a mounting bracket for a shelf.

Dust covers for the back of the rack are made of cane design steel, and are finished in the same sizes as the side sections. The depth of the rack is 14½" which allows plenty of room between each shelf and the back for power supply wiring and other inter-stage connections.

The side sections are louvred to provide adequate ventilation, and all parts are finished in black crackle enamel.

Bud Radio Inc. also manufactures a complete line of rack panels and metal panels to fit this cabinet.

◆

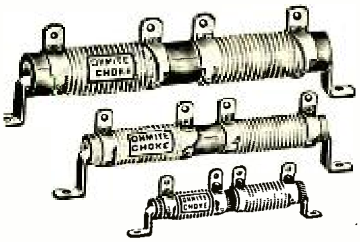
New Power Line Choke

A power line choke of unusual effectiveness is announced as a new product of the Ohmite Manufacturing Company, well-known makers of rheostats and resistors.

These chokes were primarily designed for use on amateur radio transmitters, to prevent the interference which they may cause to owners of radio receiving sets in their immediate neighborhood, insofar as such interference may be fed back out over power lines.

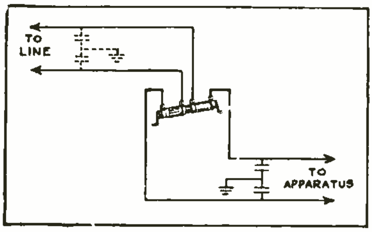
One of these chokes, however, is also specifically designed to be used on radio receivers, to prevent interference of radio frequency from coming in to such sets over house lines and power lines, from nearby sources.

These power line chokes will not prevent interference of audio frequency and they are not recommended for that purpose. However, the choke men-



tioned in the above paragraph as being suitable for use on radio receivers will suppress the radio frequency component of many miscellaneous sources of noise coming into a radio receiver over the house line, in addition to preventing interference coming in over the line from recognized sources of *high frequency* currents— such as radio transmitters, therapeutic machines, welding machines, and similar apparatus.

The chokes must in all cases be used in connection with grounding condensers, as shown on the diagram, to form a filter. These by-pass condensers are each 0.1 micro-farad. Their best location is determined by trial. Three sizes of these line chokes are now available, capable of handling currents of 5, 10, and 20 amperes, respectively. The smallest of these sizes



is the one which is designed to be also used on receivers. In devices where currents greater than 20 amperes are used special units are made up to order to fit the special requirements of each case.

◆

Midget Oscillograph

The new type 913 cathode-ray tube has made possible an entirely new form of cathode-ray oscillograph, the model 105, which has just been announced by the Clough-Brengle Company.

Except for physical size and screen area, this instrument is identical to their larger oscillograph, model CRA. Every performance feature has been retained, such as the following: built-in linear sweep, separate high sensitivity amplifier for both horizontal and vertical inputs, and beam centering controls on the front panel.

The entire unit is contained in a compact carrying case, 8⅞" high, 8¼" wide, and 9⅜" deep. The finish is baked black crystalac with an etched silver and green front panel. A unique feature is the adjustable hood which surrounds the cathode-ray tube and may be extended several inches out from the front panel to keep all direct light off the tube screen.

Notwithstanding these advantages, the model 105 is offered for about one-half former oscillograph prices. It is supplied complete with tubes for direct operation from 110 volts, 60 cycle power supply. Special models for other voltages and currents are available.

The instrument is complete for all radio servicing, transmitting, and general laboratory applications.

Complete new descriptive bulletin and price may be secured by writing the manufacturer, Clough-Brengle Company, 2815 West 19th Street, Chicago, Illinois.

◆

Filamentless Rectifier

After eight years of research and experimentation, Raytheon has brought out a filamentless auto radio set rectifier, which is embodied in two types, the OZ4, a metal type illustrated herewith, and its companion, the OZ4G, a tube of the same characteristics, but in glass. These tubes will mean much to auto radio manufacturers. The OZ4 and OZ4G are very efficient, have no filament to burn out, and save battery drain. They possess excellent regulation, making possible greater undistorted output. High voltage surges,

which customarily shorten condenser life in auto radio sets, are tremendously reduced. Much less heat is radiated to affect the delicate parts of the auto radio receiver. The tubes are extremely small in size, representing a considerable space saving in auto radio construction, where space is at a premium. The illustration shows the greatly reduced size as compared with the 6X5G and 6X5, which the new tubes replace.

Since the OZ4 and OZ4G have no filament, burn-out trouble at high battery or charger voltage is not possible, nor is the customary drop in output at low battery voltage existent. The new tubes are not affected by change in temperature, and are interchangeable insofar as characteristics are concerned with the 6X5 and 6X5G. They can replace the older type 84 by merely changing to an octal base socket.

◆

Microphone Data Sheets

An innovation in the presentation of technical data on microphones is the new *"Microphone Applications and Specifications Chart"*, just published by the Shure Brothers, 225 W. Huron Street, Chicago.

This chart gives complete detailed technical data on 50 Shure microphones of all types in convenient, readily-accessible form. The chart folds to 8½" x 11" size and is punched for standard 3-ring binders.

The convenient grouping of models by applications and types greatly simplifies the selection of the proper microphone for a given installation. Another new feature, introduced for the first time in this chart, is the statement of output levels in terms of millivolts per bar, with simple conversion factors to obtain the approximate total microphone output voltage for normal speech. This is very convenient when calculating required amplifier gain. Many other useful facts, including sizes and weights, operating data, directivity and the approximate response characteristic of each model, are given in the chart.

Copies of the chart are available to engineers, sound men and servicemen. Simply request form 227 on letterhead or mention your regular distributor's name.

◆

New "Communication" Type Mike

The model VT-73 voice transmissions microphone is a new Turner Crystal unit designed to have a most suitable response for voice transmissions work, hence the name. This model VT-73 denotes the entire microphone setup of crystal head, stand and anti-resonant cable, and shielded plug. The microphone head is housed in a light weight aluminum shell finished in black crystalline, having a very wide open face. The unit itself is protected by a heavy monel metal screen with such opening that no sound is lost in passing through the screen. This unit is provided on a swivel head arrangement allowing the head to be placed in almost any position. The output level is high, being -55 db.

An important feature of this microphone is the length of the cable equipped with it, this being six feet, contrary to the standard practice of furnishing eight-foot cables. This is particularly desirable to short wave transmissions, the six-foot cable being non-resonant at five meters. This feature eliminates any "motorboating" and other feedback effects.

The shielded microphone plug is all of machined brass, chrome finished, very solid in construction, and 100% shielded. Shielded jacks are available for this plug. However, the plug fits a standard phone jack.

The stand is light in weight, finished in rubber satin finish with rubber mounting feet and the entire assembly is so light that it can be used as a hand microphone over long periods of time without effort. The use of this microphone is not confined to ham use, alone, but may be used for police transmissions work; in fact anywhere where *voice* transmissions are carried on. This is a special microphone designed for a special purpose, and is not intended for general public address work.

◆

Self-Aligning Chassis Punch

An improved type of self-aligning punch for making large holes in chassis for tube sockets, filter condensers, etc., has been brought out by the Insuline Corporation of America, 25 Park Place, New York.

This new tool produces perfectly clean, round holes in a few seconds. Because of a spring-supported inner member, the cutting edges center themselves automatically when the head of the punch is struck by the hammer, and shearing is entirely impossible. No drilling of center hole is required. Hardened and tempered steel is used throughout, and hundreds of holes of uniform size can be made in succession.

Designed for amateurs, experimenters, servicemen, machinists, and other workers in sheet metal, the new ICA punch is available in five sizes, to make holes of the following diameters: $\frac{3}{4}$, $\frac{7}{8}$, 1 3/16, $1\frac{3}{8}$, and $1\frac{1}{4}$ inches.

The 1937 catalog of the Insuline Corporation is now available to amateurs, service men, and experimenters. It contains 40 pages measuring $8\frac{1}{2}$ by 11 inches, and describes the extensive "ICA" line of receiving and transmitting parts and accessories, service tools and attachments, racks, panels and chassis, and hundreds of other items.

◆

New Etched Foil Condensers

Cornell-Dubilier has recently brought out the etched foil dry electrolytic condensers. This type is notable for its extreme compactness and the fact that it assures a much better condenser than that made possible by less modern foil etching methods. An idea of the small size of the type KR may be gained from the fact that the largest condenser in the series (24 mfd.) is approximately the same size as the average metal tube. This makes for convenient servicing of small receivers, greater symmetry of layout, and contributes to the neatness of service jobs. Full details of this line of condensers are given in a special catalog no. 134A, which is now available and which may be secured by addressing the manufacturer at South Plainfield, New Jersey.

◆

Precision Plug-in Resistors

Precision resistors in handy plug-in form and of selected ohmages permitting of various combinations for any total resistance value, are now offered by the

Clarostat Mfg. Co., Inc. These plug-in resistors were originally developed for use in resistance bridges and other test equipment employed in the Clarostat laboratory and plant. Housed in a standard 4-prong tube base, these units are available in values of 1 to 10,000 ohms, with any accuracy up to 1/10th of 1 per cent. Due to the design, they are quite inexpensive.

Postscripts and Announcements

QSL CARD CONTEST

To the owner of what our judges vote the most clever or distinctive QSL card, RADIO will give as first prize one Amperex HF-100, and one RK-39 will be given as second prize.

The card may be a line-cut cartoon, a photographic card, a regular printed card, or any other type. However, color will not be taken into consideration. In other words, if your card is printed in fancy colors, it will have no more chance of winning than a plain black-and-white card. Only one entry may be sent in by one person.

To enter, take one of your cards and write on the *back* any suggestions you have for the improvement of the magazine. What you write will have no bearing on the chances of your card winning the contest (the judges will examine only the front), but you must offer some constructive criticism in order to qualify. *Do not write anything on the face of the card.* Enclose the card in an envelope and mail to RADIO, c/o Contest Editor, 7460 Beverly Blvd., Los Angeles, Calif. Enclosing the card in an envelope will keep it from becoming soiled in the mail. This is necessary, as the eight best cards will be reproduced in RADIO for the benefit of our readers. These will include the two winners and the next six runners-up.

Contest closes February 28, 1937. Entries must be postmarked by that date. Entries are not limited to this country; they may be from any foreign country. Foreign winners must pay import duty on their prizes.

Low "C" but High "Q"

Several inquiries have been received as to whether or not the high-efficiency 5-10 meter resonant line amplifier described by Dawley last month can be modulated satisfactorily, in view of the fact that the tank is "very low C, which is not recommended for phone".

The linear tank has very high "Q", and is for that reason very well adapted for telephony. After all, the only reason for using a higher ratio of C/L in a phone transmitter is to increase the "Q" of the tank. The linear rods have a very good "Q" with no lumped capacity at all. It matters not whether we get our "Q" by using high "C" or by other means, just so it is there.

The "Super Gainer" as a Monitor

The Jones Super-Gainer will operate as an efficient monitor if a special adapter is plugged in, in place of the usual first r.f. coil. The adapter is easily made by connecting the various prongs of a standard tube socket together with short pieces of wire. To operate, merely plug in the adapter and advance the volume (first detector screen) control until adequate volume is obtained. Since the oscillator circuit is undisturbed your signal will appear at its customary place on the dial. As the entire signal input is through the oscillator coil (which is detuned 475 kc. from the incoming signal frequency) this monitoring system will work satisfactorily with quite high powered ham rigs.

With the adapter in use there is no discrimination against repeats and your station signal will appear at several places on the dial. Consequently this arrangement is not suitable for frequency measurement work.—*W9YSA.*

◆

Second Braille Handbook Due

The single Braille copy of the Amateur Handbook is in such demand in New York that it cannot be obtained for the Pacific Coast. However, I. A. Bonilla and H. W. Britton, members of the Santa Barbara, Calif., Fire Department, are working on a complete Braille transcription.

Diagrams are punched into the paper in the same manner as maps are punched into a Braille geography. Bonilla and Britton use an attachment placed on a sewing machine for the purpose.

APOLOGIES

Month ago "Radio" received among many others a manufacturer's publicity request accompanied by a clipping. Without heading, by-line, or signature it appeared to be the usual house organ extract, and was run on page 74 of January "Radio". Actually it originated with a contemporary. To the author, George W. Shuart, to the readers and publishers of "Short Wave Craft", apologies. To "Radio's" editor charged with reading exchange magazines, a rebuke.

Some of our readers had trouble locating duralumin alloy 52S-H specified in the January issue. We asked Karl Duerk, W8ZY, to look up his original invoice for the material in his mast and found that the alloy is 4S-H. Upon checking back with the Aluminum Company we find that 52S-H is approximately the same price but just a bit better for the job of withstanding vibration in the wind. The invoice indicated a total weight of 41 pounds for the 70 feet of material and a total cost of $24.89, but the sizes were all outside diameters rather than inside diameters as mentioned in the article. The larger diameters as recommended in the article are stronger, but slightly heavier and a little more expensive. In either case, these alloys are obtainable upon order, delivery requiring about five weeks.

Since we called upon W8ZY, the mast was taken down to try running a zepp feeder within 33 feet of the top to make a high half-wave antenna rather than a full wave on 14 Mc. With the clamp feeder all ready, it took only *15 minutes* to take down the 60 foot mast, attach the clamp and feeder, and put it back up!

Karl decided that it was better to use the full wavelength vertical antenna on 14 Mc. because with the half-wave, while reports of R9 were received from Australia, *lower* reports received from EL2A in Liberia and other "close" stations which had formerly given QSA5 reports to W8ZY. The mean height of the half-wave arrangement was 1¼ wavelengths high, giving a sharp lobe at an unusually low angle.

Additional data on the operation of the 60 foot vertical have been given to us. Regular QSO's with EL2A indicate that reports run R8 between 4 and 7 p.m. E.s.t., R9 from 7 to 9 p.m., and R8 until midnight, when conditions are relatively poor at EL2A for U.S.A. signals. W8ZY has worked 107 countries and 37 zones, has won five dx contests for his section or district out of five entered, and ran 32,000 points in the last A.R.R.L. dx contest in 41 hours although "not competing".

We have recently checked the theoretical pattern of a full wave vertical antenna just above ground as compared with a horizontal, a half wave above perfect ground. The maximum radiation is at an elevation of 30° in each case. A higher horizontal antenna, of course, would have a lower angle for the nose of the lower lobe.—*W9FM.*

MONTHLY PHOTO CONTEST

The photos may be of any kind, just so that they are at least remotely connected with amateur or commercial radio. They may be unusual shots of common apparatus, common shots of unusual apparatus, candid camera shots of well-known amateur radio personalities.

For the best photo each month we will pay $5.00 in cash. For all those published, we will pay $1.00 each. Unused snapshots will not be returned unless accompanied by a stamped, self-addressed envelope. When sending snapshots, be careful not to mar them with paper clips. Wrap each photo separately in a piece of writing or tissue paper if you want them to arrive in top condition.

6L6 Exciter Notes

If trouble is experienced getting the 6L6 exciter described in the December issue to "put out" on 80 meters with a 160 meter crystal (this sometimes happens with an X-cut 160 meter crystal, as they usually are not very free oscillators) the trouble can usually be cured by using more turns in the cathode circuit. With nearly all good AT- or Y-cut 160 meter crystals the 14 turn coil specified will give satisfactory results.

Some amateurs have reported having difficulty in getting the exciter to function as described. This was anticipated to a certain extent, as the exciter is somewhat more "tricky" than a conventional oscillator. Nevertheless, we would appreciate your not writing us with your troubles except as a last resort. For every instance of trouble, we receive reports of a half

Schedule of 5-Meter Standard Frequency Transmissions from W1AY

Date—Each Monday evening.
Time—8 P.M. E.s.t.

8:00 P.M.	56.00 Mc.	Voice announcement and tone signal
8:05 P.M.	56.93 Mc.	"
8:10 P.M.	58.00 Mc.	"
8:15 P.M.	59.00 Mc.	"
8:20 P.M.	60.00 Mc.	"

dozen amateurs getting highly satisfactory results. We suggest that if possible you contact a local amateur who has his working properly and get help from him, as it is rather hard to "diagnose" trouble by mail.

◆

Keying the 6L6 Exciter

Many amateurs have written in asking how to "cathode key" the 6L6 exciter described in the December issue. The proper circuit is shown in the 100-T transmitter described elsewhere in this issue by Ray Dawley.

◆

80-160 Meter Calls Heard

In sending in "Calls Heard", remember that we are interested in receiving 2000-3000 mile 160 meter phone reports, 3000-7000 mile 75-85 meter phone-c.w. reports, as well as extreme dx on the higher frequency bands. Please include "R" strength, and approximate date. It is this data that makes "Calls Heard" of value to the stations listed.

◆

WAZ Honor Roll Limit

In order to prevent the "WAZ Honor Roll" from becoming too cumbersome, the number of qualifying zones for March will be raised to *28 or more.* As time goes on the figure will be raised as necessary to keep the list down to approximately 75 calls.

◆

Contest Winner

The recent receiver contest conducted by Radio was won by Mr. R. M. Barnes, W4EF. The winning receiver will appear in an early issue.

◆

Erratum

In the tube tables in the January issue, the plate-filament capacities of the RK35 and RK37 should read 0.4 μμfd. instead of 4 μμfd. as given.

Christmas Delay

Ordinarily first copies or acknowledgements are mailed within forty-eight hours (usually twenty-four) after subscription orders are received. The large volume of orders at Christmas time unavoidably increased this delay—for which we apologize. However, engraved gift announcements whenever requested were air mailed before Christmas on all orders received before that day. Even on Christmas day gift announcements were rushed out on the many special delivery orders received during the day.

Additional automatic equipment ordered was caught in the hold of a boat by the current marine shipping strike, and was not available to expedite the avalanche of Christmas orders.

Allow Time

A few of our more impatient subscribers on the East Coast are reminded that minimum first class mail time is ten days for a transcontinental round trip; somewhat longer is required for magazines. The time required was of course considerably longer during the pre-Christmas period, and many gift orders were received after Christmas requesting that first copies be delivered before Christmas! And in some cases (not all at Christmas-time) complaints of non-receipt of the first copy have been received dated earlier than the first copy could have reached the customer had it been sent by first class mail within an hour after receipt of the order.

◆

W6CUH East

Charles Perrine, W6CUH, one of the best known W6's, is leaving about Jan. 20th on a business tour of several of the amateur parts manufacturers in the east. He will visit Philadelphia, Camden, New York, and Malden, in the order named. He wants also to meet as many of the gang as possible, and will use the land phone for CQ's in each city. Incidentally, it has been rumored that he is interested in checking "arc length" on the "East Coast Kilowatts".

Ten Cents Per Foot

By Carlos S. Mundt, W6ZI

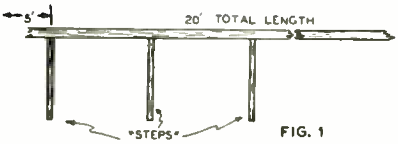


FIG. 1

FIG. 2

ABOUT 6 SQUARES AS ABOVE

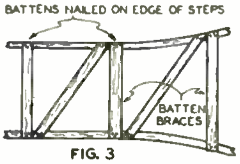


FIG. 3

FOR EDGES 2 & 4 ONLY

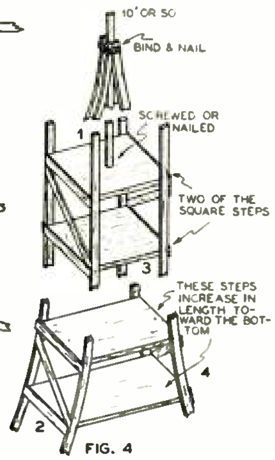


FIG. 4

Several articles have appeared on these pages describing a latticed mast of considerable height, but nothing has been said about a mast suitable for erection on a housetop. Many amateurs do not have the available area for a very tall mast and thus need every bit of height they can gain by utilizing the house itself, or perhaps a garage. Have you ever wanted such a mast and have you ever heard the hundred objections raised by the "wimmen"? In the worst kind of rhyme . . .

> Breathes there a ham with soul so dead
> Who never to himself hath said
> "Let me put on the house a radio mast!"
> Whose mom and ex-y.l. have turned
> From him, when for one he has yearned
> With "Migosh no" from first to last!

The usual objections as given in terse terms are *atrocious, unsightly, impossible, disgraceful, ungainly,* and *inartistic*. Well, here is the remedy—twenty-five feet of graceful neat-appearing mast which cannot be considered objectionable by the most fastidious. The cost? Just about ten cents per foot, depending just how lucky you are in picking up the wood. We now proceed to Act Two, which tells the details of construction. And we might add in passing that the mast may be completely built and painted in a Saturday afternoon's work.

Materials are as follows:

- Four 3/4" x 1 1/2" x 20' straight-grain pine or redwood
- One 3/8" x 5 1/2" x 16' ditto
- One 1 1/2" x 1 1/2" x 10' ditto
- Assorted length batten or perhaps lath
- Galvanized nails and paint

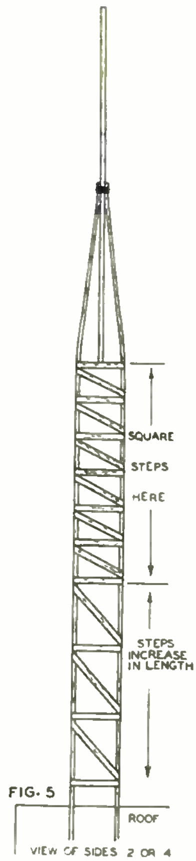


FIG. 5

First cut off about six pieces from the sixteen-foot board so that they will be all square (5 1/2" recommended, though 5" and 6" are also useful). Mark the edges as 1, 2, 3, and 4. Across edge 1 nail two of the 20 foot pieces, starting five feet from one end (see figure 1). The same is shown in figure 2. After these "steps" are securely nailed in, continue toward the proposed bottom of the mast and lengthen each step so that the legs of the mast will spread gradually. The amount of spread depends largely upon your artistic taste and upon the amount of "give" to the long pieces which form the legs.

Now start bracing edges 2 and 4, using the battens across and diagonally downward, about every 1 1/2 feet (detail figure 3). No bracing is needed on the number 1 and 3 edges as the nailed-in ¾ x 1½″ pieces will be sufficiently rigid.

You have left five feet at the top. Set in the ten foot 1½ x 1½″ so that five feet project beyond the top of the mast proper and bind this and nail in as shown in figure 4. The general looks of the finished product are as shown in figure 5. Guys may be run in several ways, but four of them at 90° apart is perhaps best.

One person can "walk up" this mast into position and can easily lift it off the ground unaided. Have the kid brother or a ham on hand to anchor the guys while you hold the mast in position. Another valuable tip is to cut old tire tubes into strips and thus make "rubber feet" so that the mast will not damage the house roof. Perhaps this type of mast will cure many family objections and do its bit in the advancementof the radio art. Here's luck!

◆

OPEN FORUM

Mercer Island, Wash.

Sirs:

For the past several months, I've been packing a sort of disgruntled grouch. It's been growing all the time until now it's reached the stage where I'm just doggone mad! This terrific hogwash c.w. interference on the amateur so-called "40 meter band" has reached the point now where somebody has to erupt all over the place, and I'm going to risk being the goat, although there are thousands of c.w. amateurs who are with me on this. Maybe we're going to arouse the ire of some of the newer c.w. men, but doggone it, something's got to be done, and that right soon!

Take a listen on the 40 meter band any evening between six and nine p.m. Any time of the night is bad enough, but these hours are the worst. Did you ever hear such a conglomerated mess of sour fists, frothy notes and meaningless nothings in your life? And that is amateur radio at its best! What in tarnation has this old game degenerated to, anyway?

I used to think I could copy anything at all readable through just about any kind of QRM —I've been pounding brass for twenty-eight years and ought to be able to, but I swear it's got me down. When I first started in this amateur game, there were about six of us in the entire U.S.A., and we were glad to get a little QRM so we wouldn't feel so lonesome. Times have certainly changed!

We've got, I believe, some 45,000 licensed amateurs in the country today. Let's say only half of them are active. It seems like the whole 22,500 pick the 40 meter band and the evening hours to exercise their activity! Hundreds of new amateurs are entering the field every month—I haven't any official FCC figures, but I'll bet they'd be interesting. We hear new ones in our own neighborhood almost daily, and many of these lads make us wonder how in thunder they ever managed to copy 13 words a minute or to make a tape record that even remotely resembled Continental code. I must say for the new-comers however, that the majority of them break out with a decent sounding crystal-controlled rig; but it's generally parked right on a fellow we're trying to do business with at some distance, and kills our QSO.

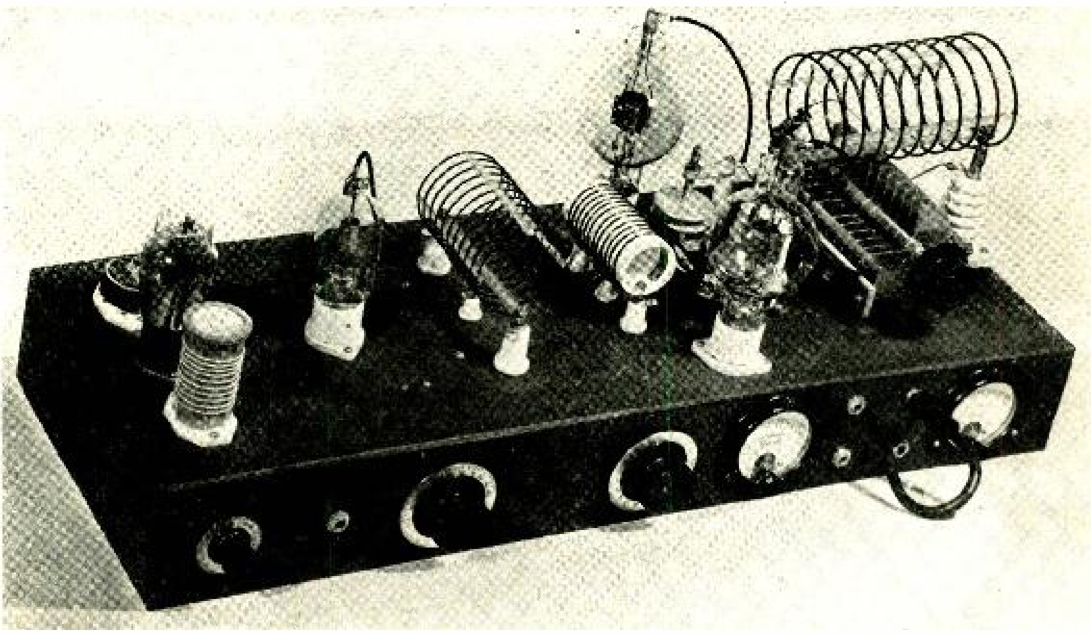
So far, I've offered only a growl, to get it off my chest and clear the air. Criticism is worthless unless it's constructive, and in my meager way, I'm going to try and offer something to relieve this situation. Nobody seems to be doing any fighting for the amateur fraternity; most magazines have deserted us; and politics and commercial money seem to be offsetting what little activity towards bettering conditions might have been kindled. So it looks like it's squarely up to us, the individual amateurs of America, to put up our own battle or just as surely as day follows night, we're going to be exterminated.

We have a number of bands allotted to us in the frequency spectrum. Three of these have become known as the "popular" amateur bands: "80, 40, and 20", to use the commonly accepted designation. 80 is generally supposed to be more or less of a local band—district QSO's and such. 40 is the great nighttime dx band, and 20 serves the same purpose in the daytime. Aside from these, we have the 160 band and a number of the ultra-high frequency bands. The latter are more or less generally accepted as experimental bands, and interference is no problem—in fact is more or less welcomed as offering more opportunity for testing and experimentation. The 160 band is generally sneered at, and looked upon as of little value to anyone. That's the root of a lot of our trouble—more on that later. The restricted phone stations have found, to their apparent great surprise, that they can talk farther than across town on 160. They never would have known it, if the restrictions placed on their licenses didn't force them to use it. And they

[*Continued on Page 88*]

A 10, 20 and 40 Meter Kilowatt

By Ray Dawley, W6DHG



Looking down on the transmitter. The small flashlight bulb connected in series with the crystal is hiding behind the 6L6-G. It is screwed into a small hole in the Masonite and connections soldered to it.

For the amateur who is interested only in 10, 20, and 40 meter dx, the transmitter described in this article offers a very inexpensive means of running a full kilowatt input on those three bands. The final amplifier uses two of the new 100-TH triodes recently released.

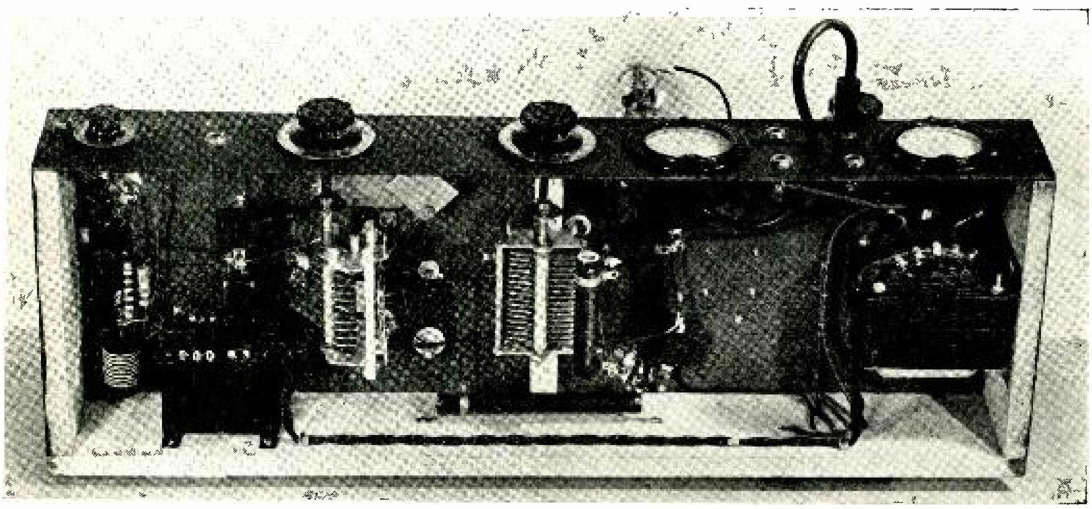
To the majority of hams the possibility of ever owning a one kw. transmitter has been something only to hope for. In addition to the initial investment required, the replacement cost of the high powered tubes required has therefore often been a prohibitive item. Recently, however, there have been brought out a number of inexpensive, high transconductance, low plate impedance triodes, a pair of which will easily handle a kilowatt. One of the newer of these is the Eimac 100-TH. It is given a rating of 225 ma. maximum at 3000 volts. Our tests have shown that with quite reasonable excitation, a pair of these tubes will operate very efficiently at 450 ma. with 2200 volts applied. 990 watts input to a pair of tubes costing less than $15.00 each and the tubes operating within their maximum rating is quite remarkable performance.

The low cost and convenient excitation and plate voltage of this tube make a kilowatt rig within the reach of a much larger number of hams. With the primary requirement of low cost in mind, the transmitter to be described was designed and constructed.

It is capable of handling an input of one kw. on 7 and 14 Mc. c.w., and 750 watts on 28 Mc. c.w. With the condenser used in the final plate tank, 1500 volts is all that can safely be used with high-level modulated phone. However, if a 10,000 volt condenser is substituted for the 6000 volt one shown, the full plate voltage of 2200 can be used on phone.

The Oscillator

The 6L6G crystal oscillator is the one shown in December Radio, adapted to use only a 7 Mc. crystal with 7 or 14 Mc. output available by simply turning the plate condenser to the



The under side of the chassis. The filament transformers are mounted directly on the chassis to keep the leads short and reduce voltage drop. No. 10 enamelled copper wire should be used for all tank circuit leads and for filament leads to the 100-TH's.

band desired. This is done by using a fixed cathode coil, and a plate coil cut to hit both these bands with the 140 μfd. plate condenser. As capacity coupling is used between the oscillator and the buffer, the shunt input capacity of the buffer stage necessitates the use of a smaller coil for L_2 and a larger turning condenser than would normally be required. 11 turns are used instead of the 14 required for link coupling out of the oscillator. Also shown in the oscillator is an arrangement whereby it can be keyed for break-in operation. A great number of amateurs have written in asking how they could key their 6L6G oscillators. The arrangement shown gives very good results even with the oscillator operating on a harmonic of the crystal frequency. The clicks obtained were not at all bothersome on a B.C.L. set operating in the same room as the transmitter.

A Mazda 46 dial lamp is incorporated in the circuit in series with the crystal. This lamp gives an indication of excessive crystal current, and, in addition, lights up very brightly when the circuit is oscillating "without benefit of crystal." If the filament does not show color the crystal current is at a safe value.

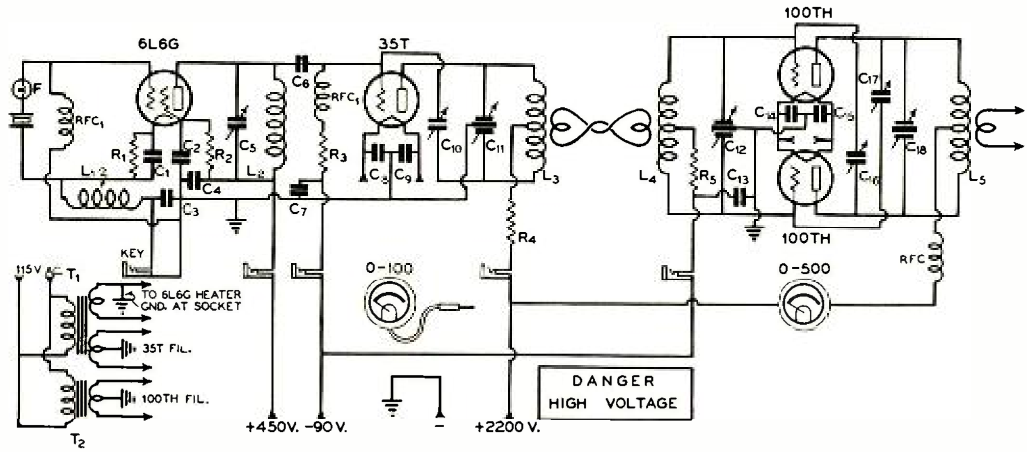
The 35-T Buffer-Doubler

The high power-gain and amplification factor of the 35T make this an excellent power buffer-doubler to follow a medium powered crystal oscillator. Capacity coupling to the input was used to reduce the number of tank circuits required. Ample drive is obtainable without the added compliation of link coupling. Fixed neutralization with a spit-stator tank condenser is used so that the stage may be operated either as a neutralized amplifier or a doubler without making any circuit changes. Ordinarily the tube operates as a neutralized amplifier on 7 and 14 Mc. and as a power doubler to 28 Mc. The plate shows no color when running as a straight amplifier but glows quite brightly when doubling to 28 Mc. Actually the dissipation is of the order of 50 watts when doubling.

A 6000 ohm resistor in series with the plate return of the tube lowers the plate voltage from 2200 to the safer potential of 1200 to 1500 volts. This resistor also acts to stop any r.f. that might tend to flow through the tap on the plate coil, replacing an r.f. choke.

The 15 to 20 ma. of grid current available from the oscillator furnishes ample excitation to the 35-T when operating as an amplifier and enough for respectable output when operating as a doubler. In the event that a transmitter similar to this were designed primarily for 28 Mc., the 35-T would operate as a more efficient doubler with higher grid bias and less grid current. The substitution of a 30,000 ohm grid leak for the 10,000 ohm one used would improve the doubling efficiency, allowing a full kw. input on 28 Mc. c.w.

A surprise is due those accustomed to neutralizing conventional tubes when they attempt



General Wiring Diagram of the 100-TH Transmitter

C_1—40 μμfd. fixed mica
C_2—.006 μfd. mica
C_3—.01 μfd., 600 v. tubular
C_4—.006 μfd. mica
C_5—140 μμfd. midget
C_6—.0005 μfd. mica
C_7—.006 μfd. mica
C_8, C_9—.002 μfd. mica
C_{10}—3 μμfd. neut. condenser (see text)
C_{11}—50 μμfd. per section, 4200 v. spacing
C_{12}—75 μμfd. per section, 3000 v. spacing
C_{13}—.006 μfd. mica
C_{14}, C_{15}—.006 μfd. mica
C_{16}, C_{17}—"800" type neutralizing condenser
C_{18}—50 μμfd. per section, 6000 v. spacing
R_1—500 ohms, 5 watts wirewound
R_2—20,000 ohms, 5 watts
R_3—10,000 ohms, 10 watts
R_4—6000 ohms, 75 watts
R_5—4000 ohms, 50 watts
RFC—2½ mh., 500 ma.
RFC_1—2½ mh., 125 ma.
L_1—12 turns spaced to 1¼" on 1" tube
L_2—11 turns spaced to 2" on 1½" coil form
L_3, L_4, L_5—See coil table
T_1—6.3 v., 1 amp.; 5 v., 6 amp. transformer
T_2—5 v., 20 amp. transformer

to neutralize a 35-T. It has a C_{gp} of the order of 1 to 2 μμfd., which makes it difficult to find a small enough neutralizing condenser. In this transmitter the condenser is made from a pair of small aluminum plates. One, about 1" square, is mounted on the "other end" of one of the feed-through insulators that support the plate coil; the other one, about 1" by 2" is mounted on a small standoff insulator adjacent to the grid post of the 35-T. These two plates, spaced about ¼", are meshed less than one-half when neutralization of the 35-T is obtained.

The Push-Pull 100-TH Final

Coupling between the 35-T buffer and the final stage is accomplished in a rather unusual manner on the 7 and 14 Mc. bands. The plate coil on the 35-T and the grid coil on the 100-TH's are so located in inductive relation to each other that approximately optimum coupling is obtained on these two bands. Actually the spacing between the lines of centers of the two coils is about 4". On 28 Mc., however, due to the small size and consequent small fields of the coils, additional external coupling must be supplied by means of a conventional link. In the actual transmitter this link consisted of a piece of no. 16 2000-volt pushback with the ends joined together. A small loop about 1½" in diameter was formed at each end and the wire joining the two loops was twisted for about four inches. These two loops were then shoved down between the center turns of the two coils until the optimum amount of coupling was obtained.

The balance of the final stage is conventional with the exception of the manner in which the nodal point is obtained for the neutralizing voltage. The rotor of the plate tank condenser is left floating to reduce the danger of flashover and the rotor of the split-stator grid condenser is grounded instead. Besides being electrically effective, the expensive plate return by-

Grid and Plate Current Table

	6L6G	35-T		2 100-TH's	
Band	*Plate*	*Grid*	*Plate*		
7 Mc.	75 ma.	18 ma.	55 ma.	80 ma.	450 ma.
14 Mc.	70 ma.	15 ma.	60 ma.	75 ma.	450 ma.
28 Mc.			95 ma.	45 ma.	325 ma.

TANK COIL TABLE

Band	L_3	L_4	L_5
7 Mc.	22 turns no. 12 enam. 2½" dia., spaced to 5"	20 turns no. 12 enam. 2½" dia., spaced to 2½"	20 turns no. 10 enam. 3¼" dia., spaced to 7½"
14 Mc.	11 turns no. 12 enam. 2½" dia., spaced to 5"	12 turns no. 12 enam. 1¾" dia., spaced to 2½"	10 turns no. 10 enam. 3¼" dia., spaced to 7½"
28 Mc.	6 turns no. 12 enam. 2" dia., spaced to 2"	6 turns no. 10 enam. 1¾" dia., spaced to 2½"	6 turns no. 10 enam. 2¼" dia., spaced to 3"

pass condenser is eliminated by this procedure.

Bias is obtained by a combination of a fixed minimum to hold down the no-excitation plate current and a resistor to bring the voltage up to the operating value. Due to the rather high amplification factor of the 100-TH's a great deal of bias is not required. A 4000 ohm grid-leak furnishes about 300 volts with the normal grid current of 75 ma. This, added to the 100 volts or so of fixed bias, makes a total of about 400 volts or about six times cutoff for the tubes. This of course is ample bias for plate modulation of the final. Even the 250 or so volts of bias obtained on 28 Mc. is ample for high-level modulation. This 100 volts of fixed bias can best be obtained by an arrangement similar to that shown in figure 3, page 25 of the January, 1937, issue of RADIO.

Keying

This transmitter is so arranged that it may be keyed in either one or both of two positions. First, for break-in operation, the transmitter may be keyed in the crystal oscillator. However, all oscillators (even crystal controlled) when keyed produce a certain amount of "yoop" in the signal. This is especially true on 14 Mc. and higher, where it is difficult to hold a keyed-crystal-oscillator transmitter on a receiver having a crystal filter operating near peak. For general communication, however, the keyed crystal oscillator is satisfactory. The second method of keying is accomplished by breaking the common C bias return of the last two stages. The key, with a .01 μfd., 600 volt condenser across its terminals, is hooked in series with the lead from the C bias pack to the bias terminal on the rig. When the key is lifted a potential of over 300 volts is produced across the key by the rectifying action of the 35T grid on the excitation furnished by the crystal oscillator. This bias potential is sufficient to cut off all output from the 100-TH stage. The keying produced by this latter method is very clean-cut and distinct but there is a back-wave produced inside the station, which makes the system unsuitable for break-in operation. If desired, keying jacks could be placed in both positions so that the method of keying could be instantly changed to suit the condition at hand.

The grid and plate current values to be expected on the various bands are all tabulated in the table shown. Some variations can be expected but if the values obtained are too far off from those given, more than likely there is some trouble that is causing the discrepancy. No trouble should be experienced in getting the rig into operation; however, if any is had, grid current variations are very helpful in indicating where the trouble can be found.

Operation

Getting the transmitter into operation should entail no difficulty, providing the proper coils and a good active crystal are available. For the first try, either the 7 or 14 Mc. coils should be in place. The crystal oscillator power supply should be turned on and the plate tank on the crystal stage resonated on the band desired. If the lamp in the crystal stage lights up brightly (indicating self-oscillation) it is best to check the crystal in another oscillator. If the crystal is active, no difficulty should be had in tuning the oscillator just by the plate tank from the 7 Mc. resonant position to the 14 Mc. one. Next, if normal grid current is obtained on the 35T buffer, it can be neutralized, once and for all, by turning the chassis on its back and adjusting the small aluminum plate until tuning the plate tank through resonance does not flicker the grid current. This position of neutralization need not be changed for operation on any band.

The grid tank on the final stage can now be resonated and the stage neutralized in the conventional manner for a push-pull stage. With the plate voltage on all stages the no-load plate current on the final stage runs about 40 ma.

[*Continued on Page 92*]

Remote Controlled Instantaneous QSY

By Dave Evans, W4DHZ

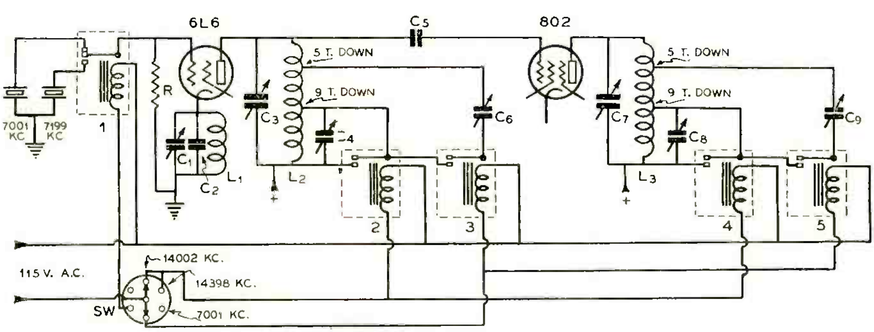
Whether you are a traffic man, a dx man, or a phone enthusiast, rapid QSY is a boon to good operating. This article shows how to design an exciter that may be shifted from one frequency to another by a single switch at the operating position. In a future issue we will show how to speed up frequency shifting of the high-power stage or stages in your transmitter.

During the past several years yours truly toyed with several ideas for "instantaneous remote QSY" but cast them all aside for one reason or another. The one that seemed the most plausible was the use of small relays, designed for r.f. use, to short out turns or cut condensers in and out. However, because of lack of suitable relays and ambition, and because we were not so sure the system would work as hoped anyhow, nothing much was done about it.

While on a visit out west last spring, I had the pleasure of working the first amateur transmitter I had ever seen incorporating instantaneous frequency change: the rig of Charlie Perrine, W6CUH. So much fun was had jumping around the band that a resolution was made to fix up some such sort of arrangement at W4DHZ. Charlie's rig was still in the experimental stage, and he had not yet decided upon the best arrangement for the final setup. However, he was using relays to do a good part of the job, and we were encouraged enough by this to attempt a QSY relay system that would suit our own purposes.

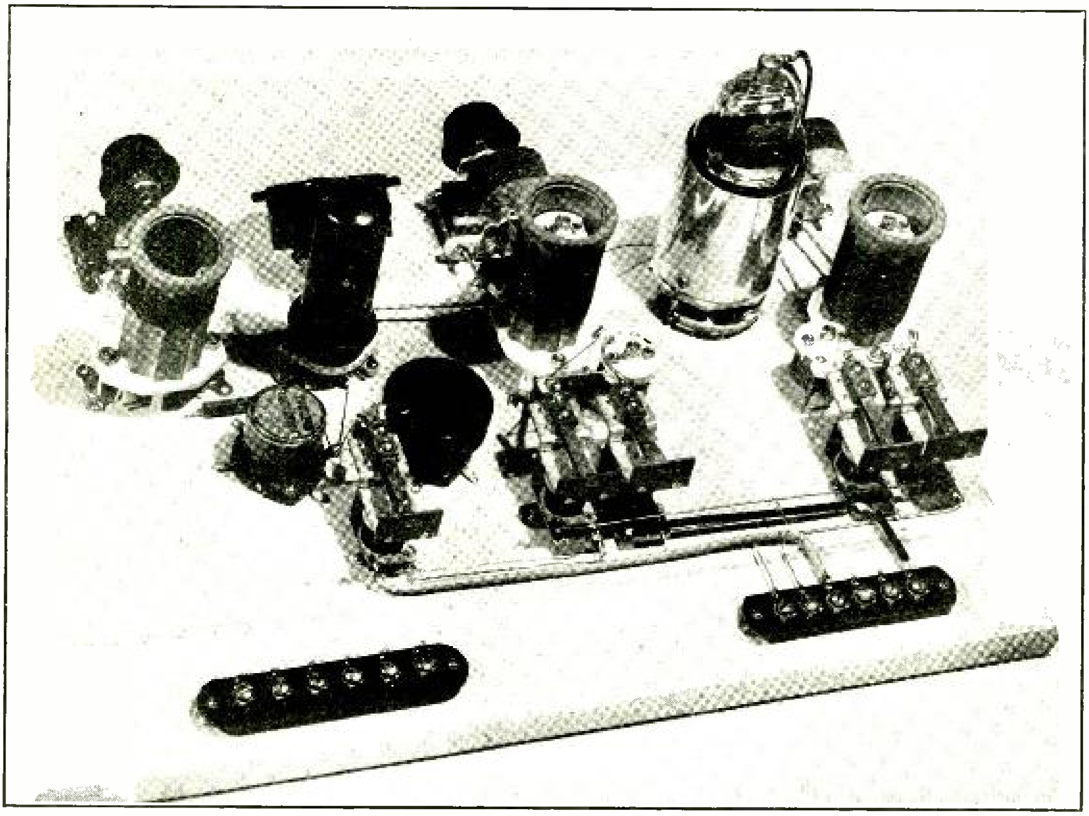
The first prerequisite was an exciter that would deliver about 10 watts on 7001 kc., 14,002 kc., or 14,399 kc. by merely flipping a single switch at the operating table. After designing the thing on paper, we remembered the job W6CUH had in making his relays, and instead of attempting to build our own we turned "chicken" and wrote to the Guardian Electric Co. about our ideas for a relay. They thought so much of the idea that they refused to make up one to the suggested specifications (because it lacked adaptability) and instead worked out a single, versatile unit that may be used either singly or in banks to give most any sort of switching arrangement imaginable. The relays are compact, low loss, and operate on 110 volts a.c. By utilizing several of these, the same results could be secured as with the multiple-unit relays that I had originally planned upon; in fact, they are better, because more frequencies can be added at any time just by adding extra crystals, relays, and padding condensers.

The relays, due to their ingenious design, are not expensive, and the improvement in efficiency of operation is well worth the cost of incorporating them in an exciter. We are not inferring that you are too doggone lazy to get up from the operating table, though it *does* conserve one's strength for pounding out CQ's; it is



Wiring Diagram of the Exciter, QSY Portion Only

C_1—140 μμfd. midget
C_2—200 μμfd. mica fixed
C_3, C_7—140 μμfd. midgets
C_4, C_8—100 μμfd. "APC" sub-midgets
C_5—100 μμfd. mica
C_6, C_9—25 μμfd. "APC" sub-midgets
L_1—12 turns wound to occupy 1 inch on standard 1½" form
L_2, L_3—19 turns over full length of XP-53 1½ inch form, tapped as in diagram
SW—Selector switch (band switch)
Relays—Described in text. (Special r.f. type)



The QRQ-QSY exciter used at W4DHZ. QSYing is done remotely with a single switch by means of relays and padding condensers in the tank circuits.

merely a timesaver—conducive to more snappy operating. And every amateur is interested in being able to snag up to the other end of a band or to another band fast enough to be able to answer a CQ the moment the station signs over, regardless of whether that amateur is a traffic, phone, or dx man.

In working dx alone it will save enough time spent in calling stations to justify the time spent in installation. And in a dx contest . . . hot dorg! Now don't go turning the pages to the Dx News or Scratchi, and I'll describe the exciter. It really works; and was I tickled. All you have to do is say "Alkyzam" and throw the switch. In fact, if you forget to say "Alkyzam" when you throw the switch the thing still works. That's what I call performance. For that matter, if you are a phone man you had better just throw the switch. Otherwise the "Alky" may go out on one frequency and the "zam" on another, the danger being that listeners on the former frequency will think you are asking for a drink and those on the latter frequency might think you are indulging in a bit of unadorned cussing.

The exciter is as simple as it is efficient, and the loss of r.f. due to the switching circuits is negligible. The complete circuit is not shown because it was desired to emphasize the fact that the switching may be applied to most any exciter, and probably will work just as well in your pet exciter circuit as the one used at W4DHZ, which is conventional and uses a 6L6 tritet to drive an 802 (wish I had an 807!) running at 575 volts.

The unit was built up on a breadboard because, although we were not anticipating any trouble, we had no assurance that everything would work the way we dared hope. The breadboard is genuine, by the way. It was really manufactured for the purpose of supporting a loaf of bread while being cut, and cost 65 cents.

If anyone razzes me about the exciter's being built "breadboard", I can have the satisfaction of telling them that at least it is a *genuine* breadboard. Of course some fellows will betray the true breadboard spirit and knock the end out of an apple box instead. This apple knocker is the sort of fellow who will refuse to say "Alkyzam" when changing frequency, the kind of guy who goes around scaring little kids.

The use of shielded pentodes after the oscillator greatly simplifies construction, as the necessity for neutralizing turns and condensers would rather complicate the switching process. The relays are all single pole, and all except the crystal relay are single throw. The crystal relay is a double throw affair. If more than two crystals are used, it will be necessary to use a separate single-pole single-throw relay for each crystal.

Were a steel chassis used, each relay could be mounted under the chassis directly under its own coil. This would make for shorter leads and conserve space at the same time. No sign of r.f. is induced into the relay windings, and no trouble should be encountered with either type construction.

The switch "SW" is in the control box, which is mounted on the operating table. It is an inexpensive double circuit tap switch. These are made by several manufacturers, and are commonly available as "band switches".

The terminal strip on the right is the junction for the control switch connections. The one to the left is for power supply connections to the exciter. This wiring is run under the breadboard and cannot be seen leaving the strip in the photograph. The blanks on the right hand strip are for more frequencies, when, as, and if they should be added.

Tuning of the two tanks is the same. In other words, C_4 corresponds to C_8, relay no. 2 to relay no. 4, etc. After getting the first tank tuned up, all you have to do is duplicate the procedure to tune up the L_3 tank.

The switch is first thrown to 14,399 kc. (or highest 14 Mc. frequency) and the tank tuned with C_3. Now throw it to 14,002 kc. (or lowest 14 Mc. frequency) and resonate C_6. Now throw the switch to 7,001 kc. (or any other 7 Mc. frequency, depending upon crystal) and resonate C_4. A study of the circuit will show just what goes on in the way of shorting out turns and adding padding capacity when the switch is thrown to the different positions. If you have no difficulty following just what goes on from study of the diagram, you should have no trouble at all in designing a switching arrangement to suit your own needs in regard to bands and frequencies.

The coils are wound on standard XP-53 forms, and room is saved by mounting an APC condenser in each of the two plate tank coils. The tuning of the cathode coil is not critical and is left alone when once set. It consists of 12 turns on an XP-53 form, wound to occupy 1 inch of winding space. It is tuned by a 140 μμfd. midget, which is shunted by a 200 μμfd. mica padding condenser.

Well, 40 just passed out so think I'll listen on 20 and see what's doing. Used to be that I looked to see what band the transmitter was on before listening. Now it doesn't make much difference. Oh, oh. W8CRA just said "73" to VS6AQ. Guess I am next.

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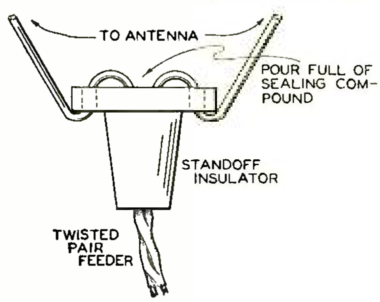
Stand-off Kink

The common jack type stand-off insulator can be used to very good advantage for the "V" termination on a twisted-pair doublet antenna. These insulators are manufactured in various



sizes, a suitable size being chosen for the particular feed line to be used. I used a Birnbach type 866-SJ with the hardware removed. After all connections are made, the insulator is poured full of sealing compound. This prevents moisture from getting into the crotch of the transmission line.—*W9NBE.*

◆

On October 27, W5FSK worked W6NCT on ten-meter phone. Ordinarily, that wouldn't cause much of a stir, and would hardly deserve special mention. However, W5FSK, W5FOG, W5FKL, and the rest of the radio gang at Fort Sill thought it so odd that they took the transmitter over to the laboratory and measured the input. It turned out to be less than one-fifth of a watt, secured from 144 volts of battery on a type 30 tube in a transceiver, modulated with a type 33 and a single-button carbon mike. The set is an Army outfit, type SCR194.

A 28 Mc. Rotatable Array for the City

By Stanley Hadfield*, W6MZR

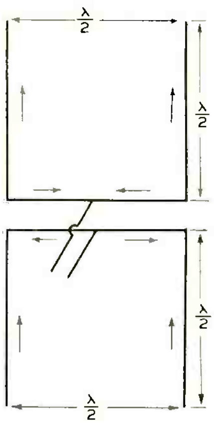


FIG. 1

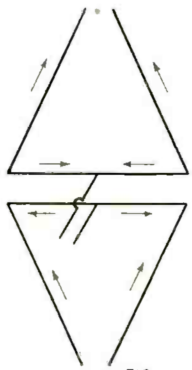


FIG. 2

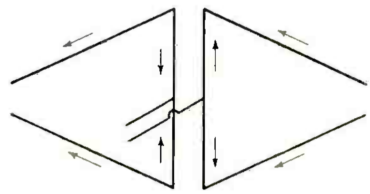


FIG. 3

The advantages of a beam antenna for transmission are generally accepted. But it is not so widely realized that a good beam array is of even greater value for receiving, as it discriminates against unwanted noise from the "wrong" direction. For that reason a beam array is especially useful in cities where automobile QRM and other man-made interference is, on the higher frequencies, almost intolerable. However, since most arrays (even for ten meters) require more room than is available in most city locations, few city hams attempt to erect an array.

The antenna to be described is especially suited to city locations as it requires only one pole (of moderate height) and doesn't have to be guyed. Furthermore, it may be rotated with but little difficulty.

Fundamentally it is an "H" array of the type shown in figure 1. With the exception of "long wire" arrays, the "H" is probably the best array for ham use, combining, as it does, good horizontal directivity with vertically polarized low-angle radiation. The greatest objection to the "H" is the fact that it requires two rather high poles, and unless telephone poles are used, they will have to be guyed. Of course guy wires are very undesirable in an array of this type as they tend to upset the radiation pattern. This objection can be eliminated if we incline the legs of the "H" inward in the form of a diamond as shown in figure 2. The array in this shape can easily be supported by a single pole; moreover, the pole height has been cut down somewhat. Best of all, the array may be rotated. Figure 4 shows the array in detail. The pole shown in the diagram should be at least twenty-eight feet high. A higher pole will give a lower angle of radiation.

For those who have the space available, the antenna shown in figure 3 will give slightly better results as it will give lower angle radiation for a given pole height. Also, since this array is horizontally polarized, there will be greater discrimination against man-made static, as the latter is largely vertically polarized.

There are several methods of matching this antenna to the transmission line. Perhaps the best is with Johnson Q bars. However, this method will not be satisfactory if the array is rotated unless the whole pole is rotated.

A better method would be with a quarter-wave matching section, as this will permit the array to be rotated. To rotate the beam, first loosen the halyard about six inches, then disconnect the two guy ropes and with another person holding one guy, walk around the pole in a circle until the plane of the array is at right angles to the direction in which it is desired to transmit. Drive two stakes in the ground and attach the guys. These stakes should be on the edge of a circle whose radius is the same as that of the stakes holding the guys in their original position. After the stakes

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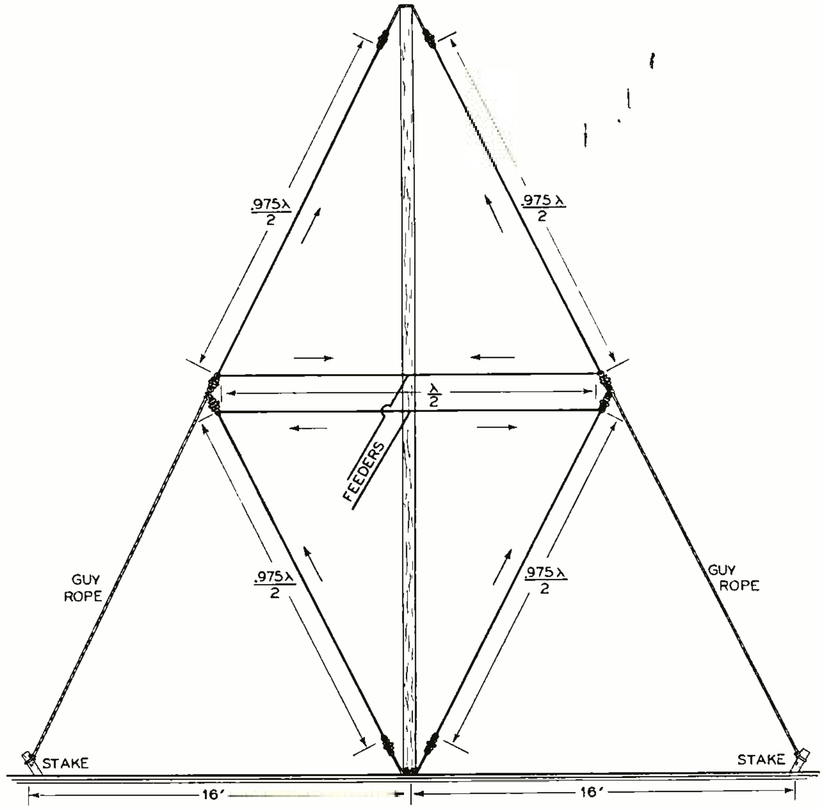

Figure 4: The Array Requires But One Pole, and Is Easily Rotated

are once located it is an easy matter to change directivity. Note: the radiation pattern will be affected by nearby objects and some experimenting is advised before the stakes are permanently located. In rotating the antenna be sure the feeders do not get twisted.

In determining the length of the radiators, a certain amount of cut and try is advisable as folding the wires sometimes affects their electrical length. In general, the length is not excessively critical, and an antenna cut for the middle of a band will work satisfactorily over the whole band.

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"Chinese Mayfair"

In casting a "Life of David Windsor" play for a b.c.l. program, KECA had considerable difficulty in getting a suitable juvenile for the childhood episodes. Barbara Wong, Chinese screen player, was the choice for role of child Edward, as her enunciation was better "Mayfair" than native-born English Juveniles.

CALLS HEARD

J. Vincent McMinn, NZ16w, 12 Edge Hill, Wellington, New Zealand
To Oct. 1

(7 Mc. phone)

CT1AD-7; LU1EE-7.

(14 Mc. c.w.)

CT3AB-6; CX1CX-5; CX2AK-6. — D 4GJC-6; 4HCF-5; 4JTK-5; 4KMG-4; 4PIU-5; 4SIG-4; 4SXR-5; 4TKP-5; 4YWM-5. — EA2BH-6; EA2BL-5; EA3EG-5; EA3EG-5; EA4BM-5; EA5AE-5. — F 3FA-5; 8DC-4; 8EB-6; 8EF-6; 8NJ-5; 8NV-5; 8RJ-5. — HAF4K-5; HAF8C-5; HB9AK-6; HB9AW-6; HB9BD-5; I1TKM-6; J2CL-6; KA1EL-5. — LU 1MC-5; 2AM-5; 2AX-5; 2CW-5; 5BZ-6; 6AD-5; 8EN-6. — OA4J-5; OK2PN-5; OK2RS-5; OK3VA-6; ON4FR-5; ON4GW-4; OZ2H-5; PA0AZ-4; PY2DO-5; PY2QD-6; U2NE-6; VE1IW-7.

(7 Mc. c.w.)

CT1BG-5; DC3COK-6; D4BRT-5; D4SGH-4; D4WIL-5; D4XHD-5; D4YRI-5; D4YUM-5; EA1AE-6; EA5BG-6. — F 3AQ-5; 3AS-5; 3BJ-5; 3KE-5; 8DI-6; 8HO-5; 8NB-5; 8OY-6; 8TG-6; 8VO-5. —FK8AA-5; G2NC-5; G6PD-6; G8BD-5; HK5JD-7; I1LEC-5; KA1KN-6; KA1TS-6; NY1AA-7; OE3WB-6; OK3DK-6; ON4DM-6; ON4FE-5; ON4GK-5; ON4MA-6; PA0LJ-5; PK1WB-7; SP1IE-6; SP-IK-5; U4OJ-5; UK3CH-6.

(14 Mc. phone)

W 1AXA-6; 2APV-6; 2IKV-7; 3EGB-6; 4AJA-6; 4BAC-7; 4BDD-7; 4LL-7; 5RJ-7; 6EB-6; 6IXZ-8; 6KW-7; 6PB-7; 7QC-7; 8JVF-6; 9ACP-6; 9ITS-7; 9NA-7; 9UJS-7. — CX1AA-7; EA3EG-5; EA7BA-6; G5ML-6; PY2DA-7; PY2EJ-7; SU1CH-7; VE3AFD-7; VE5EF-7.

A Percentage Modulation Meter

By Durward J. Tucker*, W5VU

Description and constructional data of a modulation monitor that indicates carrier shift and also modulation in either per cent or decibels on either positive or negative peaks. Or it may be adjusted to read only peaks exceeding a predetermined value.

At one time it was common practice to check the modulation of amateur phone transmitters by whistling into the microphone and watching the antenna or feeder radio frequency ammeter. If it dropped, that was bad, but if it went up, all was well. In fact, the higher it went the better it pleased us, even though we had a vague recollection of reading somewhere that a 22.6 per cent rise was plenty. Our "in-between QSO's" sport was further dampened by the experts who wanted to get technical by asserting that the antenna current should never increase 22.6 per cent for 100 per cent modulation except in the case of a constant tone pure sine wave. The only fault to find with the experts is that they should have steered clear of the word tone. The impression spread through the ranks that the 22.6 per cent rule held good if one could holler into the microphone at a constant volume. (I once knew a ham who talked fast into his mike, as he said it gave him more modulation!)

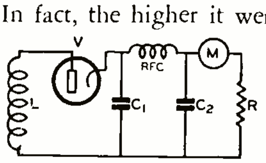


Figure 1
Carrier Shift Indicator
V—1v.; 56; 37; or 76. (If a triode is used the grid and plate should be tied together.)
C_1, C_2—100 µµfd.
M—0-1 d.c. milliammeter
R—20,000 ohms
L—6 turns for 20 meters (add or subtract accordingly for any other band)

We may be able to produce, with our voice, what sounds like, and approaches, a pure sine tone, but this tone is made up of several sine waves. The human voice is rich with harmonics and produces very complex waves. For a complex wave the sideband power is approximately 25 per cent of the carrier power instead of 50 per cent as is the case when the tone is a single, constant-amplitude, sine wave. Then for speech the increase in antenna current is approximately 12 per cent. So many factors such as crowded meter scales and sluggishness of thermal meters may cause the apparent increase of the meter to be 100 or 200 per cent in error.

From the foregoing, it is evident that the antenna ammeter is of little value in checking modulation percentage. The present rules and regulations of the Federal Communications Commission render this method of modulation monitoring wholly inadequate.

An oscillograph is quite satisfactory for checking the modulation of amateur transmitters. A good oscillograph is expensive and few amateurs can have one sitting on the operating table just to view modulation peaks. The oscillograph is of more value as an aid in making the proper adjustments of a transmitter when using a pure sine wave to modulate the carrier than for monitoring speech modulation peaks anyway. For instance, the transitory nature of speech makes it difficult to be sure just how high the peaks really go, as they flit up and down the screen with great rapidity. The oscillograph does not show carrier shift with speech modulation except for the flattening of the complex wave, which can be detected for extreme conditions. These are some of the reasons why the Federal Communications Commission will not accept it as a means of monitoring modulation at broadcasting stations.

The simplest and most economical means of monitoring modulation peaks is by the use of a carrier shift indicator. This instrument consists of a pick-up coil diode rectifier and milliammeter, all in series with an r.f. filter to by-pass r.f. around the meter. Such a meter is shown in figure 1.

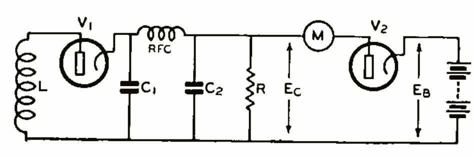
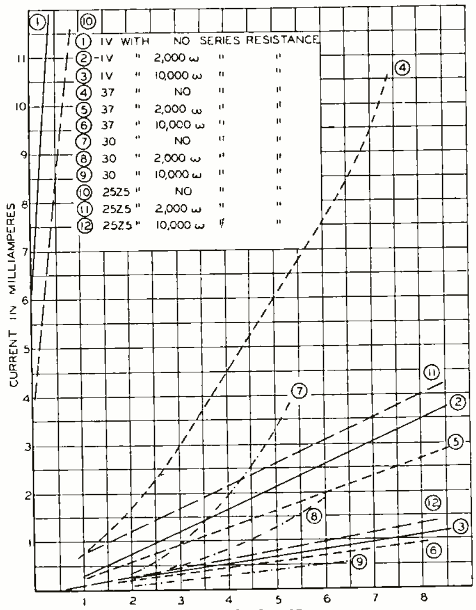


Figure 2: Simplified Schematic of Modulation Monitor

L—R.f. pick-up coil
V_1—R.f. rectifier
RFC—2 mh. choke
C_1, C_2—100 µµfd.
R—Load resistor
E_C—Rectified and filtered r.f. carrier voltage
M—0-1 ma. milliammeter (low resistance)
V_2—Audio voltage rectifier
E_B—Balancing or "bucking out" voltage

This instrument can be made up from spare parts to be found in almost any phone man's shack, and every phone man should have one if he cannot afford a more accurate modulation

*W5XM, 5712½ Marquita Ave., Dallas, Texas.



Ep-Ip CHARACTERISTICS OF 30, 37, 25Z5, 1V.
GRID & PLATE TIED TOGETHER FOR 30 & 37
PLATES & CATHODES PARALLELED FOR 25Z5

Figure 3

indicator. On over-modulation, the meter reading either increases or decreases depending upon whether positive or negative carrier shift is present. The disadvantages of this type of meter are that over-modulation is already present before it indicates its presence, and carrier shift alone is not always an indication that the modulation is passing the 100 per cent mark. Carrier shift does indicate that the modulation capability of the transmitter is being exceeded, regardless of what percentage of modulation it makes its appearance. Unless the positive and negative peaks can be measured at the point of carrier shift, one is in the dark as to what adjustments should be made on the transmitter.

The instrument described in this article not only indicates carrier shift, but both positive and negative percentage of modulation at any instant; indication only on a pre-determined value of either positive or negative modulation peaks; and also provides a means of monitoring the carrier for distortion and quality. The frequency response curve of the entire transmitter from the input of the speech amplifier to the carrier can be determined, since the modulation meter is calibrated directly in decibels as well as percentage of modulation.

Circuit Survey

Figure 2 gives a schematic of the modulation monitor. An inspection of this circuit shows that there are six major functions performed by the monitor by as many parts or groups of equipment. Briefly, in the order of their functions these parts are r.f. pick-up coil, r.f. rectifier, r.f. filter, indicating meter, carrier audio component rectifier, and balancing voltage source. Carrier voltage as picked up in coil L is rectified by V_1 and filtered to d.c. by the smoothing action of C_1, C_2 and r.f. choke. This voltage is indicated by E_c as measured across the load resistance R. When the balancing voltage E_b is equivalent to E_c, then there is no flow of current through V_2 and meter M. If the carrier is modulated by the voice or by some other audio signal the carrier voltage E_c will fluctuate above and below the steady no signal carrier voltage in accordance with the modulating signal wave form. When the voltage is higher than the no-signal value there will be a flow of current from left to right due to the voltage being higher than the balancing voltage. When the voltage is less than the steady no signal value there will be no flow of current from right to left because of the blocking action of V_2. The r.f. filter has no effect upon the audio frequencies of the modulation envelope; so the rectified and filtered carrier voltage E_c varies in accordance with the modulating frequency or frequencies. Due to the blocking action of V_2 to the audio frequencies, only the positive peaks are indicated by the meter M. If the polarity of V_2 is reversed, then the meter will indicate only on negative peaks—that is, when the voltage E_c falls below the balancing voltage E_b. The meter used should be a low current milliammeter. In this instance a Weston 0-1 milliammeter was used. This makes it possible to use a relatively high series resistance with the meter, which has no serious loading effect upon the voltage being measured. In fact the meter should be purely a voltmeter which reads the difference in voltage at any moment. The tube V_2 will be required to rectify very small values of voltage at low voltage peaks and many times this value at 100 per cent modulation. For this reason the resistance of V_2 must be constant over a wide range of voltages and the E_p - I_p curve of the tube should be linear. From the foregoing, it is evident that a suitable tube for V_2 is one that has a linear E_p - I_p curve and low internal resistance that must be as

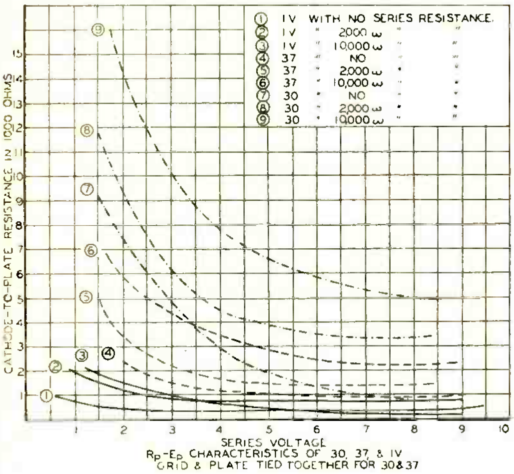


Figure 4

constant as possible over the entire voltage range used. With a low resistance rectifier V_2 and sensitive meter M, the series resistance to be placed in series with the tube and meter is large enough to minimize the resistance effect of V_2. Figure 3 shows the E_p - I_p characteristics of the 30, 37, 25Z5 and 1V tubes for zero series resistance, 2000 ohms series resistance, and 10,000 ohms series resistance. The curves in figure 4 show the effect of plate voltage on cathode to anode resistance. The curves for the 25Z5 were not included in figure 4 as they were similar to the 1V curves and would have crowded the graph and made it difficult to interpolate any of the curves in that vicinity of the graph.

It was hoped at first that a 30 tube could be used. This tube proved unsuitable as is evident from figures 3 and 4. Next in the order of their trial came the 37, 1V and 25Z5. Both the 37 and 1V compared favorably, but as indicated in figure 4 the 1V is more suitable because of its lower and more linear resistance characteristics. The 25Z5 did not show any added advantage over the 1V; so it was discarded in preference to the 1V. When a vacuum tube has its filament or heater lit up and no voltage on the grid or plate, there is a constant stream of electrons leaving the cathode and then falling back on the cathode to repeat the process. Some of these electrons find their way to the plate due to their high velocity. This causes a small current to flow in the external plate to cathode circuit at a potential of 0.8 to 1 volt. This factor was corrected for in figure 4. This factor was also corrected for in the modulation monitor, as it would have shown a false unbalance in voltage.

Wave Analysis

The meter is a d.c. instrument; therefore it reads only average values. An audio peak voltage of 10 volts, for example, will by no means be read as 10 volts by the meter. Suppose that the transmitter is modulated with a pure sine wave. The rectified audio component to the meter will be as shown in figure 5(a). If the peak voltage is 10 volts, then the average voltage for ½ cycle is 6.37 volts. Due to the rectifying action on the audio wave by V_2, the dotted portion of the wave is cut off and only the shaded area is indicated by the meter. During one-half of

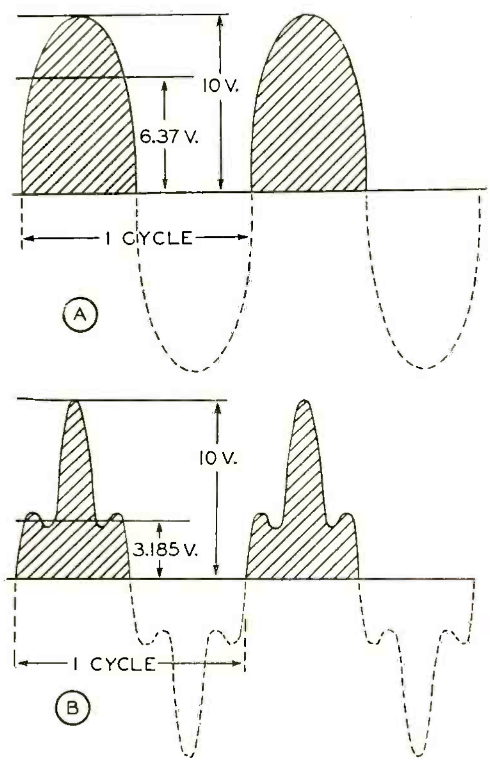


Figure 5: Audio Waveform to Meter

(A) A pure sine wave
(B) A typical complex wave

every cycle, current is not flowing; therefore the average voltage as read by the meter over an entire cycle is one-half of 6.37 or 3.185 volts. For a pure sine wave with a peak value of 10 volts we would have a deflection on the d.c. meter of 3.185 volts.

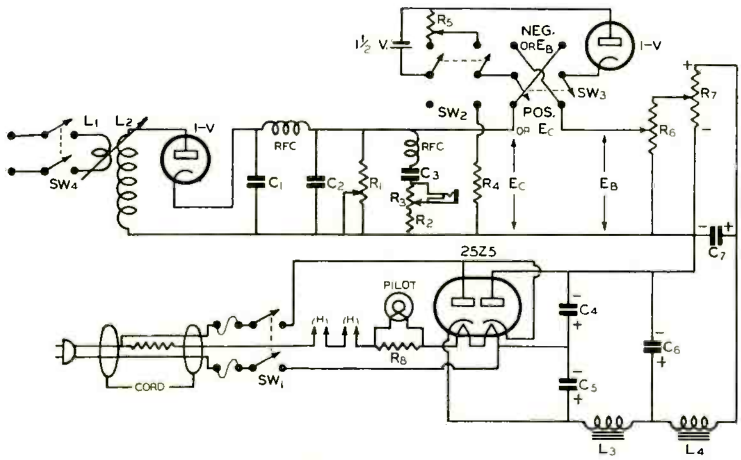


Figure 6: The Modulation Monitor

L_1—1 turn variable coupling, 3 in. dia.
L_2—5 turns for 20 meters, 3 in. dia.
L_3, L_4—15 hy. filter chokes
V_1, V_2—Type 1v rectifier
V_3—25Z5 rectifier
C_1, C_2—100 μμfd. mica
C_3—.05 μfd. paper
C_4, C_5, C_7—8 μfd. electrolytics
C_6—16 μfd. electrolytic

RFC—2.5 mh. pie wound choke
R_1—25,000 ohms, 20 watts (with variable slider)
R_2—20,000 ohms, 2 watts
R_3—25,000 ohm potentiometer
R_4—105,000 ohms, 2 watts
R_5—400 ohm potentiometer
R_6—25,000 ohm voltage divider potentiometer
R_7—10,000 ohms, 10 watts (with slider)
R_8—50 ohms, 10 watts
M—0-1 ma. d.c.
CORD — "Cordohm" dropping resistor
SW_1—On-off switch
SW_2—Switch for selecting carrier or balancing of percentage - modulation peaks.
SW_3—Switch for selecting either positive or negative modulation peaks.
Line fuses—2 amp.

Suppose now that the transmitter is modulated by our voice instead of by a pure sine wave. For voice the wave is very complex and at times sharp peaks extend upward above the main body of the wave as shown in figure 5(b). An inspection of this figure indicates that the energy for the voice wave form is not as much as for a pure sine wave. The average energy for an average voice wave form while talking is approximately 50 per cent of that for a pure sine wave. For a peak value of 10 volts the average voltage would be $0.50 \times 6.37 = 3.185$ v. For a full cycle the average voltage as read by the meter would be 1.592 volts. $10/1.592 = 6.28$ peak volts of audio to cause 1 volt deflection on the d.c. voltmeter.

TABLE I

— db	% Modulation
1	89.2
2	79.4
3	70.6
4	63.1
5	56.2
6	50.1
7	44.7
8	39.8
9	35.5
10	31.6
16	15.86
32	7.15

Construction

The complete circuit details are given in figure 6. Figures 7 and 8 give the reader some idea of what the finished product looks like.

Batteries can be used and the entire power circuit including the 25Z5, C_4, C_5, C_6, C_7, L_3, and L_4 will be eliminated. It is only a matter of choice as to whether one wants to make the meter entirely a.c. operated or not.

A carrier voltage of at least 20 volts should be used as the linearity of V_2 is improved by using a large signal. Other factors of like importance influence the carrier voltage used to operate the monitor. It is hard to keep the series resistance, associated with the meter, down to a reasonable value. If the resistance of the potentiometer R_6 is too low, it will not pass the current circulating through it from the power supply. R_6 should be as high as possible and R_7 as low as possible so that the bleeder resistance R_7 will carry most of the circulating current from the power supply. The carrier load resistance R_1 is the only return path to ground for the balancing voltage when negative peaks are being checked due to the blocking action of V_1 to the balancing voltage. For this reason R_1 must be low enough to add to the other associated series resistances to give the proper total

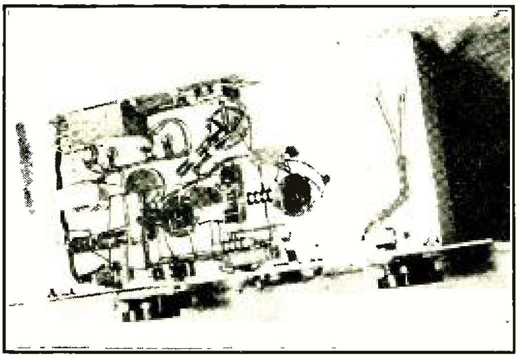


Figure 7: Under-chassis View
The r.f., audio, and d.c. balancing voltage circuits are fairly well isolated from each other

resistance required for the proper voltage scale selected. On the other hand, a low load resistance allows a high and undesirable carrier circulating current. The higher the ohms per volt sensitivity of the meter used at M, the easier it is to find the optimum values of resistances R_1, R_6, and R_7. Considerable juggling of these resistors resulted in the values given. The slider of R_1 shorts out about 2/3 of the resistor. It must be remembered that the series resistance circuit, associated with the meter, must be the same for both negative and positive peaks if the calibration is to be correct.

Since 6.28 peak volts is equivalent to 1 d.c. volt deflection,* it was decided to use a constant carrier voltage of 50.24 v. across load resistor R_1. When switch SW_2 is thrown to "volts" position and switch SW_3 is thrown to "POS or E_c" position, the meter will read the carrier voltage. Since the meter is calibrated only in db and percentage of modulation, a red hairline should be placed at exactly the middle of the meter scale as the voltmeter resistance R_4 is adjusted to 100,000 ohms resistance. With the switches in this position the meter is a carrier shift indicator. By throwing switch SW_3 to "NEG or E_b" the balancing voltage should be adjusted to 50.24 volts by means of the slider on R_7 with potentiometer R_6 set at about midpoint. For 100% modulation the peak audio voltage across R_1 will be 100.48 volts and the voltage as read by the d.c. meter will be 8 volts. For 100% modulation the peak audio voltage in the positive direction will be 106.76 volts and the full scale deflection of the meter will be 9 volts. The resistance in series with the meter for both positive and negative positions must be 9,000 ohms.

A tiny 1.5 volt flashlight cell is used in conjunction with a 400 ohm potentiometer to balance out the "shot" effect of the filament electrons. This is done by placing a temporary strap across the switch arms of SW_3 and with SW_2 in position "peaks" adjust R_5 until the deflection of M is zero. Care must be used in making this adjustment so that the voltage will not be increased beyond the point of zero current. It is best to start with the variable arm at the point where negative battery and plate join. The deflection will be maximum at this point. Move the arm along the resistance until the meter is right on the verge of zero. Failure to make the proper adjustment here will cause a maximum error of 10%. When the meter is not in use, SW_2 should be in "volts" position to open the battery circuit.

The dial that controls the balancing voltage potentiometer R_6 is shown on the right hand

The "CONK-lin" overmodulation indicator, suggested by Bill Conklin, W9FM.

*This is an average value that has been found to hold for the average person while talking in a normal voice. Actually, the ratio of average to peak voltage varies for the different vowel and consonant sounds, as some are more complex than others. Therefore, do not whistle or say "oooooh" and attempt to calculate the exact modulation percentage, as it will not necessarily be correct as read on the meter. As an integrating device, this instrument must be used only for the purpose for which it was calibrated, in this case to give a close approximation of the percentage peak modulation during normal conversation and most kinds of music.—EDITOR.

side of the panel in figure 8. The point for 50.24 volts was marked zero. With a voltmeter from the variable arm to ground, indicated by E_b in figure 6, the dial was rotated to the right until the voltmeter at E_b read 100.5 volts. This new position of the dial pointer on the panel was marked "100% POS." This means that with SW_2 on "peaks" and SW_3 on "pos." the meter will not read until the peak voltage across R_1 swings above 100.5 volts or the 100% modulation value. The dial was rotated further until the 110% modulation point of 105.5 volts was reached. Voltages of 60.3 v., 70.3 v., 80.4 v., 90.5 v., for the corresponding points of 20%, 40%, 60% and 80% modulation were found in a like manner. Voltages below 50.24 v. of 40.2 v., 30.1 v., 20.1 v., 10.0 v., and 0 were spotted for the corresponding negative peaks of 20%, 40%, 60%, 80%, and 100% modulation. The dial should never be rotated below the zero percentage mark of 50.24 volts unless the switch SW_3 is on the "neg." position, as the meter is liable to be damaged. The carrier voltage should not be cut off when the switch is in the "neg." position as this will throw the full 50.24 v. balancing voltage on the 9 v. full scale reading meter. For the same reason the balancing voltage should not be removed when the switch is in the "pos." position and the carrier voltage is on. When the balancing voltage dial is set on any value except the zero point of 50.24 volts the monitor is a peak indicator of whatever positive or negative percentage of modulation the operator happens to choose. The use of a meter instead of a light is an advantage in that the meter not only indicates at the instant the modulation exceeds the value we have chosen, but the degree of swing on the meter will give us some idea of how much the peak exceeded the value we have the monitor set for.

If it is desired to know the percentage of modulation at any instant the balancing dial should be set on the zero percentage mark of 50.24 v. and the percentage of modulation read on the 9 v. full scale deflecting voltmeter M, which is calibrated from 0 to 110 per cent instead of volts.

No modulation monitor would be complete unless a check could be made on quality, as all measurements really lead to that end anyway. A high resistance audio monitoring circuit consisting of a series arrangement of an r.f.c., .05 µfd. condenser, 25,000 ohm volume control, and 20,000 ohm resistor is connected across the load resistor R_1. A closed circuit jack is connected across one side of the potentiometer volume control and the variable arm. This circuit has a negligible effect upon the operation of the monitor.

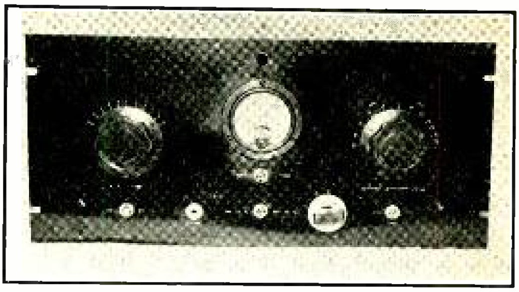


Figure 8
Engraving and Layout of Front Panel

The dial on the left controls the rotor of L_1 and the dial on the right is potentiometer R_6 controlling the balancing voltage. The meter in the center is calibrated in percentage of modulation and decibels. The pilot light is directly above the meter and the "VOLT—PEAK" switch SW_2 directly under the meter. The apparatus on the bottom row from left to right is: radio frequency "on-off" switch SW_4; audio phone jack; switch SW_3; audio volume control; power switch SW_1.

Calibration

So far the factors that affect the calibration have been mentioned, but little has been said in regard to the actual calibration of the monitor. If all values of resistance are used as indicated, it will be a comparatively easy matter to get the right combination of R_1, R_6, and R_7 for the correct series resistance. The 0 to 1 ma. scale should be removed and replaced by a blank scale that has been bought or made from stiff bristol board or other suitable material. This scale should be divided into 11 equal parts with light pencil marks. These marks correspond to 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, and 110% modulation. The only one that we are sincerely interested in is the 100% mark. All broadcasting stations are required to have modulation monitors; so the simplest procedure is to take the monitor to a broadcasting station and calibrate against its monitor. After a preliminary adjustment of the carrier and balancing voltage to 50.24, notice where the meter swings to when the broadcast monitor shows 100% modulation. If the meter overshoots the 100 mark, the series resistance should be increased, keeping the carrier and balancing voltage con-

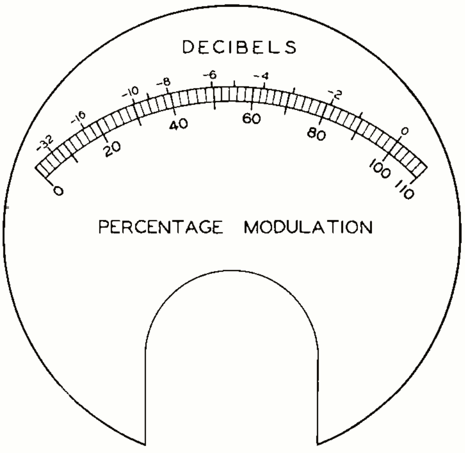


Figure 9: Scale Layout of the Indicating Meter

stant, until the meter swings to 100. Once the two meters correspond at the 100 mark, the resistance sliders should be fastened securely and left alone. Now it is a simple matter to check the other points. The calibration of the lower scale will probably vary from our temporary lines due to the slight unlinearity of V_2. If one is not fortunate enough to calibrate the meter against a broadcast monitor, the trick can be done with an oscillograph, using the trapezoid figure.

If an oscillograph is not available, a variable battery voltage of 9 volts may be inserted in series with the ground end of the load resistor R_1 after the carrier and balancing voltages have been adjusted for 50.24 volts. When SW_3 is set on "pos." position (SW_2 on "peak") the polarity of the battery should be such that the total carrier voltage is 59.24 volts. R_6 and R_7 should be adjusted until the meter reads full scale (110%). Now reverse the polarity of the battery such that the carrier voltage now reads 41 volts and change SW_3 to "neg." position. Adjust R_1 until the meter reads full scale. There should be no modulation on the carrier while these tests are being made. The battery should be temporarily removed and the carrier and balancing voltage readjusted each time that a resistance value is changed. A short-circuited push-button switch should be used across the meter while calibrating the monitor to guard against damage should it get across one of the 50 v. sources of voltage. When the meter reads full scale on both "pos." and "neg." positions of SW_3 the sliders of R_1 and R_7 should be locked and the "zero" point on R_6 permanently marked. The other percentage points on the meter can be rapidly plotted in by decreasing the 9 volt battery to zero in eleven 0.82 volt steps. A voltage divider of 30 or 40 ohms across only one cell of the 9 volt battery will not disturb the series resistance to the meter, and provides a means of obtaining the various voltages.

After the monitor has been calibrated in per cent, the decibel scale can be drawn in. 100% modulation corresponds to zero decibels and any percentage below 100% is read in minus db (below zero level). The scale space is divided such that the per cent is below the scale and db above the scale. Table I gives the decibel calibration points directly in percentage of modulation, and figure 9 gives the scale layout.

◆

BAD BOYS

In a recent issue of *QST* we learn that Mr. Warner has "spanked the wrists" of those who had the nerve to exercise their American right of protesting to their government, the protests referred to being several thousand, we understand, which were sent to the Commission relative to the League's request that one of the phone sub-bands be enlarged.

RADIO is neither "pro-phone" nor "pro-c.w." Fortunately its staff is pretty well divided between "phone men" and "c.w. men", none of whom are extremists. Our only attitude on the question has been that we should all get together and fight for more frequencies rather than squabble among ourselves as to the division of what little we do have.

We are glad that the situation occurred, not for its effect upon our phone-c.w. allocations, but because it has brought to light the falsity of the claim of the A.R.R.L. to represent the wishes of amateur radio in this country.

It does not do so, it cannot do so—until many of its policies have been drastically changed. Until its methods are greatly improved [why have referenda never been used?] it cannot even adequately determine the wishes of its own membership, let alone determine the wishes of those amateurs who are still outside its ranks, and who in fact constitute the majority of amateurs in this country.

A little house-cleaning and self-improvement is decidedly in order before we make too many claims at Washington, claims which aggrieved persons will most assuredly prove false.

A Band Spread 20 Meter Phone Receiver

By R. F. Harrison*

This receiver was designed to cover just the 20-meter phone band and to do the job in the best possible way. Because of the crowded conditions of the band, great selectivity is required; therefore, a crystal filter is used.

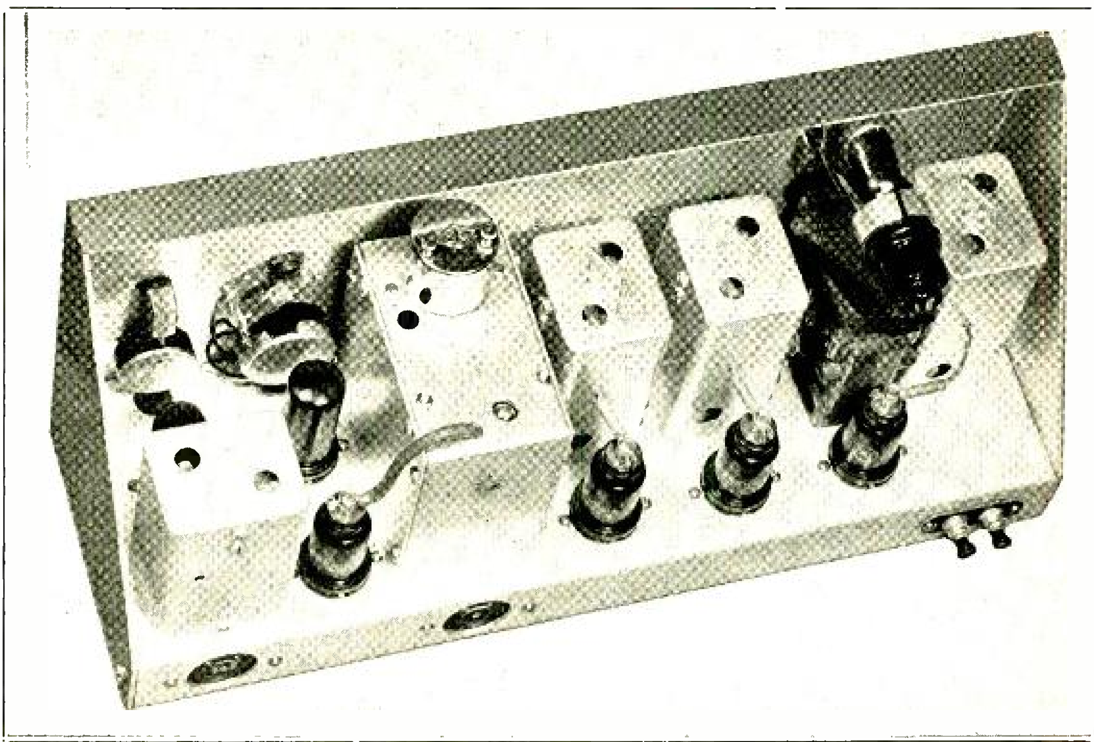
With many receivers on the market, frequency drift is a very serious drawback. In this receiver, an attempt has been made to reduce the drift as much as possible by making the oscillator tuning circuit (also the r.f. and first detector circuit) fairly high C (200 μμfd. minimum circuit capacity) and by taking pains to keep the heat emitted by the tubes *away* from the tuning circuits. No enclosed box is used, thus making for good ventilation and better frequency stability.

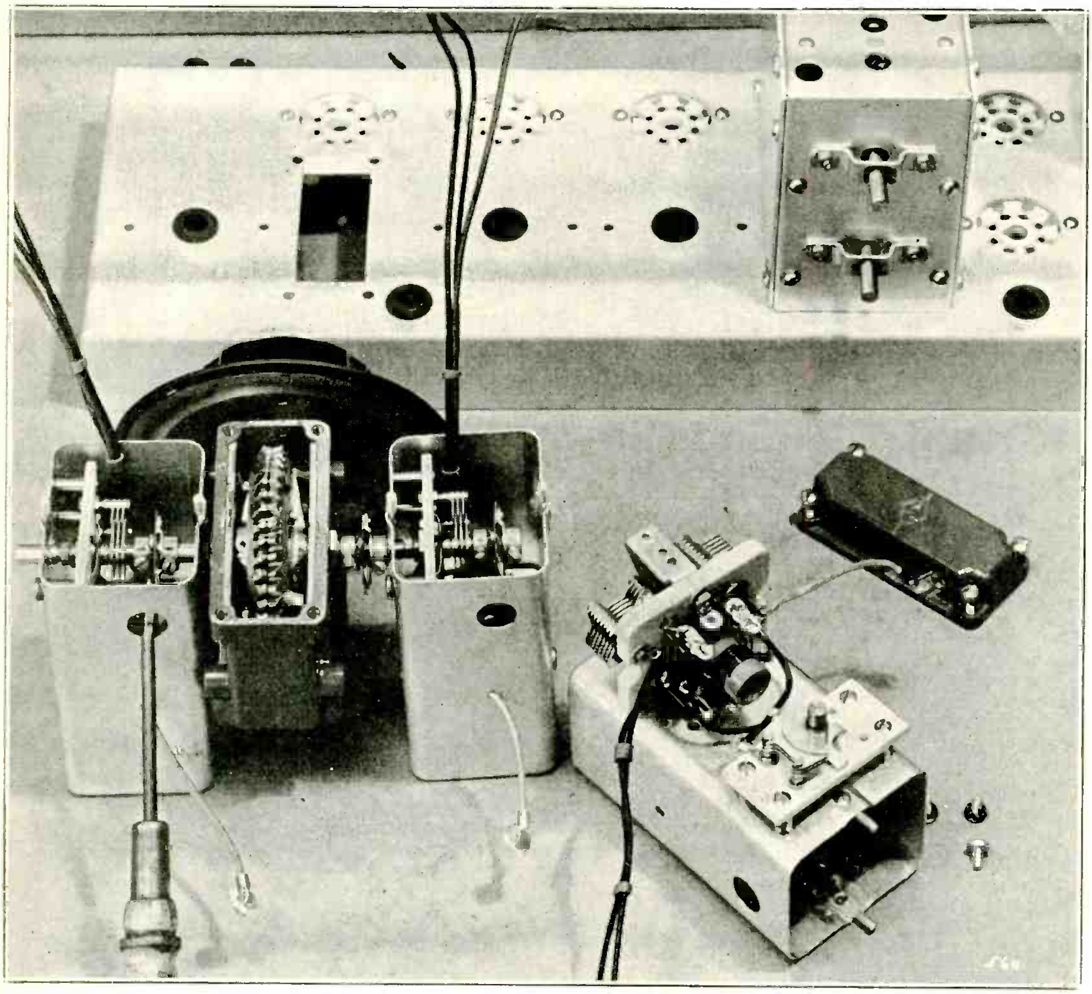
The chassis is made of 3/32″ aluminum 5½″ x 17″ and with bent side of 1½″. The panel is of the same thickness and is formed around the chassis as shown in the photos. It is painted a light gray.

*6 Bank Street, New York City.

The tuning units (all trimmers, padders and coils) are mounted in separate shielded cans. The cans are National i.f. transformers, minus the transformers. The two air condensers of approximately 100 μμfd. which come with each unit are wired up in parallel. The coil, wound on 9/16″ diameter tubing, is mounted in place of the i.f. coil. The variable tuning condenser, a National VM-15, is mounted near the end of the can. The shaft is ¾″ from the bottom. A rotor and stator plate should be removed to give the necessary band spread. However, the set will work quite well if they are left as is. Too much band spread will make the tuning rather wearisome. It will result in one's having to turn the dial three or four complete revolutions to go from one end of the band to the other.

Flexible couplers are used to gang the condensers together. A ½″ hole should be drilled in line with the set screw on the coupler, in order that they may be locked when the units





The ganged tuning assembly. Construction can be simplified by using fixed-tune 14,200 kc. tanks for the r.f. and first detector stages and tuning only the oscillator. The resulting loss in efficiency over the narrow phone band is very small, due to the high frequency involved.

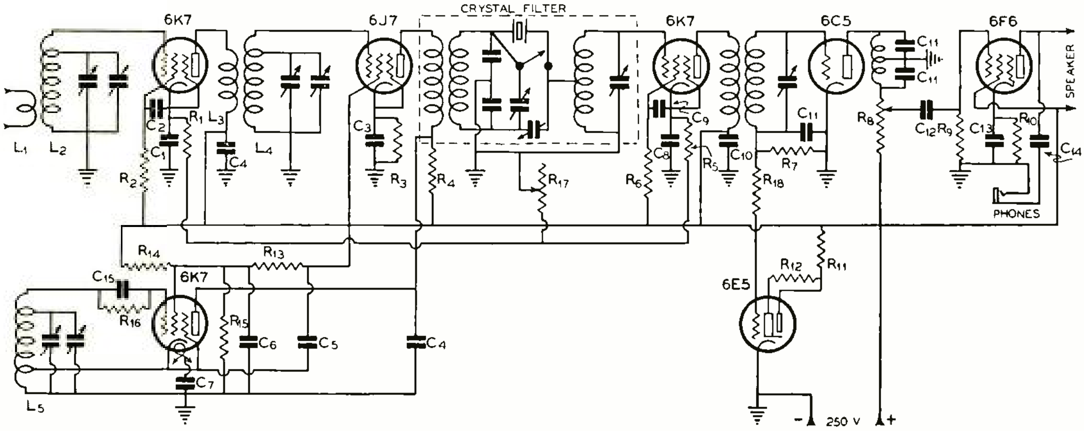
are mounted on the chassis. One of the photos shows a screw driver pointing to this hole. In the same picture is shown one of the units outside of its can shield.

The dial and driving unit is a National PW and is mounted upside down on the chassis. A hole is cut in the chassis large enough to clear the worm gear; the cover is placed under the chassis, and the whole unit is screwed in place. The hub on which the dial turns will have to be turned 180 degrees in order that the dial will read correctly. The hub has the word "top" marked on it—and it means what it says.

After the receiver is wired up, the tuning circuits can be lined up. Make sure that the variable tuning condensers run nearly alike. Then, adjust one of the padding condensers in the top of the shield can to line up the circuits. The other padding condenser should be set at maximum.

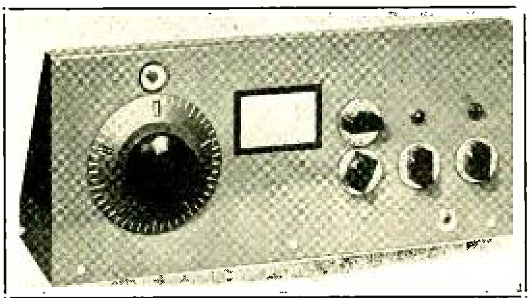
The circuits should be lined up in order that 250 on the dial hits the middle of the band. This will then give approximately one half of the dial for the 20-meter phone band, with plenty to spare on either side. If more band spread is desired, take out a plate from each variable condenser (the UM-15).

The crystal filter is absolutely necessary these days in order to work this band properly. I used the National filter similar to the one which is used in National's HRO. I think that



The Bandspread Special 20 Meter Phone Receiver Wiring Diagram

C_1, C_2, C_3—0.1 µfd., 400 v.
C_4, C_5—.01 µfd. 400 v.
C_6—0.1 µfd. 400 v.
C_7—.01 µfd. 400 v.
C_8, C_9, C_{10}—0.1 µfd. 400 v.
C_{11}—.00025 µfd. mica
C_{12}—0.1 µfd. 400 v.
C_{13}—25 µfd. 25 v. elect.
C_{14}—0.1 µfd. 400 v.
C_{15}—.0001 µfd. mica
Tuning condensers—See text
R_1—350 ohm, ½ watt
R_2—15,000 ohm, 1 watt
R_3—5000 ohm, ½ watt
R_4—2000 ohm, 1 watt
R_5—350 ohm, ½ watt
R_6—15,000 ohm, 1 watt
R_7—1 megohm, ½ watt
R_8—50,000 ohm pot.
R_9—250,000 ohm, ½ watt
R_{10}—450 ohm, 2 watt
R_{11}—10,000 ohm, ½ watt
R_{12}—1 megohm, ½ watt
R_{13}—100,000 ohm, ½ watt
R_{14}—50,000 ohm, ½ watt
R_{15}—100,000 ohm, ½ watt
R_{16}—20,000 ohm, ½ watt
R_{17}—10,000 ohm pot.
R_{18}—500,000 ohm, ½ watt



From the Front the Receiver Presents a Very Pleasing Appearance

the circuit diagram and the photos tell the story rather well and can see no need to add more in the way of notes, other than to point out what the knobs are on the front panel. The crystal filter has two controls: the top one is "selectivity"; the bottom, "phasing". The dial next to this one is the "radio gain" and the next is "audio gain". A switch is used in the "B" circuit for stand-by use, and a jack for phones. Only one stage of i.f. is used; therefore it should be a good one. A high-gain i.f. transformer, which has the primary and secondary coils rather close-coupled, is used.

The gain from this receiver is high enough to get any signal that can be heard at all in the mess that occurs in this band. With the crystal filter phasing control, quite a good bit of interference can be cropped out. Altogether, this set has proved to be a great help in enjoying the phone stations on this interesting band and is well worth the time and money spent.

◆

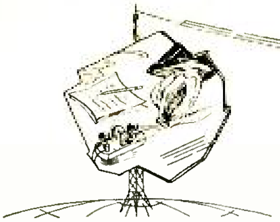
KANSAS CYCLONES

Manhattan, Kansas.

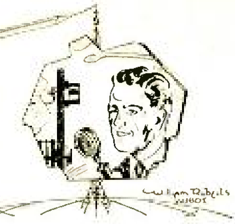
Sirs:

Just a few lines to tell you briefly of one of the newest and fastest growing amateur organizations in the Middle West. It is known as the *Cyclone Network*. The original was organized by W9ECF of Leonardville, Kansas, and myself and is known as the *Kansans* Cyclone Network. It is now spreading to adjoining states. Most of the members are phone men, but c.w. men are not barred, and we want as many hams as possible. The one aim is to eliminate as much QRM between stations as is possible by cooperation and by tying up interfering stations in round-tables. This is, of course, difficult to accomplish at night. But in day time, especially on 160 meter phone, it is very successful, and 6-, 7-, and even 10-way QSO's are not uncommon.

VINTON G. JOHNSON, W9FWY,
The "Terrible Swede" of the
Kansas Cyclone Network.



CALLS HEARD AND DX DEPARTMENTS



Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor*, not to Los Angeles.

William J. Williams, KFSH (W6AHP) aboard 230' Yacht "Stranger" on South Sea Island Cruise
Bora Bora (Island), Society Islands
June 14

(14 Mc. phone)

W6AGJ; W6AVU; W6FJ; W6FQU.

(14 Mc. c.w.)

W 2BSW; 2DSH; 3BSB; 3EVT; 3GAW; 4CYU; 4LL; 5CEN; 5DLC; 5EGA; 5FIX; 5IF; 6ADP; 6AET; 6CNO; 6CQK; 6ECP; 6GXQ; 6IHW; 6QC; 6SN; 8HPD; 9PTI. — EA4AV; K5AG; K6KSI; K6MAW; VK5HG; VK5ZC; ZL2BP.

Gnau, Fiji Islands
July 19

(14 Mc. phone)

W 5BDB; 5JC; 6ANU; 6BHO; 6EJC; 6ETX; 6ITH; 6MIM; 6NEH; 6NNR; 7IF; 9RUK. — K6LV; K6KDX; K6KKP; VE4HQ; VK2BW.

(14 M.c. c.w.)

W 1AEP; 1DPV; 1JAU; 1JLE; 8BZC; 2CIN; 2DFN; 2ECW; 2FBA; 2HMD; 2PY; 3EL; 3EXR; 3RT; 4BED; 4CUO; 4DRD; 5DTJ; 5EFT; 5EIS; 5EMQ; 5EOW; 5ETZ; 5FAE; 5FRL; 5SI; 6AMN; 6ASD; 6AWT; 6CFK; 6CGQ; 6CUH; 6DRE; 6DUC; 6DRU; 6EXQ; 6EZB; 6FQY; 6GRL; 6HKA; 6HZT; 6INC; 6JWT; 6JYF; 6KBD; 6KRI; 6KTH; 6LDD; 6LDF; 6LDP; 6LHN; 6LHW; 6LXM; 6MTD; 6MVJ; 6NQR; 6NYA; 6UO; 6VQ; 7AEA; 7AFS; 7DXZ; 7EGE; 7EOF; 7EOW; 7EYEQ; 7EZC; 7FCC; 7FDJ; 7FEC; 8BTR; 8DFH; 8DHC; 8FGA; 8HHZ; 8HLD; 8HVS; 8IQB; 8JVI; 8JWC; 8KKG; 8MUC; 9AHR; 9AUN; 9BEU; 9GBJ; 9KCL; 9KLS; DLQU; 9RBV; 9RXF; 9UWD; 9VLP CM7AI. — K 5AA; 5AG; 5AH; 5AI; 6DV; 6EWQ; 6GQF; 6NCW; 6NRF. — LU6AD; LU9AQ; VE3AFR; VE4IV; VE4ZK; VE5EE; VE5MH; VK3EO; VK7NC; VP6AS. — XE1FL; ZL2QA; ZL4AO.

Fiji Islands
July 22

(14 Mc. phone)

W 3DDO; 6DQP; 6FJ; 6HAA; 6LHM; 6LLQ; 6NNR; 6RP; 7EXK; 8JFY; 8LAC; 9RUK. — VE4HQ.

(14 M.c. c.w.)

W 1HER; 2AFO; 2BHW; 3FQB; 3QT; 4CBY; 5BLW; 5DQD; 5EIP; 6AWT; 6BAG; 6BAM; 6BIF; 6BXL; 6CQQ; 6CUH; 6DLN; 6HFD; 6KGD; 6KHE; 6KIP; 6KWA; 6LDP; 6MOJ; 6NDB; 6SC; 7BYW; 7EOF; 8DDO; 8KHE; 8NPR; 9BWT; 9GIH; 9OT; 9VLP; 9ZT. — J3FI; K6MAW; VE4BG; VE4LV; VE4UP; VE5QP; VP9AA.

July 30

(14 Mc. phone)

W 6AH; 6BKY; 6CQG; 6EBJ; 6FQY; 6GAL; 6GRL; 6LJY; 6LMA; 6NNR; 7EXK. — K6LJB; K6NRF; OM2BC.

(28 Mc. phone)

W 5BDB; 5EB; 8ANO; 9AEQ; 9ARN; 9CXX; 9EMC; 9JEH; 9MCD; 9NUS; 9RUK; 9WBR. — XE2N.

Shigeo Okaya, J3FI, 1876 Tantakabayashi, Sumiyoshi, near Kobe, Japan
July 1 to Oct. 12

(14 Mc. phone)

W 6AM-9; 6CKR-6; 6FQY-8; 6LLQ-8; 9RUK-5. — K5AA-6; K6JLV-8; K7EXU-5; K7VH-6; KA1AK-9; KA1AN-9; KA1BH-9; KA1ER-9; KA1LB-9; KA1ME-9; LU4BH-8; LU7AX-6; MX2B-9; OB2BC-7; PK1MX-8; PY2AK-7; SU1CH-7; VK4JU-6; VK4XS-5; VS2AK-8; VS6AH-8; VS6AQ18; XE2AH-7.

(14 M.c. c.w.)

W 1AQT-6; 1BD-5; 1BJP-5; 1BUX-6; 1CMX-5; 1DF-6; 1FF-5; 1FH-6; 1LZ-6; 1TS-6; 2CC; 2DTB-6; 2GWE-6; 2KL-6; 3CIC-4; 3EDP-6; 3EMM-5; 3EXW-5; 3QM-5; 3ZD-6; 4AH-5; 4AUU-6; 4BCR-6; 4CEN-5; 4CYP-5; 4DVD-4; 4EF-5; 4TR-5; 4ZH-6; 5AFX-6; 5BB-7; 5CPB-6; 5CPT-6; 5EGA-5; 5EHM-6; 5EOJ-5; 5EWJ-5; 8AZD-6; 8BOX-6; 8CHA-8; 8CXC-6; 8DVX-5; 8IWI-5; 8JAK-6; 8JMP-6; 8KKG-7; 8LEC-5; 8OSL-6; 9AJA-6; 9ANQ-6; 9CTR-6; 9GLG-5; 9LM-6; 9NEV-5; 9NNZ-6; 9RME-6; 9RXL-6; 9TNR-5; 9UJS-6; 9VBQ-5; 9VDY-6; 9VPG-6. — CR9AB-7; D4AAR-7; D4DCN-5; D4DLC-6; D4NXR-5; D4VRO-5; D4XCG-5; ES2C-5; F8KS-4; F8WK-5; FB8AB-6; G5WP-5; G6QX-5; HAF8C-5; HB9X-6; HK3JB-6; HS1PJ-7; LA2Q-5; LY1J-6; OE1ER-5; OH5NF-6; OH5NR-5; OK2PN5; OK2RM-7; ON4AU-6; OZ5C-4; PA0MDW-5; SM6UA-6; SM7UC-6; VE2AX-5; VQ2RS-5; YL2BB-6; ZB1H-5.

*George Walker, Assistant Editor of RADIO, Box 355, Winston-Salem, N.C., U.S.A.

Robert G. Wilson, Jr., W3GHD, 24 Waverly Road, Llanerch, Pa.

(14 M.c. c.w.)

CE1AQ; CM2AI; CM2AZ; CM2DO; CM2FM; CM2OP; CM7AI; CM7AB; CM8AZ; CN8AH; CN8MQ; CP1AA; CP1AAA; CP1AC; CT1GU; CT1ZZ; CX1BG; CX1BN; CX1CC; CX1MB; CX2AK. — D 3CFH; 3CSC; 3DBN; 3DHN; 3DXU; 3FZI; 4ADF; 4AKK; 4ARR; 4BFU; 4IJH; 4JPK; 4JKK; 4KMG; 4KRJ; 4LTN; 4MNL; 4NPR; 4NVR; 4OAR; 4ORT; 4PAU; 4PIU; 4PQU; 4RRH; 4SIG; 4SXR; 4TGT; 4TKP; 4WLL; 4WSL; 4WYG; 4XCG; 4XJF; 4XQF; 4YCF; 4YRI; 4YTM; 4ZMI; 4ZPI. — EI5G; EI6I; EI9F; EI9J; ES5C. — F 3AK 3AY; 3AU; 3CX; 3KH; 3LU; 8CP; 8DC; 8DW; 8EB; 8FE; 8FK; 8GQ; 8IZ; 8KJ; 8LY; 8NJ; 8NV; 8QY; 8WQ. — FA8BA; FB8AB; FR8VX; FT4AA; FT4AB; FT4AG. — G 2AS; 2BK; 2CL; 2DL; 2FO; 2GC; 2GN; 2HQ; 2JF; 2KB; 2KZ; 2LA; 2LK; 2MF; 2NN; 2OF; 2OU; 2PL; 2PN; 2QY; 2RC; 2RD; 2RX; 2TM; 8TP; 2TR; 2TW; 2VZ; 2WD; 2WK; 2XY; 2YY; 2ZL; 2ZY; 5BN; 5GL; 5GS; 5IV; 5JJ; 5JX; 5KT; 5LI; 5LV; 5PR; 5QY; 5RI; 5RS; 5RV; 5SR; 5SX; 5UA; 5UD; 5US; 5UU; 5VQ; 5XB; 5XH; 5YH; 5YV; 6AH; 6AK; 6BQ; 6CL; 6DI; 6GL; 6GM; 6IR; 6JZ; 6KP; 6LD; 6NJ; 6OS; 6QA; 6QC; 6QN; 6UH; 6US; 6WO; 6XK; 6YO; 6ZO; 6ZR; 6ZS; 8DN.— GI5QX; HAF4H; HAF4J; HAF4K; HAF5C; HAF8D; HAF8I; HB9AK; HB9AW; HB9B; HB9BD; CH1DC; HH1B; HI4F; I1TKM; I1WW; I1XD; J2CE; J2CL; J2FU; J2LV; J5CC. — K 4BU; 4BNH; 5AA; 5AC; 5AG; 5AH; 5AI; 5AJ; 5AM; 5AT; 5AV; 5AY; 5AZ; 6ILT; 6LGZ; 6MAW; 6MEM; 6MTE; 6NCW; 6NEK; 7AU. — LA2X; LA4K; LU1EP; LU4BH; LU4DQ; LUAQ; LU5BZ; LU7EO; LU8EN; LU9BV; MX2B; OA4J; OE1FH; OH2OV; OH3OD; OK1AW; OK1KL; OK1RO; OK1SU; OK2AK; OK2HK; OK2PN; OK2RS. — ON 4AS; 4CC; 4DX; 4FE; 4FX; 4LF; 4LB; 4LV; 4LZ; 4NC; 4PA; 4UH; 4UW; 4ZOP. — OS1BR; OZ1G; OZ2B; OZ2H; OZ4LM; OZ5G; OZ5M; OZ5R; OZ7CC; OZ7KG; OZ7SE. — PA 0AD; 0GN; 0JV; 0KG; 0KW; 0LL; 0MQ; 0MD; 0MX; 0NP; 0QF; 0QL; 0SD; 0XA; 0XF; 0ZK; 0ZN. — PK1PK. — PY 1AP; 1DW; 2BY; 2CK; 2CW; 2DC; 2DK; 2DO; 2IG; 2JO; 5AG; 5QD. — PZ1AL; PZ1PA. — SM 5SX; 5UD; 5UW; 6QN; 6WI; 7UC; 7QC; 7YB. — SP1FD; SV1KE; U1AP; U1CN; U2NE; U5KS; U6SE; U9MF; — VK 2AS; 2DD; 2HV; 2JN; 2JX; 2OQ; 2PH; 2PK; 2PX; 2SQ; 2SS; 2VQ; 2XJ; 2XT; 3EO; 3HK; 3JK; 3LR; 3MR; 3RV; 3UJ; 3XH; 4IS; 4YL; 5CB; 5KG; 5QR; 5RX; 5WJ; 5WR; 7CJ; 7JV; 7KU. — VO2N; VP1WB; VP2AT; VP2AT; VP2DF; VP4TM; VP5AF; VP6YB; VP7RC; VP9H; VP9R; XE1AM; XE1AY; XE1BT; XE1DA; XE1DD; XE2V; YL2BB; YM4AA; YM4AL; YR4AL; YR5AT; YR5RR; YU7DX; ZB1C; ZB1H. — ZL 1DL; 1HY; 1KF; 2GO; 2JQ; 3AX; 3DJ; 3JA; 4AO; 4BQ; 4CK. — ZS1AL; ZS2X; ZT1Q; ZU1T.

Don McVicar, VE4PH, 9819 - 104th St., Edmonton, Alta.
Oct. 17 to Nov. 15

(28 Mc.)

D4DON-6; D4FND-8; D4QET-4; F3KH-6; F8EO-6; F8KJ-6; F8RR-5; F8WQ-6; G2AX-6; G2XC-5; G5CM-5; G5IR-6; G5SY-6; G5YS-6; G6DH-7; HB9AO-7; J2IN-6; J2IS-8; J2CF-7; J2LU-8; OZ2M-6; OZ7G-5; PA0AZ-5; VK2TF-5; VK2LZ-6; VK3EG-7; VK2GU-9; VK3CP-5; VK3KX-6; VK3YP-5; VK4BB-5; VK2YN-6; VK5FM-5; VK5KO-6; VK5HG-7; ZL1HY-7; ZL1FE-6; ZL2PC-6; ZL1DV-6; ZU1C-7; ZS1H-6.

Nov. 27 to Dec. 8

(28 Mc.)

F3KH-5; F8OB-7; G5CW-4; G5IS-7; G5SY-6; G6DH-7; J2CF-6; J2JK-6; K5AC-6; K6JLV-9; K6MVV-8; K6LEJ-5; VK2GU-8; VK3KR-6; XE1AY-6; YV5AA-6; ZU1T-6; ZS1H-7.

C. J. Nolf, ON4NC, Chateau de Rameignies, par Thumaide, (Hainaut) Belgium
October, 1936

(28 Mc. code)

CN8MQ; F8EB; F8EO; F8VS; FA8JO; G6DH; G6LK; J3FJ; LU6AX; OH3NP; OH3OI; OH5OA; OH7NC; OH7ND; OH7NI; OH7NJ; ON4AP; PA0ZK; TI2EA; U1BC; U3BH; VE2AB; VE3AEY; VE3DU; VE4JV; VE4TJ; VE4TO; VE5TV; VK3YP; VK4EI; VS6AH; YR5OR; ZL2BP; ZS1H. — W 1AAK; 1AVV; 1CFD; 1DHD; 1FN; 1IKU; 1IPV; 1LZ; 1TW; 2AJF; 2CTO; 2DOZ; 2GRD; 2HYT; 2IIR; 2JXZ; 3AUC; 3BIW; 3DOD; 3EVT; 3AUU; 4BBR; 4BMR; 4DWX; 5BEE; 5DQD; 6BUX; 6GZU; 6JJU; 6JNR; 6LHN; 7AMX; 8ANB; 8BTI; 8CRA; 8FJJ; 8IJZ; 8JFC; 8JRL; 8KH; 8KTW; 8MWL; 8MWY; NK; 8OKC; 8OMY; 9BPU; 9CBA; 9CJW; 9DCB; 9DMA; 9DXX; 9EB; 9EF; 9HDU; 9ISM; 9JNB; 9TEQ; 9TFY.

(28 Mc. phone)

W 1ADR; 1CCZ; 1DBE; 1JDV; 2AOG; 3AIR; 3BSY-4; 3CKT; 3CYK; 3FBG; 4BMR; 4CPG; 4CWR; 4DEK; 4DSY; 4EBM; 4EC; 4FT; 4GB; 5BEE; 5FHJ; 6MFR; 7FQK; 8AGU; 8CJM; 8CMS; 8EBS; 8IJZ; 8IWG; 8NK; 8OPO; 8OXK; 8OXM; 9AGO; 9DTP; 9TTB.

I1ER, Italy—forwarded by W3CDQ, Washington, D.C.

(28 Mc.)

Oct. 4, 1936

W 1AVV; 2DTB; 2FBA; 2KTB; 3VB; 3ZX; 5VV; 8ANN; 8ANO; 8CRA; 8EBS; 8FSA; 8IWG; 8MWL. — CN8MQ; VE3KF; ZS1H.

Oct. 18, 1936

W 1TW; 1KH; 1DZE; 2HYT; 2HMD; 2FAB; 2HY; 2CTO; 2HMD; 3DBX; 3MD; 8ANN; 8IFD; 8BCT; 8PSG; 9MIN; 9NY. — ZS1H.

Glenn E. Roof, W8OPG, and F. D. Gilliand, W8OQV, Shaker Heights, Ohio

(14 Mc. c.w.)

AR8MO; CE1EM; CE3AR; CE3EL; CE7AA; CN8AD; CN8AH; CN8MJ; CP1AA; CP1AC; CP3ANE; CR7GC. — CT 1BY; 1CB; 1GU; 1JU; 1KH; 1LZ; 1MS; 1VV! 3AN. — CX1BG; CX1CX; CX2AK; EI2B; EI4G; EI5F; EI6J; EI8B; EI9G; ES2D; ES5C; ES7C; FA3JY; FA8BG; FA8DA; FA8GK; FB8AA; FB8AB; FB8AD; FB8AE; FB8AF; FB8AG; FK8AA; FM8D; FO8AA; FR8VX; FT4AA; FT4AG. — HAF 1G; 1YL; 2D; 3D; 4H; 4K; 8C; 8D. — HB9AK; HB9AQ; HB9AU; HB9J; HB9T; HC2MO; HH1P; HH2Z; HH3L; HH5PA; HJ3AJH; HK1Z; HK5JD; HRLJR; I1IT; I1KA; I1RRA; I1TKM. — J 2CL; 2GW; 2IS; 2JJ; 2JN; 2JV; 2KJ; 2LB; 2LK; 2LO; 2LU; 2ME; 3FU; 3FZ; 5CC; 5CE; 8CA. — K7CHP; K7ENA; K7EPQ; K7FCR; K7FRU; K7PQ; K7UA. — KA 1AK; 1AN; 1CM; 1DF; 1FS; 1LB; 1MD; 1ME; 1US. — LA 1G; 2B; 2X; 3B; 4N; 4P; 5N; 5P; 6A; 6B. — LU 1EP; 3DQ; 3EV; 3HK; 4BH; 4DQ; 5BV; 7AZ; 7BH; 7BY; 7DJK; 7EO; 8DJ; 8EN; 9AF; 9BV. — LX1AS; LX1A; LY1HB; LY1J; LY1ZB; LY1ZZ; OA4J; OA4Q. — OE 1BI; 1EK; 1ER; 1FH; 3FL; 3KH; 6DK; 7JH. — OH 2NE; 2OV; 3OF; 3OI; 5HB; 5NR; 5OA; 6DH; 6NN. — OK 1AW; 1FD; 1FF; 1FZ; 1SU; 1WF; 1XA; 2AK; 2KO; 2OP; 2PN; 3VA. — OM2RX; ON4CJJ. — OZ 2B; 2M; 3D; 3J; 4H; 5C; 7CC; 7FD; 7KG; 7ON; 7Z; 8JB. — PJ1B. — PK 1BO; 1BX; 1DU; 1MK; 1MX; 1PK; 1RA; 2KO; 3BK; 3BM; 3LC. — PY 1EP; 1FZ; 1MZ; 2BX; 2DC; 2FJ; 2FY; 2GP; 4AP. — PZ1AA. — SM 5QU; 5UU; 6PA; 6RC; 6SS; 6UJ; 6ZF; 7MU; 7RV; 7UC. — SP1CM; SP1DC; SP1DE; SP1DT; SP1FI; SP1IA; SP1IT; SU1AC; SU1RO; SU1SG; SU1SS; SU5NK; SX3A; TI2FG; TI2LR; TI2RU. — U 1AD; 1AP; 1BL; 1CN; 2NE; 3DF; 3QE; 5KH; 5KS; 6AH; 9AC; 9AL; 9MF; 9MI; OND. — UE3EL; UN2A; VK6AA; VK6FL; VK6FO; VK6MO; VK7JB; VK7KV; VO2Z; VO3HM; VO3X. — VP 1JB; 1MR; 1RO; 1WB; 2AT; 2BX; 2CD; 2GB; 2TG; 4AP; 4TH; 4TM; 4TN; 5IS; 5GM; 6MO; 6MY; 7AA; 7NA; 7MB; 9H. — VQ 2RS; 2TT; 3BAL; 3FAR; 3JT; 3MSN; 4CRE; 4CRH; 4CRO; 4CRP; 4CRT; 8AB; 8AC. — VR4BA. — VS 3AE; 6AG; 6AH; 6AQ; 6BD; 7RA; 7RF. — VU2BG; VU2CM; VU2CQ; VU2LJ; VU7FY; XU1D; XU3DF; XU3ST; X6F; XU8AG; XU8AL; YL2BB; YM4AA; YM4AF; YN1AA; YR5AR; YR5CP; YR5OR; YS1FM; YT7AQ; YT7VN; YT8MT; YU7DX; YU7GL; YV4AC; YV5AA; YV5AP; ZB1E; ZB1H; ZB1I; ZC6CN; ZE1JE; ZE1JJ; ZE1JR; ZE1JS; ZE1JU; ZE1JV. — ZS 1AH; 1AL; 1C; 1D; 1H; 1V; 2A; 2V; 2X; 4J; 4U; 6AF; 6AG; 6AM. — ZT5P; ZT6A; ZT6AK; ZT6N; ZT6Q; ZT6Z; ZU1C; ZU1T; ZU5X; ZU6B; ZU6M; ZU6P.

Petr. Jastrzembskas, LY1J, Hipodromo 14, Kaunas 1, Lithuania

(14 Mc. c.w.)

W 1BBN-5; 1FPP-6; 2CYN-5; 2GKE-5; 4BSJ-6; 4CYU-5; 4DVL-5; 5AFX-4; 5QL-5; 6AET-4; 6BPT-4; 6BYY-5; 6DI05; 6GHI-5; 61OJ-5; 6JNL-5; 6QD-7; 7AFS-4; 7FLU-5; 8DFH-6; 8JMP-6; 8KWI-5; 8LEC-6; 8ZY-6; 9GDH-6; 9JDP-5; 9KGK-5; 9LOM-5; 9MNU-6; 9RCQ-6; 9VKF-4. — HP1A-8; K5AG-6; KA1HN-5; VE3UG-5.

E. L. Walker, W8DFH, 2717 Connecticut Ave., Pittsburgh, Pa.
Oct. 1 to Nov. 1

(14 Mc. phone)

CN8MB-6; FA3JY-5; FB8AB-7; KA1AN-5; KA1BH-8; KA1RR-7; KA1ME-8; OM2BC-8; PK1BX-8; PK1MX-8; PK3LC-8; SU1CH-9; VS6AH-7; VS7RF-5; VU7FY-4; ZE1JM-6; ZE1JR-8; ZS1AL-5; ZS6T-6.

(14 Mc. c.w.)

AR8MO-9; CN8AH-9; CN8MB-9; CR9AB-9; FA3JY-8; FA8DA-9; FA8GK-8; FB8AB-9; FB8AD-9; FB8AF-9; FB8AG-9; FK8AA-8; FM8AD-8; FT4AA-9; FT4AB-8; FT4AG-8; FT4BA-8; HS1BK-9; HS1PJ-7. — J 2CB-7; 2CC-8; 2CL-8; 2HQ-7; 2IO-8; 2JJ-8; 2KJ-8; 2KX-7; 2LL-8; 2LO-8; 2LU-9; 2ME-7; 2MI-7; 3CR-8; 3CX-7; 3FI-9; 3FK-7; 5CC-9; 6DK-7; 8CA-7. — KA 1AN-8; 1AP-8; 1BH-8; 1DD-8; 1DL-8; 1EL-7; 1ER-7; 1JR-7; 1LB-8; 1MD-9; 1ME-8; 1RR-8; 1TS-8; 1US-8. — MX2A-8; OM2BC-8; OM2RX-9; ON4CJJ-8; PJ1B-9. — PK 1BX-9; 1GW-8; 1JR-9; 1MD-7, 1PK-9; 1RA-7; 1RY-8; 1VM-7; 2HD-7; 3BM-8; 3LC-9; 4YY-7; 6AJ-8. — PX 7M-8; PZ1AL-8; PZ1PA-8; SU1AC-7; SU1CH-7; SU1SG-8; SU5NK-8; SV1KE-7; SX3A-8; TF3C-8; TG2AJ-9; U6SE-7; U9AC-8; U9AL-9; U9AZ-8; U9MI-8; VQ8AA-8; VQ8AE-8; VQ8AF-8; VR1AK-8; VS6AG-8; VS6AH-9; VS7EB-8; VS7MB-8; VS7RF-8; VU2BY-7; VU2CQ-8; VU7FY-8. — XU 2OC-7; 3FK-8; 3YK-7; 3ZC-8; 8AG-8; 8AL-8; 8HR-8; 8MK-8; 8RL-8. — YJ2K-8; YS1JC-8; ZB1C-7; ZB1H-8; ZD8A-8; ZE1JG-7; ZE1JM-8; ZE1JR-8; ZE1JS-7. — ZS 1AH-8; 1AL-8; 1AX-7; 1D-7; 1Z-7; 2P-7; 2V-8; 2X-9; 4U-7; 5Z-9; 6AJ-8; 6AV-8; 6T-8. — ZT2B-8; ZT2Q-8; ZT2V-8; ZT6AK-7; ZT6AL-7; ZT6AQ-7; ZT6AY-8; ZU1T-8; ZU5AF-8; ZU6AD-7; ZU6AF-8; ZU6E-7; ZU6L-7.

A. E. Lower, XU3XA-XU8XA, Chinwangtao, North China.

Heard aboard the *U.S.S. Augusta* near Peiping *Sept. 21*

(14 Mc. phone)

W7QC-5.

(14 Mc. c.w.)

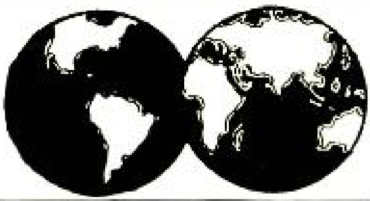
AC4YH-4; CR9AB-5; F8RR-5; G6CL-4; HAF7H-5; KA1MD-5; KA1ME-5; KA1KY-5; LA5N-5; LU7EN-4; OK1RU-3; OZ3J-5; OZ5M-4; PK1BX-5; PK1RL-5; PK3LC-5; PK3MP-5; U9MF-4; VK3WX-5; VK4EL-3; VK6FL-4; VQ8AF-2; VS1AA-5; VU2BQ-5; VU2DY-5; VU2JB-5; W6CRI-4; W7MB-4; W7QC-5; W9UFJ-3; ZS2N-4.

Donald W. Morgan, BRS 1338, 15 Grange Road, Kenton, Middlesex, England
Sept. 1 to Oct. 5

(14 Mc. phone)

W 1AHB-6; 1AJZ-7; 1BLA-7; 1BLO-7; 1BQQ-7; 1COX-7; 1DNL17; 1ENE-7; 1GBE-7; 1GJX-7; 1ICD-7; 1ICB-7; 1IFE-7; 1IRO-7; 1KK-7; 1NW-7; 1QS-6; 2AJ-7; 2BFB-7; 2CPA-7; 2CJJ-7; 2DC-7; 2DH-7; 2DQZ-7; 2EDW-7; 2EUG-7; 2FF-7; 2GKO-7; 2HCE-7; 2HUQ-7; 2JEH-7; 2MJ-7; 2PJJ-7; 2ZC-8; 3CKT-7; 3EKH-7; 3EOX-7; 3EOZ-7; 3EWW-7; 3EXC-7; 3FIH-7; 3FF-7; 3GBH-7; 3NF-7; 3PH-7; 4AKY-6; 4AQU-7; 4AWK-7; 4CAY-6; 4CAV-6; 4CJ-7; 4CVQ-7; 4CZQ-7; 4DBR-7; 4DCI-7; 4EDC-6; 8CMA-7; 8DEE-7; 8GB-7; 8GLY-8; 8GOY-7; 8FHW-7; 8FH-7; 8IYM-7; 8JJN-7; 8JYU-7; 8LFE-6; 8LT-7; 8LUV-6; 8MPX-7; 8PNC-7; 8QBT-7; 9CB-7; 9CVN-7; 9DZZ-7; 9GS-7; 9KWI-7; 9MHN-6. — CE1AR-7; CE3DW-7; CO8RV-6; CO8YB-7; CT2AB-7; CX1AA-7; HB9AY-7; HB9B-8; HI5X-7; HI7G-7; LA1G18; LA4N-7; LU3DH-7; LU4AW-6; LU5CZ-7; LU6KE-7; LY2AG-7; PY2BA-7; YP2CK-7; PY2ET-7; PY8AB-7; PZ1AA-6; SU1CH-7; SU1KG-7; SU1RO-7. — VE 1AR-7; 1AW-7; 1BR-7; 1CF-7; 1DC-7; 1DC-7; 1DT-7; 1EA-7; 1EX-7; 1GH-7; 1IF-7; 1IN-7; 2BG-7; 2CP-7; 2GA-7; 2HN-7; 2JJ-7; 3BK-7; 3JV-7; 3NB-7; 3NF-7. — VK2BA-6; VK2HF-6; VO1I-8; VO4Y-7; VP2CD-7; VP6YB-7; VP9R-7.

DX



By HERB. BECKER, W6QD

Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, California.

Herb pleaded with ye ed. not to run any pictures of himself and newly-acquired wife. However, we thought it a good idea to slap one in just in case he was merely trying to be modest.

If this section is more disconnected than usual (and I'm sure it's bound to be) please don't hold me altogether responsible. This past month has been one of hectic activity. Reason: The y.l. and myself decided to see if it is really true that two can live as cheaply as one . . . and with this in mind we walked off the end of the pier on January 1, 1937. Guess you might say that was starting the year off right. Alright, you guys, I know you're thinking it's the end of d.x. for QD. To this I'll say, it is definitely not the end, and as a matter of fact the x.y.l. knows most of the code now, and before long I wouldn't be surprised that both of us would be pushing the key. Anyway, we'll be on the air within a month, and if you remember I mentioned in last month's ramblings that I was moving the station back to the original QRA in Manhattan Beach. But will take a while to get all of the stuff back in harness.

This marriage business may be a bit of a surprise to many of the d.x. owls with whom hours have been spent in ragchews on this very same subject . . . and for that matter sometimes it seems like a surprise to me, too. If I were fone I would probably say, "Well, that's the dope on that, o.m."

Let's see . . . oh yeah; we'll pick on Mr. and Mrs. CUH first. It seems that the f.b. location of W6CUH has finally come under the axe. By that I mean that here was Charlie, sitting pretty, with two rhombic antennas covering several acres, and along comes Mr. Real Estate Man who says something like this: "Mr. Perrine, I understand all these elevated clotheslines belong to you, and where I personally appreciate the beauty of them on this acreage, it seems that many prospective buyers of this property cannot perceive their hidden beauty. Therefore, in order that these future home-builders may satisfy their desires and purchase my property, thus enabling me to buy groceries for another 40 years, I was wondering if you could dismantle these nice clotheslines."

There was Charlie with a 2 kw. glare in his right eye, saying, "You mean you want me to cut down all of those poles?"

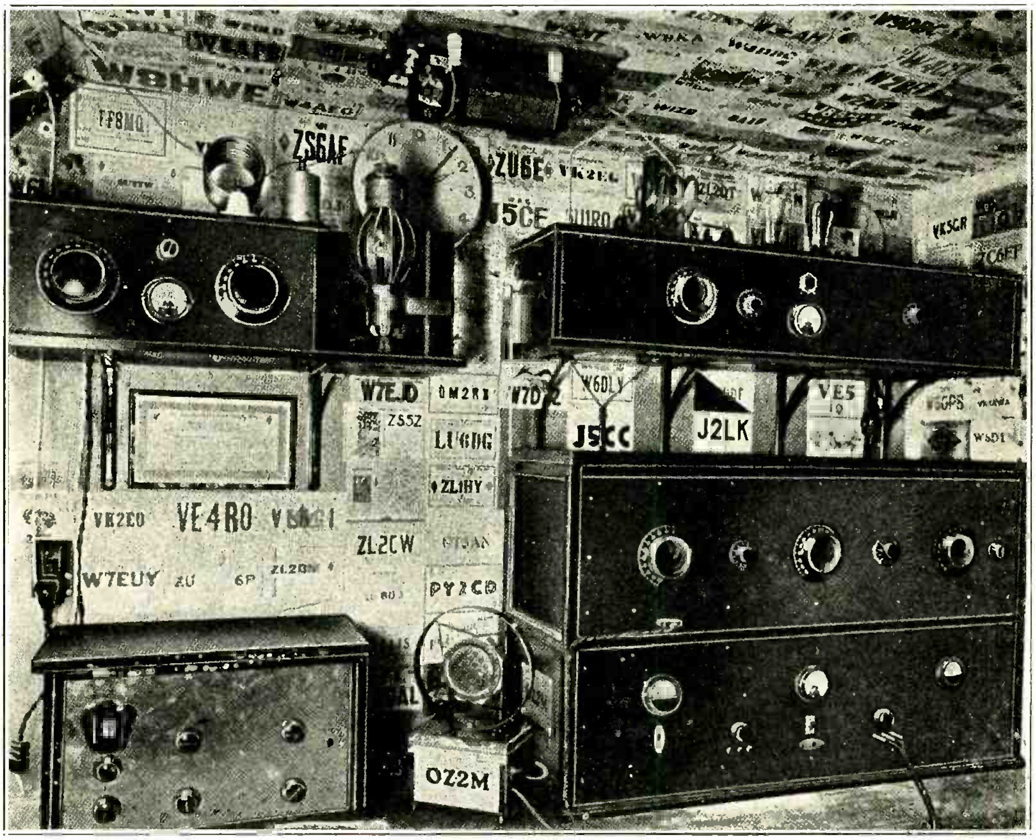
However, this glare soon turned to a beam of self-satisfaction, because all his life he has wanted the opportunity of walking up to a 65 foot antenna pole with a pair of pliers, nonchalantly cutting all the guy wires, and then just standing by and watching it fall. At last . . . here was his chance, and that is just what Mr. CUH did . . . Only instead of just cutting down one pole . . . he cut the guys on all 8 of them . . . Imagine that . . . eight 65 foot poles crashing. That's a real spectacle. Incidentally, Charlie has moved back to his original location in Hermosa Beach.

Flash

W.a.c. on fone in 36 minutes. W4DLH was the station, and the news was sent in by o.m. Walker, W8DFH, who was listening in on an all-continent fone hookup. All continents were hooked up together, with each station taking a turn in this order: W4DLH, VU2CQ, SU1CH, HK1Z, G5ML. The sixth continent for DLH was W8RL, giving him a 36 minute w.a.c. This took place on December 30th, 1936 from 7.45 a.m. to 8.15 a.m., e.s.t. I think this is a record for c.w. and fone. Congrats, W4DLH.

W8DFH has been hearing a new one, IF2OT, who is supposed to be in Italian East Africa or Ethiopia. High freq-end on 14 Mc., T7. 8DFH has completed his R9 w.a.c. in snagging HS1RJ and gives his full QRA as: Sangiem Powthongsook, c/o Radio Operator's School, Saladeng, Bangkok, Siam.

W1HIO worked YR5IG for zone no. 24 and SU1SG for 25. Uses a pair of 3-year-old 46's with 50 watts input. In 1934 W9ADN made w.a.c. in 10 hours, which was darn good time . . . then. But now he has hooked the six of 'em in 1 hour and 50 minutes. This was done on the last day of 1936. A note from Walt Ellis, W6CVW, discloses that after 13 years of chasing Europeans, he has at last hooked one for his w.a.c. The guy was F8SA and on 7 Mc. Nice work, Walt; and now you can have a sign made for your shack . . . "W6CVW, WAC in 13 years".



The station of K. L. Ewald, OZ2M, Denmark. O.m. Ewald says that soon his 12-year-old daughter, Kirsten, will have a license and will be on the air under the call OZ2YL.

G6QX reports not much this time but says that when these mornings are not so cold and dark he thinks he can fall out of bed and get on the air again. G2ZQ tells QX he thinks these stations are phoney: OS1BR (QSL's returned), EP1A, VS5YP, ZK1AA, HS4T, VC1KR, VQ4BP, in Nairobi, and TA2BS in Angora. What do you think about 'em?

W9CCT on c.w. aagin and has worked CR7AD and CN8AH. W9GK has new rig with the new 808's with 400 watts input . . . W9TOQ having fun with ten meter rig on fone and gunning for w.a.c. . . . W9PTV is chasing bugs out of his new final amp., which uses a 150T. W9GDH getting big final for d.x. contest . . . W9DHN worked G5ML on 80 meters with 50 watts input . . . W9ARL has 36 zones now. Keat Crockett, W9KG works TF5C, and as a whole conditions at KG are not so hot, but at his other station, W9ALV, things are much better. On Xmas day he worked 20 Europeans and one J on 14 Mc. This was done in ten hours and the rig uses a pair of tens with 95 watts input.

W1APA worked SV1SM on 40 and said to QSL via SV1CS in Athens. Frequency 7125 kc. Other new ones for W1APA . . . VK6MO, VK6LJ, ZT2Q, LA5N 14,050 kc., OH1NL 14,050, PA0UN, PA0AZ, OZ5M, VK2ACN. APA has been using his T-55 buffer as a final lately with 225 watts input.

VK4DO, Harold Hobler, did a pretty job when he made a quick w.a.c. last October in 50 minutes. In September he also worked all continents on c.w. and two on fone in 105 minutes. The rig Harold uses has a 210 final with 40 watts input. W2GTZ has added 10 new countries to his list and now it totals 97. The new ones: EL2A, HR7WC, VP3BG, SV1KE, HI6O, VP2GA, VE5TV Nottingham Island, J8CD, CR7AS, and TF5C. Reg Tibbetts, W6ITH, has been working a bunch of new fones on 20. Among those heard and worked are VP6YB 14,040, OA4AB 14,010, LU5CZ 14,076, PY2CK 14,084, VP6TR 14,054, ZE1JF 14,090, ZU6P 14,080, LU1DA 14,100, CE3DW 14,110, LU7AG 14,070, CE1BC 14,020, ZU6E 14,116, ZU6AS 14,360, ZS4J 14,306, ZS2X 14,370, LU4BH 14,390, VS6AB, VU2CQ 14,358. Reg has a new diamond pointed for Europe; so he should be laying them low any time now.

W9TKX is all for giving the good old 40 meter band some publicity as a dx band. He suggests that we all give it a whirl, as on forty you really appreciate the dx you work, but on 20 it's so easy you think nothing of it. This is really not a bad idea, and for that matter there is plenty of dx coming through on 40 and it will just take the fellows getting on that band again to really make it function. Europeans are coming through in the p.m. and the South Africans

"WAZ" HONOR ROLL

G2ZQ	39	W3DCG	31
W3SI	39	W5CUJ	31
W6CXW	39	W9KA	31
W4DHZ	39	W3EXB	31
W8CRA	39	W6BAM	30
W6GRL	39	W6GHU	30
W6ADP	39	W9IWE	30
W3PC	39	W3EVW	30
W9TJ	38	W6FKZ	30
G5YH	38	W8OQF	30
G6WY	38	W6DIO	30
W6CUH	38	W6VB	30
W6QD	37	W3AWH	29
W8BKP	37	W9LW	29
W2GWE	37	ZU1T	28
W8OSL	37	W6CGQ	28
W6FZY	37	W6GNZ	28
G6NJ	37	W5EOW	28
W2DTB	37	W3CIC	28
LY1J	37	W9JNB	28
W8HWE	37	W6HJT	28
W8DFH	36	W3EYS	28
W9ARL	36	W6CEM	28
W1ZB	36	W6JBO	28
W1CC	36	W7BLT	27
W9PTC	36	W8BWB	27
W6GAL	36	W8BOF	27
W6AM	36	W8FJN	27
W9KG	36	W6CLA	27
W3EDP	35	W6DQZ	27
W6HX	35	W8DOD	27
W2BSR	35	W6CVW	27
W6EGH	35	W9PGS	26
W8KPB	35	W9DMY	26
W8LEC	34	W6FET	26
W3EJO	34	W9DEI	26
W2FAR	34	W6IDW	26
W9PK	34	W2ALO	26
W9LBB	33	W6ITH	25
W5AFX	33	W9MKO	25
G6QX	33	W6KRM	25
W9AFN	33	W2DZA	25
W9ALV	33	W7AHX	25
G6CL	33	W1HIO	25
W8AAT	32		
W8BTK	32	Phone:	
W5EHM	32	W5BDB	27
W9EF	32	W6AM	23
W6NHC	32	W6ITH	21
W6FL	31	W6LLQ	22
W2BJ	31		

If you have worked 28 or more zones and are willing to produce confirmation on demand, send in your score on a postcard.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.

likewise. South Africans, where not so many are coming through in the p.m. and on the West Coast, they come through in the a.m. Asians also in the early a.m. W9TKX adds that if I want to work some dx, I can find him almost any night on the low edge of 40. Thanks for the tip; I'll be seein' ya.

W6GRL has added four new countries to his list . . . VS7RF 14,300, ZB1H 14,390, SV1KE 14,402 and YM4AA. Doc's antenna system took a beating in the wind storm last week and one of his poles buckled up. It's back up and he has his five Vee beams doing their stuff again. W6FKZ added two countries by hooking SV1KE and CR7MB . . . these also being new zones for him, making his number now 30. W6FZL now has 31 zones and just recently worked a guy on the Galapagos Islands . . . HD2A 14,420. And while I'm talking about W6's, I might mention that a word from o.m. Rawls, W6DRE, in Phoenix says that he has had to give up ham radio due to his health. He is trying to sell his outfit . . . so step right up, fellows. We all hope he soon gets back on his feet and busts forth with that walloping sig of his again.

W2FAR wants to know if there are any stations in zone 23. As far as I know there aren't any at present; that is, of course, any that get out across the pond. Yeah, I'm after that one too. W9PK worked ST2B but thinks he is a phoney. This Dept. had it in print last month that W6ERS worked him and was his first W. Does anyone else know anything about him? 9PK also worked HZ7RS in Hedjaz but has no details about him except that his freq. is 14,270. W1AQH has been using a 210 with 50 watts and has made w.a.c. 3 times since November 6th, 1936. Considering the QRP and location, that's pretty good work.

Remember W7AHX up near Eugene, Oregon, who generates his power from a hand-cranked Ford engine, as mentioned in RADIO a couple of months ago? Well,

ZU1T, operated by J. J. Van Ravesteym, is located 36 miles north of Cape Town, 25 miles from the nearest ham. The receiving position is shown above. Since September, 1934, he has worked 3373 stations in 27 zones.

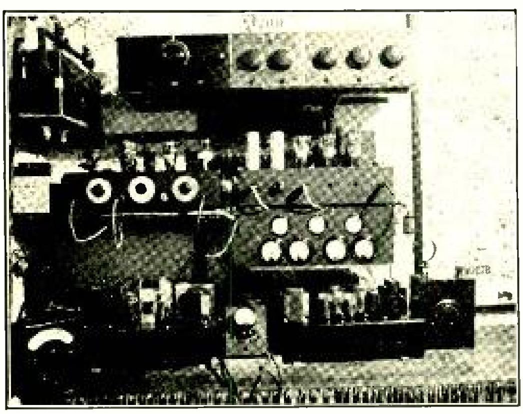
George is really going to town now, as he has put up a rhombic antenna and is knocking off the dx in fancy fashion. New Europeans for him are G2JF, G6NX, OZ2B, and OZ7FK. He is still using a 210. Bob Haas, W9HWE, has been gallivanting around the West Indies lately and therefore we haven't heard much from him. However, he is back on the air again and some stations added to his list are U9MI, VQ8AC, VQ8AF, TF5C, VP3BG, U9AL, ES5C, SV1KE, XU6SW, VU2BA, and VS8AA. VS8AA, Roy Fleming, on Bahrein Island, makes Bob's 98th country and 37th zone.

Hy Siegel, W3EDP, is having trouble from QRM of a neighbor's oil burner. However, between times he has managed to do pretty well, especially on one Sunday when he worked the following on 3.5 Mc.: HB9AD, OK2MM, G6WY, G2PL, F8WQ, and HAF8A. The QSO with G6WY gave 'em both FBTOC. Countries now 103, and expects his zone total to go up to 40 soon as he has purchased a filter for his neighbor's oil burner. Atta boy, Hy.

W6NHC, in San Diego, has boosted his zones to 32. Some new stations with him are VP4TF 14,380, HS1RJ 14,385, VP1AA 14,360, VP2AT 14,390, VQ8AC 14,325, HK1JB 14,340, ZE1JS 14,350, PK1BX 14,300, ZT5G 14,375, ZT6AQ 14,380, LY1J 14,300, G6TD 14,320, U1BC 14,330, OH5OA 14,280, F8VP 14,100, SU1CH 14,280, VS8AA 14,320, FR8VX 14,410, HC1OA 14,300, TF3PF 14,320, CE2AR 14,410. NHC has 64 countries.

In December Radio we printed a note from W6BAX to the effect that VQ8AB was W. P. Moores on Ascension Island. This was in error, and apparently so much of an error that o.m. Moores has sent in the correct information himself. Anyway, it seems that it should have been ZD8A, P. W. Moores . . . and that he never had been VQ8AB, although in 1934 he did hold the call VQ8A. I wouldn't send any QSL's to Ascension Island if I were you, though, as P. W. Moores is now in England and is not sure where he will go from there.

W9EF is back on the air after quite an absence. Bill is still using his ten year old 852 and this does him for both 10 and 20. He first made w.a.c. in 1928 and was the first W9 to work England and Denmark on 10 meters. Bill has 32 zones and 86 countries. W6EA, Howard Seefred, an old timer around town from the good old spark days, is still on the air. Recently he got a kick out of working VE5MR on the shore of Great Bear Lake in northern Canada. Howard doesn't get a chance to get on very much but he is still batting 'em off.



Two transmitters are used at ZU1T. One is used on 20 and 40 meters; the other is for 10. A 66 foot zepp. is used on 20 and 40 meters. A 67 foot single-wire-fed antenna is used on 40, 20, and 10 meters.

Ever since this column said that W8OSL was stuck on an end-fed antenna, he hasn't been able to work a thing. He says he has missed SV1KE, PJ1AO, PZ1AL, EL2A, VP2GA, and HS1RJ. Guess we'll need a "station missed" column. However, he did break down and work VU2BA. W2GFF is through with low power. The other night he visited W2HVM and hooked FB8AB so easily that he's going to junk his 25 watts and get something higher. Now you're getting the fever . . . they all do eventually. W6RH, Bill Overstreet, received his card from VS1AL and he gives his full QRA as Sgt. B. Pook, Royal Air Force Station, Singapore, Malaya. His freq. is 14,350 kc. W8DOD has worked 27 zones and a few of the new stations hooked by him are: FR8VX, U9MI, YT7KP, CN8MQ, and J8CD. Uses 100 watts to an RK-20 final.

Station VK3EG and its operator, Ivan Miller. Ivan has been active in radio for 12 years. The transmitter is a 5-stage outfit operating on all bands from 3.5 to 28 Mc. The Vee beam used for U.S.A. has 10 full waves on a side, and a separate, phased Vee with 330 foot legs is used for Europe. 129 countries have been worked on 20 and 40 meter c.w. Ivan is a dentist, and when not pushing the key of his transmitter, pushes the keys of a piano, which he plays in his own dance band. He is an excellent lacrosse player and has represented N.S.W. in that sport. His only vices are smoking, swearing, and ham radio.

W4CQR, in Macon, Ga., has been doing right well with his 50 watts. Hooked VP7NI on the Great Aboco Isle in the Bahamas. His frequencies are 14,400 and 6,990 kc. He claims that HR7WC is an illegal one in Honduras. HH3L has a new Xtal rig (hooray) and may be found on 14,300 kc. HH5PA, the fone hound, is on c.w. and at 14,080 kc. HH2Z and HH1P can be located around 14,325 kc. HI2T is T9 and on 14,050 kc. ZS1AN and ZS5X are good ones for the east coast boys, and are about 14,010 kc. W4CQR also says that CR7AS usually comes in on 14,008 kc. and has a T6 note. A really good one that he snagged is YA2R whom he worked for a half hour. YA2R gives his QRA as "Radio YA2R, POB 83, Kabul, Afghanistan". I think that is a pip. CQR is another one still waiting for a QSL card from OS1BR. He takes issue with my statement of a few months ago when I said that VV2AA was probably a fishing scow off the Florida coast. Now he says he is definitely on the Manua Island. Maybe the scow has landed at last.

W6KRI has been doing some nice work . . . Why, only a few nights ago he was heard working W3BBD, W8CRA, and W4DHZ. Gosh, what a gang to get all hooked up the same night. 3BBB is going to college or something, and the man-on-the-mountain Lucas is still fiddling around back there, while Dave down

VK3EG is located on a hill above the town, which may be seen in this photograph. It makes an ideal dx QRA. VK3EG is Australian representative for the B.E.R.U. and R.S.G.B.

there in Atlanta has been busy getting his junk polished up for the contest. By the way, Dave has a nice little article in this issue of RADIO, so don't pass it up. And while I am talking about articles, I believe Mr. Perrine has a story on how to get more of something out of something else. Anyway it's good; so look that one up too. I feel as though I should write a story about something, but I'm saving up so I can write a real bang up one on how to work bigger and better W9's. Boy, that is something to look forward to . . . sez me.

I'll let you all know about this "two as cheaply as one" business next month. Oh . . . you W9's just take it easy . . . But I warn you, as soon as I get the heap cranked up again I'll be out after you.

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28 AND 56 MC. ACTIVITY

By E. H. CONKLIN, W9FM

56 Mc. Dx Again!

On December 2, Frank South at W3AIR turned on his 28 Mc. receiver shortly after noon, to run across W6DOB's signal calling "CQ 56 Mc." This apparently was 28 Mc. doubler leakage to the antenna. Frank had learned of his 56 Mc. harmonic so ran up the bias voltage to increase the second harmonic output from the 28 Mc. transmitter (a pair of 830 B's and raised W6DOB. Back he came with, "Ur R7 QSB R2—am copying u on 56 Mc.—are you on five?" W6DOB attributed the ten meter output to the proximity of the 28 Mc. antenna feeder and final tank coil. He mentioned having schedules with G5BY, LU1EP, XE1AY, and VK4AP on 56 Mc., and expressed regret that W3AIR was not listening on five meters to make it two-way. We believe that this QSO should be credited as the first for W3-W6 on 56 Mc.

On November 22 between 10:00 and 11:00 G.m.t., both G2HG and BRS250 heard CN8MQ on 56 Mc. On seven days between October 13 and 28, ZT6K in South Africa heard the sound portion of television broadcasts on 7 meters from Alexandra Palace, London. On October 20, he heard the 56 Mc. harmonic of W6IRD calling ZS2P. The receiver at ZT6K consists of a battery model Pilot Wasp, regenerative detector and two stages audio, with homemade coils for seven and five meters.

G2HG's comments on the reception of CN8MQ on five meters are these: "On the morning of November 22, BRS250 and myself heard CN8MQ on 56 Mc. with a very chirpy note. Needless to say I called him until there were no contacts left on the key, but n.d. This reception has been confirmed and CN8MQ was calling 56 Mc. at the times we heard him here. Incidentally, CN8MQ says that he has heard harmonics of SP, LP, and OH stations down there recently—all on five meters."

G6PK has been using crystal controlled c.w. on 56 Mc. and has had a report on these signals from YT.

BRS1173 reports hearing several W stations on about 7 meters on November 15 between 1610 and 1720 G.m.t. The calls were identified as W1HHX, W1AXO, and W2AO. If this sort of thing keeps up, the W stations might develop "bad 7 meter harmonics" and try to work some unusual 42 Mc. dx! We always thought that we should have a band of a few hundred kilocycles at that frequency—even if only temporarily until television pushes us out—when, as, and if.

Better 56 Mc. Dx Receivers

We feel that more U.S.A. stations could hear 56 Mc. dx if ordinary regenerative receivers or good superheterodynes were in use, capable of hearing code, or phone carriers. In December, a month of long skip distance, 28 Mc. signals have occasionally been heard as close as 600 miles. A year ago W6DOB was heard at W3SI. Certainly the shorter skip this coming spring and summer should enable us to set up new records for long-distance five-meter work.

We have been looking about for stations which would volunteer to put automatically-keyed five-meter code signals on the air more or less continuously. These could be straight c.w. where local interference would otherwise be created, but some tone modulation could be applied elsewhere so that non-oscillating receivers could hear the signal. With such "beacons" on the air regularly, the 56 Mc. gang would definitely have something to listen for. This long distance work does not require beam antennas, and horizontal receiving antennas can probably be used to good advantage (if high) where local noise would interfere with a weak signal received on a vertical antenna.

The Oakland and Berkeley, California, gang, we hear, is gradually shifting to crystal control—realizing that a ten watt crystal signal will out-perform fifty watts self excited.

28 Megacycles

During November and December there has been some complaint about lower signal strength on ten meter dx. Part of this may be the usual year-end slump of very long distance signals between points north of the equator, though some may be due to a larger number of signals and consequent QRM, particularly in the jam at 28 Mc. flat.

To all except the west coast, Asians on ten meters are still news. Yet to W3AIR (phone, with a pair of 830B's) who uses the beams described in the Nov., 1936, issue of Radio, they are just the usual evening entertainment. Frank sends us this list with frequencies, all worked except J2DC:

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100% Excitation Increase

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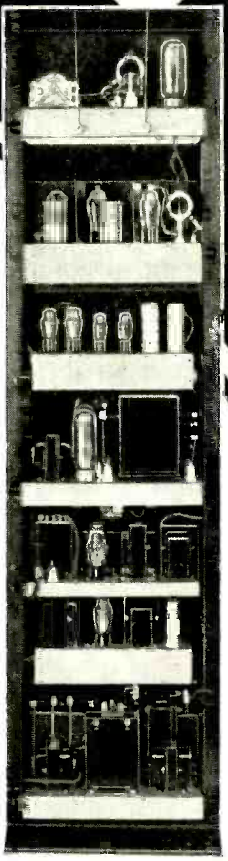
New Developments for All Bands

These tested and approved suggestions apply to 10, 20, 40, 80, 160 meter operation of All-Star Transmitters. Don't delay. Send now for your free copy of Bulletin SD-262. Write Dept. R 72 or see your parts distributor.



THORDARSON ELECTRIC MFG. CO.

500 W. HURON ST., CHICAGO, ILL.

Demand "Power by Thordarson"

J3FJ	approximately	28,450 kc.
J2CB		28,080
J2IN		28,120
J2DC		28,220
J3FZ		28,300
J2IS		28,305
J3FK		28,350
J2CF		28,355
J2LU		28,090

If you have trouble finding J's, listen late afternoons and evenings from late January to April.

The beam for receiving not only helps signal strength when the stations can be heard on an ordinary antenna, but increases the number of days on which J's can be heard, and the length of time they come through. The matched feeder, of course, is a help. Recently we have been working out the patterns for stacked antenna systems, directional or not. We have about concluded that stacking horizontal antennas one above another gives gain without lowering the angle of radiation appreciably, although with vertical antennas both gain and low-angle radiation result. The horizontal arrangement has an advantage on receiving, when the signal follows a somewhat higher angle of approach, and where local interference is to be reduced.

Every now and then we get word from one of the gang asking us to stress the need for the use of a proper (resonant) receiving antenna on 28 Mc., and a feeder that really gets the energy to the receiver.

New countries are represented, this month, by YT7MT on about 28,300 kc., reported by W3AIR; YR5OR heard by ON4NC; and PK3ST who has been working G's. Several of our readers have asked for frequencies of various dx stations, particularly the "hard" ones. We'll print them if you send them in.

Station Reports

British Report via G2YL: Conditions during November were very similar to those of October but showed a decline toward the end of the month, and the band sometimes went "dead" as early as 17:00 G.m.t. Australians and New Zealanders were more numerous than before, hut the latter were usually only audible for a short period around 08:15 G.m.t. and VK's are now often stronger at mid-day than earlier. Activity in Asia is graduallv increasing, and new stations heard on the band in November include VU2AM, PK3ST, VS6AS, J2CB, J2CE, and J3DC, but J's like ZL's are getting rather scarce now. VU2AU and VS6AH are probably the most consistent stations, the latter's phone being R7 in England at times. African 28 Mc. stations continued to get through well, and their numbers were swelled by FT4AG, SU1CH, SU1SG, and ZE1JR. ZS1H was audible at all hours of the day, and it is rumored that his 28 Mc. contest score is now in the neighborhood of 130,000 points! South and Central Americans were heard spasmodically but there are still only a few active stations. They include CP1AC, K5AY, LU1EP, LU9AX, OA4J, PY1BR, and VJ2AT. All districts of U.S.A. and VE1, 2, 3, and 4 were heard during the month; occasionally it seemed as if the usual occupants of the 14 Mc. phone band had emigrated *en bloc* to 28 Mc. W6 stations have been as good as ever, but for some reason W7's have become scarce. European signals were considerably louder and more numerous than at the same time last year, the most consistent countries being the comparatively distant ones: Russia, Finland, Latvia, Roumania, and Jugoslavia. New G stations appear on the band almost daily, and the number now active must be approaching the 100 mark. A noteworthy feature this winter is the frequent reception of "distant" G's at about R3-4. G6DH has added considerably to his contest score during November by working 22 different Oceanic, 7 Asiatic, 15 African, 20 European, 5 South American, and 207 North American stations. On November 22 he worked all continents—VS6, three VK's, LU, ZU, OH, and W2 in just over 2½ hours, and apart from the Asiatic contact was w.a.c. in 1½ hours! G6YL has made w.a.c. and w.b.e. twice since October 21, and her 30 different countries worked with 6 to 10 watts input include VK, VS6, U9, ZS, ZE, FB, LU, and PY. She suggests that dx stations, even if they prefer to transmit at the low frequency end, should sometimes tune their receivers from the high frequency end after a CQ. G6RH worked seven W6's in consecutive QSO's on November 28, 17.15-19.00 G.m.t.: W6IOJ, W6LEE, W6GRL, W6JNR, W6JJU,

W6NEP, W6EYC. Conditions were very poor in England on Sunday, November 29; Africa and South America were the only continents heard.

ON4NC: The rare continent in October was South America. Asia in the mornings with J, VS6, and U9. Heard a rare one, TI2EA. ZL and VK at about 9 a.m. ZS1H still comes through, weaker in evenings, but often QRM'd by U.S.A. stations. W stations, all districts, begin to get over at about 13.00 G.m.t. West Coast a little later in the afternoon. On the whole, conditions fine in October.

W9ALV: Work here week-ends during the past months included G6OZ and OK2HX on October 20; D4GFF, HAF8C, OE1FH, G5QY, and OK2RM on November 1; VP2AT on the 8th; D4QET, D4DMN, and SM7YA on the 15th; and G2WO and J2IN on the 22d. Not much doing on the band from then to December 22d, with signal level down. Expect a pick-up in conditions in February.

W9DSR: Deserves mention, says W6ITH, for R8-9 signals on phone, using only 5 watts to a type '19 tube in his final. Antenna is Johnson Q-fed. Uses a windcharger, storage batteries, and a dynamotor.

W6ITH: During Sweepstakes Contest in November, worked 111 stations on ten meter phone, and had replies from K7PQ, ZL1CD, LU9AX, and HI7G. VK2GU's new frequency is 28,120 kc. with a very nice phone signal about dinner time, working up to a dozen fellows every evening. He goes to work at noon so he can spend his mornings on the air. VK2YP and VK7KV are heard infrequently but well. VK4WH at Longreach in the middle of Queensland is using 12 watts to a single '10 feeding a Reinartz beam (see *Antenna Handbook*) and working Europe quite often. Australians hear FM8AA occasionally. ZE1JR comes in well on 28,390; J3FZ on 28,285 fairly well with good English; LU9AX occasionally on about 28,040. Worked ZU6P at 8:00 a.m. P.s.t. and received 27 letters and cards from SWL's in England on this one QSO. "Of course, all the above is on phone."

W3AIR: During October and November all continents were heard nearly every day, but with lower signal strength than a year ago. Contacts with U, VO, ZE, YL, YU have brought the countries up to 47 for 28 Mc. The J's have been the only code and phone signals readable on the Asiatic beam. On October 16th there were many, but I worked only three new ones (R7 and R6) while they lasted—about 45 minutes. On November 10, J3FZ was R7 and for a few evenings, J2IS phone held the S meter up to R7-8. November 17 was rather poor hut permitted three contacts. Little or no sign of J's in late November but VK2GU, who is sometimes up to R8, still affords good dx on phone.

G2HG: For the first time in months I went on 28 Mc. December 13 just to get a change from calling "test 56 Mc." and listening to the mush. The W9's seemed to be in sole possession and between 16:05 and 17:20 G.m.t. I worked W9JZJ, W9BPU, W9GIL, W9FS, W9PST, and W9EF.

VE4PH: South America is definitely the hardest continent to QSO from this location and no contacts have been made since lasr spring. ZS1H has been worked six times out of sixty calls, with good reports at each end. All the J's worked here were between 18:45 and 20:00 m.s.t. or quite a while after the band seemingly went dead. The best was an R9 report from J2CE. On October 28th, J2IS on phone at 19:45 was about R8, good quality, pretty fair English. The only VE5 w.a.c. on 28 Mc. was VE5HC, not VE5AC. Only VE3ER has made w.a.c. on the band in that district, with VE3KF needing only Asia. Changed here from single-ended 800 final to a pair in push-pull, with a noticeable increase in efficiency with the same exciting power.

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Open Forum

[*Continued from Page 38*]

will be weak within a radius of 1500 miles but get stronger as they approach a radius of 2000 to 5000 miles.

Tests have been conducted with G6RB and VK2KR in the 80 meter band and the variation of a foot or so separation may change the signal strength one or two "R" points. For working distances up to 1500 miles the free end of the counterpoise should be ten feet from the ground and good reports will be received, but at dx points the signal will be weak. This proves

that the separation of the two halves affects the angle of radiation.

With the counterpoise at 5 feet from ground at the free end, my signal report was R7 at VK2KR. At 8 feet from ground it was R4. At 10 feet I could just be heard and that's all. At 6 feet I was R6. Tests with other amateurs in Europe have also proven this adjustment to be quite critical. For European QSO's a height of 7 feet gives best signal reports.

A number of other amateurs have tried this system as per my measurements and noted an increase in signal reports from dx points. Many of them were using zepp antennas that were really "up in the air". In a recent letter from Reinartz he says he noticed the same thing when working on 20 meters back in 1925 but never paid much attention to it. If you ever get a chance you might try this system out on 80 meters and look for some dx, because the 80 meter band has it all over the 20 meter band as far as dx is concerned. I don't know why the gang don't use 80 more for dx than the other bands, but it's a cinch to get w.a.c. on 80 if you know the proper time to look for the dxers. The band is quite popular for dx now.

JIM MAGEE, W8CNC.

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"FUEL ON THE FIRE"

Mankato, Minnesota.

Sirs:

Your editorial in the November RADIO was especially well put. Directors of A.R.R.L. are representatives of the members who elect them. Our League is no ordinary profit-seeking corporation, but should be a democratic non-profit organization. Above all, it should not be thought of nor conducted chiefly as a publishing business as it is now. Your idea of divorcing the management of *QST* from the management of other League affairs appeals to me.

The League badly needs strengthening. There is danger now of its losing its standing with the F.C.C. Factions are appearing that may divide amateurs against themselves. The best way to strengthen the League and to counteract these signs of weakness is to wage a vigorous drive for active, alert members without delay. There are several reasons for believing that the HQ staff does not care to carry on such a campaign.

The attitude of the HQ staff is one of antagonism to an active, alert membership. They feel themselves most secure when the membership is inactive and ignorant of the significant A.R.R.L. affairs. This is especially true now when so many of the active amateurs are openly opposed to HQ methods and policies. Try to find out what happened to the phone hearing

or what happened at the Chicago Convention by reading *QST*!

The HQ staff feel that they themselves have built up the publishing aspect of A.R.R.L., and cannot understand why the membership, its rightful owners, or anyone else should want to interfere with it. Preoccupation of the HQ staff with the publishing problems has helped to weaken the real purpose of the League.

This summer Mrs. Young and I visited HQ in West Hartford. In the course of a rather heated and stormy discussion of HQ policies with Assistant Secretary Budlong, he revealed that HQ prefers newsstand sales of *QST* to membership sales from several aspects. For one thing, it relieved HQ of certain responsibilities and grief connected with memberships. Can you ever expect the HQ staff to be interested in a membership campaign while putting the publishing aspect of A.R.R.L. first? Budlong also said some rather sarcastic things about membership interest in A.R.R.L. affairs. What can he expect with *QST* silent on so many vital points?

Now let me summarize some of the things that should be done if A.R.R.L. is to be recovered from this decline into which it has been permitted to fall:

> The A.R.R.L. must be strengthened by a truly democratic policy where members are taken into confidence with the officials, rather than exploited. *QST* must contain critical opinion such as to keep the interest of all amateurs no matter what their views.
>
> *QST* must be separated from the other activities which the League is supposed to carry on. It must have an editor who is not the secretary nor responsible to him, but responsible to the board and members only.
>
> The advertising policies and discriminations now carried on by the HQ staff in connection with *QST* should be studied with a view to improvement.
>
> A more logical distribution of voting power among the divisions of A.R.R.L. should be worked out, and HQ and the HQ station should be moved to a more central location where all members could be served more adequately.
>
> I believe, with Sumner B. Young, that all A.R.R.L. conventions, contests, and other activities should be limited to A.R.R.L. members only, so that membership privileges will mean more than just a subscription to *QST*.
>
> The Board should meet several times each year in keeping with the constitution of the A.R.R.L. It should meet near the center of the U.S., and among many needed changes, wage a vigorous A.R.R.L. membership campaign.

All this means that the Board must really begin to direct the League, because as far as I know, the HQ staff is opposed to all the above points. With its present policy, the League has been slipping. Why delay?

F. W. Young, W9MZN
Dakota Division of A.R.R.L.
Alternate Director

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Only Too True

Galveston, Texas.

Sirs:

In the sixteen years since I first operated an amateur transmitter many changes have taken place. To me the most striking incident in the development of amateur radio communication to its present high state has been the continued growth and development of an art whose field of activity has been increasingly restricted. In the foregoing, I refer to the consistent, and almost periodic reduction by legislation of the bands of frequencies available in the spectrum for amateur radio operation. This is not consistent by any means with either the rate of development of the art or the consequent increase, as its facility is more fully appreciated, of the number of users thereof. Obviously, there are many organizations as well as the amateur radiomen who must have the use of a portion of the short wave spectrum. However, with the exception of the amateur, these agencies have always in the past received every allocation necessary for a successful continuation of their activities as the scope of their operations increased. I have never seen a satisfactory explanation of this condition or just why the exception, in the case of the amateur, continues to exist. The licensed amateur is a citizen of the United States of America and as such is entitled to enjoy a fair portion of the privileges granted under the constitution.

Because such rights and privileges are delegated by legislation, it is necessary, in order to obtain the advantages of concerted action, that the amateur radiomen participate in, and recognize, some organization. Such an organization exists and has in the past been delegated by common consent, the representative of the amateur radioman. As this organization is represented as being of, by, and for, the amateur radiomen, and because its activities are controlled by an executive body elected by the membership, it would appear that the attitude of the majority of its membership would determine the course of action it should pursue to protect its already meagre privileges.

It is rapidly becoming apparent that the ultimate in receiver selectivity under the present methods of reception has nearly been achieved. Simultaneously, the development of transmitting equipment has advanced correspondingly. Even with the multiplicity of developments that have been made in the last ten years, operation of equipment incorporating these new features is far from pleasant on almost any of the amateur bands due to the intolerable congestion. Amateur radio was initially, and to many is still, a most pleasant hobby in the indulgence of which the individual could find relaxation and relief from everyday cares. The present conditions are not conducive to the existence of such an atmosphere.

The value of the amateur in times of both local and national disaster has been proved often enough in the past. For this reason a summary of this phase of amateur radio work would at this time be merely useless repetition. However, it would be well to remember that as the portion of the spectrum available for amateur operation is reduced, so, inevitably will the potential number of trained radiomen available diminish. Such a contingency will naturally develop slowly but it is inevitable that it come to pass. No science or art can enjoy a healthy growth under improper conditions. Reasonable facilities for its expansion must be available.

The responsibility for obtaining better operating conditions rests entirely with the individual amateur. If he will elect capable executives to the positions in his representative organization and hold these representatives strictly responsible for protecting his rights and accountable to him for any failure to do so, a marked improvement is inevitable.

H. C. SHERROD, JR., W5ZG.

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Free Kilowatts

A man living across the road from WBZ's transmitter picks up enough soup with an antenna tuned by pie plates to light lamps about his house and grounds. Westinghouse officials say, "He has had several 500 watt lamps going for some time and recently he removed them and substituted a single 1000 watt lamp. This lamp is located on the front of his home and illuminates the front lawn. Incidentally, the man has received a number of severe burns while experimenting and adjusting but this does not seem to deter him from using WBZ's energy."

◆

One of the most severe of recent cases of 5-meter QRM was traced to a radiating receiver hooked up to a rotative reflector system. Amateurs using receiving beams should keep in mind that considerable interference may be created along the line of the beam if the receiver radiates.

The ACR-155

[Continued from Page 17]

may be controlled. There seems to be no disadvantage to this doubling up, since there is no occasion to adjust r.f. gain when using a.v.c.

The phone jack is connected in the plate circuit of the output tube and has additional contacts which short the speaker voice coil when phones are plugged in. Both jack leads to the power stage are broken by blocking condensers to keep high d.c. voltages out of the phones.

The schematic diagram of the ACR-155 is mostly self-explanatory. There are a few points, however, of sufficient interest to be dealt with in detail.

For one thing, a unique method of coil switching is used in the antenna and r.f. stages. These are not just tapped coils, although they appear as such at first glance. If the method is studied, it will be seen that in the "A" range, L_5 becomes the primary in the antenna circuit, with L_4, L_3, and L_2 as secondary. In the "B" range, L_4 becomes the primary, with L_3 and L_2 as secondary (L_5 shorted out). In the "C" range, L_3 becomes the primary, with L_2 as the secondary (L_5, L_4, and tap on L_4 shorted out).

The tap on L_4 is provided to prevent interaction with L_3 and L_2 when operating the receiver in the "C" range. This method of switching reduces the total number of coils and leads required, and results in having a low-loss primary and secondary winding for each range.

The range switch of the mixer circuits is similar to that in the antenna circuits. Coils L_9 and L_{13} are always connected in series with the plate circuit of the 6K7 r.f. tube. In the "A" range, L_{12}, L_{11}, and L_{10} are connected in series as the secondary circuit. The ground of the coil system in this instance is at the lower end of L_{12}. L_{13} is used as the primary and is resonated at the proper frequency by the combined condensers C_{18} and C_{19} which shunt this coil. In the "B" range, L_{11} and L_{10} are connected in series as the secondary. The ground of the coil system in this instance is between L_{12} and L_{11}. L_{12} is used as the primary and is resonated by condenser C_{18} which shunts it. Condenser C_{19} transfers the r.f. from the plate circuit to the primary L_{12}. In the "C" range, L_{10} is the secondary. The ground is now between L_{11} and L_{10}. L_{11} is used as the primary and is resonated at the proper frequency by condenser C_{18}. In addition, L_9 acts as a high-frequency primary which resonates at about 20 Mc. and improves the gain at the high-frequency end of the "C" range. Coil L_{12} is shorted by the range switch.

The condensers C_{21}, C_{22}, and C_{23} are air trimmers for the "C", "B", and "A" ranges respectively, and are connected to the coils by means of additional contact arms on the range switch.

The r.f. biasing system in this receiver is also of interest. It will be noted that the cathodes of the r.f., mixer, i.f., and detector tubes connect directly to ground. Initial bias for the first three tubes is obtained through the common a.v.c. grid lead which, when the a.v.c. switch S_6 is in the "off" position, connects to the arm of the r.f. gain control potentiometer R_{26} shunting a portion of the bleeder resistor in the return lead to the power supply. The r.f., mixer, and i.f. tubes are therefore provided with a semi-fixed negative bias when the a.v.c. is off, and which may be varied by the r.f. gain control.

When the a.v.c. switch S_6 is in the "on" position, all biasing functions are taken over by the plates of the 6H6 diode tube, and the initial bias provided by the r.f. gain control is completely removed. When the signal being received is of moderate level, the resultant d.c. voltage developed across the load resistors R_{10} and R_{11} is used as the control bias, just as it is used in the average receiver circuit. However, under conditions of little or no signal, the P_1 diode of the 6H6 is used to supply initial bias to the three controlled tubes. This diode, under such conditions, draws current, which flows through resistors R_9, R_{10}, and R_{11}, thereby maintaining the desired operating bias. However, if the received signal is above a certain level, the auxiliary-bias diode P_1 ceases to draw current and the diode P_2 takes over the biasing function. The a.v.c. action is therefore delayed so that the sensitivity of the receiver to weak signals will not be reduced, for the initial bias provided by the auxiliary diode P_1 never exceeds the normal initial bias value, and is of a

[*Continued on Page 90*]

High Pass Filters

[*Continued from Page 33*]

although they were noticeable if a frequency run were made.

For another practical application, using the same speech amplifier as in the previous example, suppose we wish to reduce the high frequency response as well as the low. Using the band pass formulas given, and taking the upper limit as 3000 cycles and the lower as 200 cycles with R as 15,000 ohms (so chosen because with this value of R the inductances come out easily available figures) we obtain the following values for the components:

C_2 = .0076 µfd., L_1 = 1.70 hy., L_2 = 5.57 hy.

However, inasmuch as the purpose is merely to limit the band to approximately 200 — 3000 cycles, we can use the closest easily obtained values as substitutes for these rather odd values without seriously affecting the performance of our filter. So, since the input condenser must be twice C_1, that gives us a value of 0.057 for C_5. The closest value would be 0.06 µfd. For C_1 we should use a .03 µfd., and a .0075 µfd. is good for C_2, although a .006 would be satisfactory.

Now, as to inductances, much head scratching was resorted to before we finally found a suitable combination. The closest we could get to L_1 was the primary of a U.T.C. FT1 filament transformer. This gave an inductance of 1.65 henry and a Q of about 2—rather low Q but as we are not interested in particularly sharp cut-off, it was satisfactory. L_2 is supposed to be about 5.6 henry. Upon consulting numerous factory catalogs it was found that Thordarson T-5751, T-5752, and Philco 5643 chokes all were rated at about 7 henrys. But we all know most inductance ratings are a bit optimistic. So we procured a pair of the T-5752's and proceeded to measure them. The results were quite favorable; they checked 6.13 hy., Q 7.1; and 6.6 hy., Q 6.8. Not bad for ~~little filter~~ chokes and reasonably close to the calculated value. So the whole thing was connected as shown (not exactly but approximately the theoretical way) and a check made.

We did not make an actual frequency run on this filter but the results, as checked by the ear, were just about as we expected. While the low frequency attenuation on voice was not noticeable, there was a pronounced reduction in the highs. As an example, the carbon hiss on a double button mike that was tried was

It's not a gag:

WE JUST HAVE NO MORE COPIES OF THE JANUARY ISSUE,

and regret that we cannot comply with the many requests that subscriptions be started with that issue.

You **may** still be able to get a copy from your favorite radio parts dealer or newsstand.

As a last resort, try your local wholesaler affiliated with the Kable News Company of Mount Morris, Illinois. Any local newsdealer can tell you who he is, or will try to obtain a copy for you. Wholesalers have been requested to hold any unsold January copies for a few days after receipt of this February issue.

considerably reduced, an advantage in itself but also indicating that there were plenty of highs being dropped. Also, a familiar voice was not as easily recognized with the band-pass on, as with it off. While the voice seemed just as clear and understandable, there was a reduction in its "penetrating power". This would probably allow the signal to be QRM'd a little easier.

So, in conclusion, while the band-pass filter did not prove to be as successful as we had hoped, the high-pass filter, cutting off at 150-200 cycles definitely proved more successful and useful than we had anticipated. The use of one of these simple high-pass filters is definitely recommended to any phone amateur who wishes to improve his transmitter.

◆

Using an ancient oil lamp from the house in which he was born to actuate photoelectric apparatus, Henry Ford recently turned on all the lights of the G.E.-F.H.A. exhibition house in Detroit.

Open Forum

[*Continued from Page 46*]

have a band as wide as all out-doors to play around in. Interference is no problem among 160 meter phones with a good receiver. I'll probably get an argument on this, but I know what I'm talking about. I've done a great deal of listening up there, and interference kicks come mainly from the fellows who throw up their hands and wait for the QRM to quit. They haven't mastered the principles of tuning or copying through it.

I'm not going to claim either, that *all* the QRM comes from the newcomers to the amateur fold. Many an old-timer is guilty of cluttering up the air with a lot of senseless CQing and unnecessarily long calls. However, the proportion is small. Not much we can do there except educate, and maybe someday, penalize. But we will have to admit that a very great part of our 40 meter problem does have to do with the beginners. I'm not losing sight of the fact that we all had to start, and that they have every bit as much right to the ether lanes as we have, but their use of it, in my opinion, should be commensurate with their ability. I can see no reason why a capable, competent operator, working a dx station, must have his entire QSO ruined by the halting, stumbling characters of a neighborhood beginner, working another newcomer maybe fifty miles away, and both putting an R7/8 signal out in a three thousand mile circle, to bust up probably hundreds of QSO's.

Phone stations are divided and classified according to the experience and ability of their operators. A newcomer with no previous experience in the phone field cannot buy, beg or steal a class A license. He is placed in the 160 meter band and told to find out what it's all about, and when he is good enough, as proven by his attainment of a class A license, he may have access to the other bands. To take a flyer in the 80 or 20 phone bands without a class A license, practically signs his death warrant. *But* —and here's where the shoe pinches—Johnny arrogantly marches up to the RI's office, sits him down and makes the grade for a Class B. He probably has memorized the answers in the little red book, and by diligent plugging for a few weeks previous, has stuffed himself with dots and dashes so that he can make a showing at 13 wpm. What does *he* do when he gets his ticket? He blithely plops his 20 or 30 watts on 40 meters, and doubles to 20 when he feels the urge, and calls Franky over on the West Side to tell him all about biting the big bad wolf in the RI's chair. Meanwhile, a qualified ham somewhere has a good QSO knocked right out of his cans for the balance of the evening. Does Johnny go home and call his pal on 160 c.w. or even 80? No, 40 and 20 are the thing. He's a licensed operator now and the weekly Gazette will picture another young hopeful the next day: "He has a Government license."

My contention is that restrictions similar to those placed on phone men be incorporated in the c.w. regulations as well—more stringent if anything. Johnny should be made to serve his time on 160, and then qualify for a better class license before having the other bands opened to him. The Federal Communications Commission could do this by the scratch of a pen. They need merely make the regulation covering class A and B licenses extend to the c.w. fraternity as well as the phones—class B licenses meaning no c.w. or phone operation in *any* band except 160 and the ultra-high's, operation on 80, 40, and 20 with either c.w. or phone to be absolutely prohibited unless the operator is a class A license holder. Maybe that sounds a little tough, but is it? Anything worth having is worth earning, and the kind of ham we want on the air is the kind who is willing to earn what he gets.

I'll get a lot of kick-back on this 160 stuff; the shout is going to be that they might as well fold up as to try and do anything on 160. Oh yeah? How about those old days when we had all the wave lengths from 200 meters down and everybody parked right up as close to 200 as he could get—and a lot of them spilled over on the high side too, until a few daring pioneers dropped down as low as 180 and found that wireless would still work. Then—hold your breath—110 meters gave out a squawk and the lid was off!

Don't tell *me* that 160 is no good for c.w. dx. I worked up around 200 for too many years with both tube and spark to listen to that. Carried on a nightly schedule with Honolulu from Cincinnati, too, on 200 meters with 100 watts in the antenna. Coast-to-coast on 200 got to be common nightly work. No skip and darn little fade. You newcomers have a c.w. band up there that you are going to lose if you don't use it. When you learn to copy through a flock of QRM, and send with a snap, and tune your receiver with some real intelligence, go get yourself a class A and come on down, and the older gang will welcome you.

I can't write the F.C.C. by myself and get anywhere with this idea, and apparently the interests that are supposedly fighting for the amateur have trailed their banner in the mud. So we will have to find somebody to take up the cudgel in an organized way. My suggestion is just one idea—let's see something on this from both sides.

Howard S. Pyle, W7ASL.

The ACR-155

[*Continued from Page 85*]

constant value until backed out by the automatic bias developed by the rectification of a strong signal in the circuit of the detector-a.v.c. diode P_2.

The action is produced by making cathode K_1 negative with respect to its diode P_1. The plate P_1 will therefore draw current until such time as its negative value equals or exceeds that of the cathode. Since this plate is connected to the a.v.c. line it will assume negative voltage values equal to those developed by the rectification of a signal.

The receiver is a fine performer. It is stable in operation and practically free from beat-oscillator pitch-shifting when the circuits are excited by noise impulses. The b.f.o. is not subject to drift and does not reduce receiver sensitivity when the a.v.c. is on. For that matter, a.v.c. may be used during c.w. reception with no ill effects whatsoever except on slow-speed sending, when thumping appears. This is a decided convenience, as it is seldom necessary to touch the a.v.c. switch; the b.f.o. toggle switch can be flipped on and off with no thought to other controls. There is the added advantage also that the a.v.c. will hold strong c.w. signals within practical limits and thereby prevent them from over-riding the beat frequency. The result is that signals remain clean irrespective of their input level.

The a.v.c. action is moderately good but not up to what we would call par for a receiver of this type. Selectivity and sensitivity on the other hand are quite good, and little image interference was experienced.

The little 6-inch dynamic speaker is a revelation. It can take the full 2 undistorted watts without a quiver, and considerably more without breaking up badly. Presumably the amount of space inside the cabinet, and the openings provided by the ventilation holes and dummy grill, are sufficient to eliminate the possibility of acoustical feedback. The fact that the speaker is mounted well off to the side, also may have some bearing on its practical operation. In any event, there is not the slightest trace of howl at full undistorted output, nor were we able to perceive any cabinet variation or grill chatter. Since there is a distinct advantage in building the speaker into a communication receiver, it would seem advisable to swing back to this vanishing idea, now that it is evident that it can be accomplished without ill effects.

The frequency drift of the ACR-155 at 14 Mc., measured after 15 minutes from a cold start, was found to be 11 kilocycles—exception-

NOTICE

The special Christmas gift rates offered in the December and January issues expired January 15th as stated in all advertising.

Orders requesting these rates which are postmarked after that date will be entered pro-rata at our regular rates unless specific request for a refund is made.

Circulation Dept.

ally low for a receiver of this type. This is undoubtedly due to the use of improved air trimmers in the r.f. circuits, placement of parts, and the more-than-adequate ventilation. Oscillator frequency stability is also improved by the use of a series resistor in the plate-screen circuit, which has a regulating effect on the voltage supply, and a reduction of the external coupling to the mixer tube.

The image ratios at the extremes of each band are as follows:

Kc.	*Image Ratio*
550	60,000
1500	1500
2000	3000
6000	150
6300	250
20,000	20

The noise equivalent in microvolts c.w. for the band extremes is given in the following table. "Noise Equivalent" is a coined term used to express the input in microvolts through the normal input circuit which would be required to produce an output equal to the receiver noise output—a measurement that tells its own story.

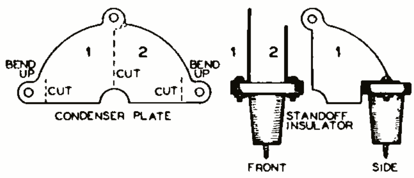
Kc.	*Noise Equivalent C.w. in Microvolts*
550	0.80
1500	1.50
2000	1.40
6000	2.00
6300	1.60
20,000	2.00

The intermediate frequency of the receiver is 460 kc. Power output is 2 watts undistorted, 4.5 watts maximum. Voice coil impedance of dynamic speaker is 3.2 ohms at 400 cycles. Total power consumption of set is 110 watts.

◆

Recently a W phone station came back to a "Test de G2NH" with a y.l. at the W mike. Naturally, Ernie went back at her, but on the change-over there was an o.m. at the W station saying, "Well, o.m., now that we've hooked you, we've taken the bait off!"—*G2HG.*

ECONOMICAL NEUTRALIZER



A very inexpensive neutralizer for 35-T's, RK35-37, 834, T-55, etc., can be made from a Johnson no. 24 stand-off insulator and one stator plate robbed from a National type DX condenser. Capacity is varied by rotating one plate. Directions: Cut, bend, mount, use.

—W6QF.

100-TH Transmitter

[*Continued from Page 50*]

on the 7 and 14 Mc. bands and about 60 ma. on 28 Mc.

The most convenient method of transferring the energy from the final tank is through link coupling. With a pure resistive load on the final, no trouble will be experienced in obtaining good efficiency at the inputs mentioned in the first of the article.

It is very important that the filament voltage be kept within 5.1 and 5.3 volts at the *sockets* of the 35-T and 100-TH's. When purchasing a filament transformer for these tubes, make sure it has several primary taps for voltage adjustment. Incidentally, the filament voltage should be measured with the key *down,* as you may find that the line voltage drops when an extra kilowatt is thrown on it.

◆

Oil Burner QRM

Occasionally we find one of the gang troubled with a rough and broad type of interference on 7 Mc. and higher frequencies. The particular type of noise to which we refer has an a.c. background, is off during the summer, and is heard for several irregular periods during the day depending on outside temperature. If you have this sort of QRM, look at the oil burners within 100 feet or so. Those with high voltage continuous spark ignition are particularly bad. Most of these have line filters for broadcast frequencies but in one case we found that the manufacturer can also supply suppressors for the higher frequencies to be placed right at the electrodes—at a cost of about $3.00. The manufacturers seem to neglect mentioning this difficulty until someone runs it down and complains. There ought to be a law agin 'em.

◆

"Vee" versus Diamond

The past year has brought increased use of long wire directive antennas of the "V" and diamond varieties. It is of interest to note that an unterminated diamond does not quite give twice the gain of the first V portion when used alone (requiring half the space), suggesting that where a longer V can be used, it is to be preferred. On the other hand, the diamond terminated with the proper resistor is an entirely different animal, operating without standing waves, and should not be confused with the unterminated, "double-V" variety.

—W9FM.

NEW BOOKS

AND REVIEWS OF CATALOGS

THE RADIO AMATEUR'S HANDBOOK, Fourteenth, (1937) Edition, by the A.R.R.L. Headquarters Staff. 544 pages (including a 112-page catalog section), with approximately 564 illustrations; 74 charts and tables and 86 formulas. 6½ by 9½ inches, double-column format. Published by The American Radio Relay League, West Hartford, Conn., U.S.A. Price, paper binding, $1.00 postpaid in U.S.A. proper; elsewhere, $1.25; buckram binding, $2.50 in all countries.

The new 1937 edition of The Radio Amateur's Handbook, the standard manual of amateur radio communication published by the American Radio Relay League, surpasses any of the previous editions, both in size and quality of practical content. The new edition has a total of 21 chapters with an appendix of miscellaneous practical information, followed by an exceptionally comprehensive topical index which facilitates quick reference.

Special attention has been given to the new developments in noise silencers for short-wave receivers and to the new technical trends in circuit design. New material is added to the wide field of transmitter planning, construction, and adjustment. The capabilities of the new tubes are exploited to the full in the radiotelegraph and phone transmitter designs presented. Extended space is also given to the ever-important subject of antennas, directional systems and the new ideas in coupling methods being treated in particular detail. The ultra-high frequencies come in for a big share of the space also, new and advanced equipment being detailed to illustrate the latest trends in this rapidly-growing field.

Osockme, Japan.

Radio Magazine, Los Angeles

Dear Gentlemen and Ed.—

"Ha so?" Scratchi are exuberate when maleman are presenting box from Gyppum Specialties Co. who are rescently advertise in your hon rag and appoint me their Far Yeast Representative at Large.

For long time, hon ed., I are nursing grate ambition to drawing an arc from my finality tank coil which would putting the California Institoot of Technocracy artifishal lightning maker to a sorrow shame. The Gyppum company's Arco Sparking Pencil, which are guarantee to give 1 inch spark from 46's, should making quite a nifty piece of chain lightning on Scratchi's California Kilowatt.

So with spirits on top and arco pencils in hand I are looking my Calif. Kw. square in face and saying, "O.B., you are now going make an ark what are going make Noah turn over in his grave."

So I are turning on my bourbon-fed Kw. and touch an Arco "Sky Blue Pink no. 14783" to stator of tank condenser. Are pulling out a nifty ozone-oozing ark about 10 feets long and stand for a moment admiring fireworks. Are wondering just how far can pulling same, so walk out into yard and across street. Whew, hon ed., it not are breaking, and such unexpected trouble leaving me non-plussed, minus, and a few other things. Are sit down on curb and try to get idear for what to do. After maybe an hour are get the bright idear to lay down pencil on sidewalk and run back to shack and shut off transmitter. By this time a big crowd are gather to see the show, and Osockme Police radio cruiser are arrive to see what crowd are all about.

"Oh, ho,—so this are why cannot hearing main station on 9 meters for last two hours and are just about decide to take down fish pole off car and go fishing," say fat sargent as he remove himself from Osockme squad car no. 45.

Well, hon. ed., I show the judge my business card which say "Representative at Large" on it and explain that if cooped up in jayle house cannot being at large or anywhere else. But as have explained in previous correspondence, standing of Scratchi with the Chief of Poleece are at zero level (.06 mw. reference) because of past events.

As Scratchi are now reposing in Osockme Municipal Jayle and would like very much to be at large instead of guest of same, please refer to the U.S.A. Court of Humane Relations which I are hear over the radio. And if could sparing $5 American monies to lend me to buying the warden a box of cigars might helping get me out sooner. Can giving you ten boxes unused Arco Sparking Pencils for security, hon ed. What you saying please?

Respectively yours,

HASHAFISTI SCRATCHI.

◆

The F.C.C. has issued a station license to General Electric covering a diathermy machine to be operated on 13,000, 13,300, 13,700, and 15,000 kc. No call letters will be used, and operation will be solely to determine the extent of radio interference from the machine.

The "Short Legged Vee"

The long wires in a V antenna are so arranged that the included angle is twice the angle of the major lobe from a single wire if used alone. This arrangement concentrates the radiation of each wire along the bisector of the angle, and permits part of the other lobes to cancel each other. With legs shorter than three wave lengths, the best directivity is obtained with a somewhat smaller angle than that determined by the lobes. P. S. Carter pointed out in I. R. E. *Proceedings* for June, 1932, that optimum directivity for a one-wave V is obtained when the angle is 90° rather than 108° as determined by the field amplitude pattern alone.

It is often pointed out that if long wires are used in the V, the angle between the wires is almost unchanged when the length of the wires in wave lengths is altered. However, an error of a few degrees causes a much larger loss in directivity and gain in the case of the longer V than in the shorter one which is broader.

Incidentally, if the ends of a V are maintained at opposite potentials by making the legs an odd multiple of a quarter wave long, or if a ¼ wave stub is placed at the apex where the feeder usually is attached, it becomes possible to feed the V at any point on either wire, but on one band only.—W9FM.

The Bell Laboratories have discovered that by varying the intensity of a pure sine tone of a low, constant pitch, the average individual imagines there is a change in *frequency*, sometimes as much as 100% when very low-pitched tones are varied in intensity by 90 or 100 db. The effect is not noticed with complex tones such as occur in music.

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104 East 10th St.

INDEX OF ADVERTISERS

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3d, 4th, and 5th insertions; 25% thereafter. Break in continuity restores full rate. Copy may be changed often as desired.

(b) Non-commercial rate: 5c per word, cash with order; minimum, 50c. Available only to licensed amateurs not trading for profit; our judgment as to character of advertisement must be accepted as final.

(c) Closing date (for classified forms only): 25th of month; e.g., forms for March issue, published in February, close January 25th.

(d) No display permitted except capitals.

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(f) Ads not relating to radio or radiomen are acceptable but will be grouped separately.

(g) No commissions nor further discounts allowed. No proofs, free copies, nor reprints sent.

(h) Send all Marketplace ads direct to Los Angeles accompanied by remittance in full payable to the order of Radio, Ltd.

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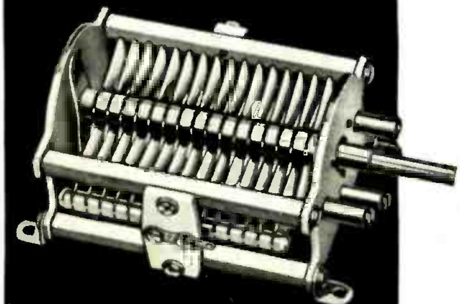
STAMP brings you sample Radio Data Digest. Keeps posted. Saves money. Kladag, Kent, Ohio.

WRITE us for trade-in price on your old receiver. We buy meters. Walter Ashe Radio Co., St. Louis, Mo.

New

TRANSMITTING CONDENSERS

Type "MTC"

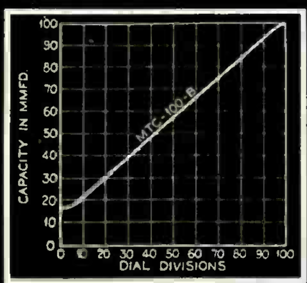


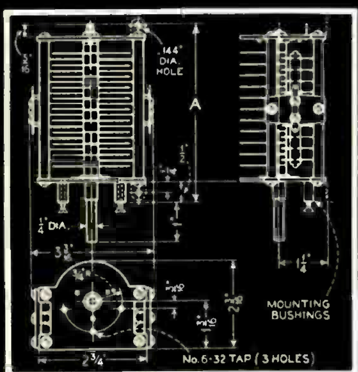
A NEW popular series of transmitting condensers for high frequency and ultra-high frequency medium and low powered units. The construction of these condensers is so rugged that even rough handling will not damage them. Though low in price, these condensers include all constructional features necessary in quality transmitters of all kinds. High operating efficiency has been attained by extensive research in materials and design plus careful workmanshp.

Made in both single and split-stator styles, with end frames of heavy aluminum sheet. Rotor and stator plates of heavy aluminum are firmly anchored in place by wedging them into deep slots and then by further staking. An accurately ground stainless steel shaft is carefully fitted to a long bronze front bearing mounted on a Beryllium cushion disc. The free floating action thus afforded provides for a perfect bearing and consistently smooth operation. Rear bearing is of the steel ball and cup type. Isolantite insulation and silver-plated Beryllium contact wiper assures lowest lowest and lowest series resistance. Noiseless operation and complete stability under all conditions guaranteed!

Produced in 19 different sizes—20 to 530 mmf.—1000 to 6000 volts—panel or base mounting. Prices range from $2.40 to $8.50!

Here is the ideal transmitting condenser for your quality transmitter. For complete details send for the special "MTC" bulletin. Write for it to-day!





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Gride to Plate ..... 4.5 uuf.
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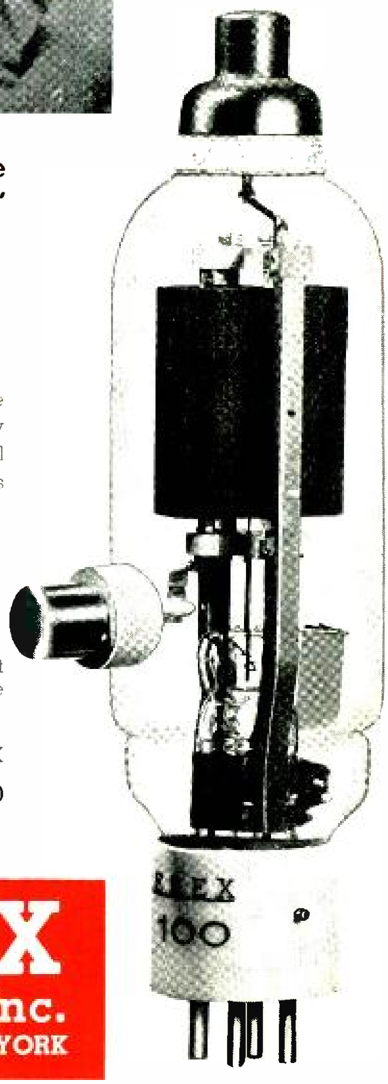

"... Any of the fellows getting ready to revamp the old rig and want to hear the HF100 just give us a call."

that's what these boys of W4AZK say about the

AMPEREX HF100

Read the rest of this unsolicited letter ...

"... Below are some of the reports received and stations worked in one evening from eleven o'clock PM to six o'clock AM and in a location very unsatisfactory for DX. The figure after the call letter indicates the signal strength as reported to us by that station. An input of 200 watts was used at 14160 kc.

W6ISH-9	G2NQ-8	VE4CW-8	VP9R-8
VEIBR-9	F3EO-8	F811-9	VE2BG-9
W6FGU-8	G6AH-8	TI2DC-7	TI2CR-7
W7AOT-8	VK5LL-7	G2MV-7	TI5JJ-8

This was two weeks ago and we are having the same consistent reports come in. We cannot say too much for the HF100 as we believe it to be a tube that cannot be beat."

Very truly yours,
David S. Traer, Lewis M. Maddox; W4AZK

(NOTE: 260 watts of output can be obtained with 2 watts of driving power.)

Write to our Engineering Department for complete data.

AMPEREX
ELECTRONIC PRODUCTS, Inc.
79 WASHINGTON STREET • BROOKLYN, NEW YORK

RCA-913 ... brings Oscillograph equipment within the reach of all!

RCA-913 actual size,
Amateur's net **$5.60**

HERE'S a brand-new cathode ray tube, only 4¾ inches long, that is of tremendous value to amateurs, engineers and experimenters. RCA-913 is a high-vacuum, low-voltage electrostatic type with all metal construction and a fluorescent screen nearly one inch in diameter.

The 913 is ideal for use where a larger tube would be unsuitable. Its low price, convenient size, plus the fact that the 913 requires only a simple power supply (operates at a maximum of 500 volts and gives good images at voltages as low as 250) makes it particularly suitable for portable equipment, and a highly desirable unit to be built permanently into the transmitter for checking operation and modulation monitoring. Your supplier has the 913 in stock.

RCA presents the Metropolitan Opera every Saturday afternoon. Also "Magic Key of RCA" every Sunday, 2 to 3 P. M., E. S. T. Both programs via NBC Blue Network

RCA

for Amateur Radio

Address Amateur Radio Section, RCA Manufacturing Co., Inc., Camden, N. J.
A service of the Radio Corporation of America