RADIO

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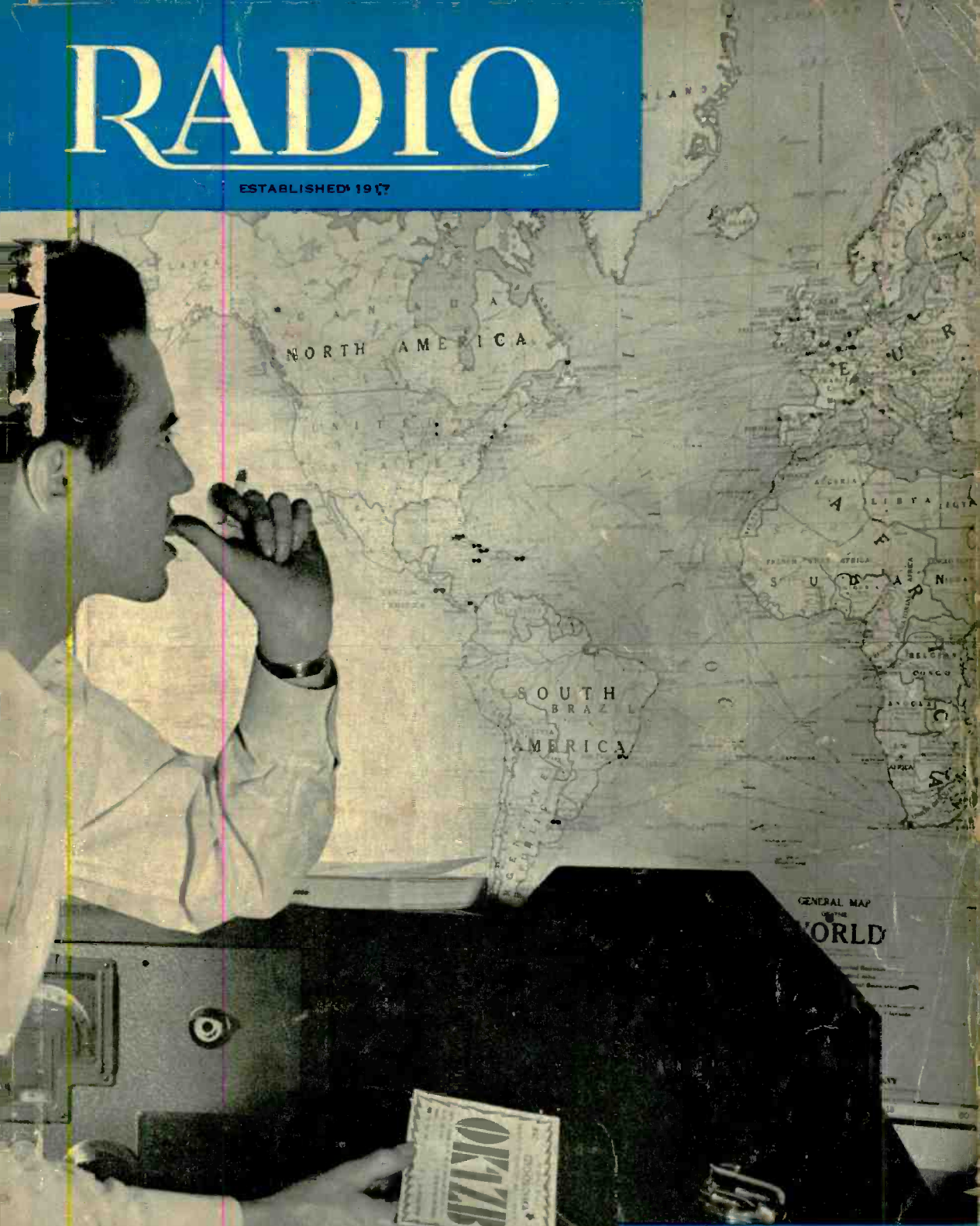

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The Worldwide Authority of Amateur and Shortwave Radio

★

July 1939

NUMBER 241

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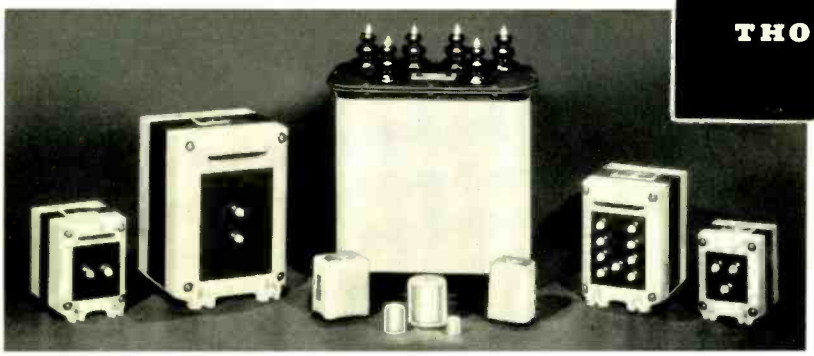

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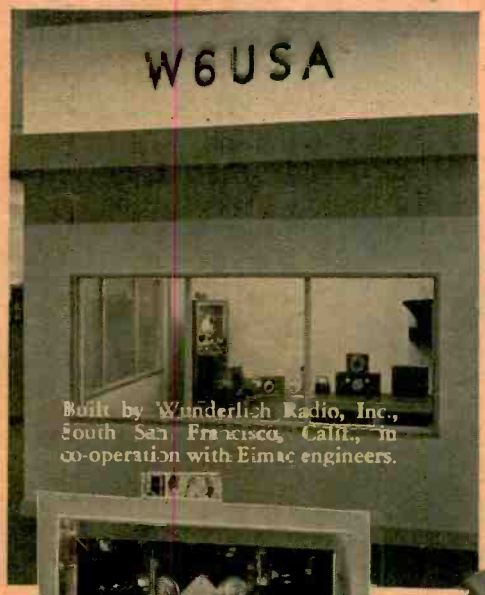
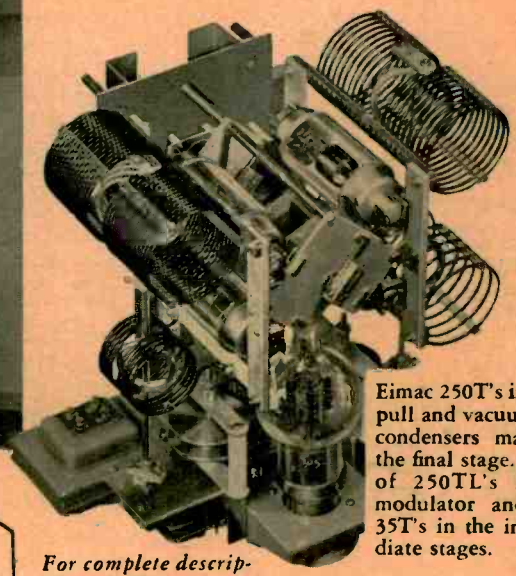
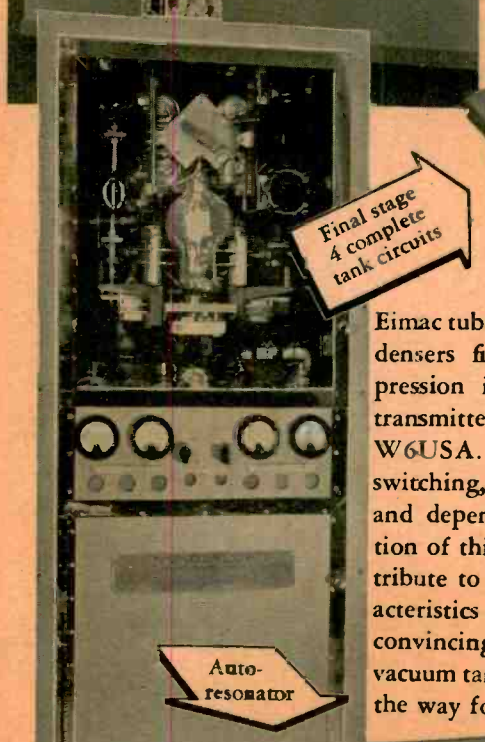


Built by Wunderlich Radio, Inc., South San Francisco, Calif., in co-operation with Eimac engineers.



Eimac 250T's in push-pull and vacuum tank condensers make up the final stage. A pair of 250TL's in the modulator and four 35T's in the intermediate stages.



For complete description of this transmitter consult the June issue of "Radio."

Eimac tubes and vacuum condensers find their true expression in the sensational transmitter at radio station W6USA. Automatic band switching, extreme efficiency, and dependability in operation of this transmitter are a tribute to the superior characteristics of Eimac tubes — convincing proof that the vacuum tank condenser paves the way for drastic improvement in the design of transmitting equipment.

All the skeptical amateur needs do to convince himself of these facts is to get a schedule with W6USA or, better yet, come to the Golden Gate International Exposition and operate this transmitter.

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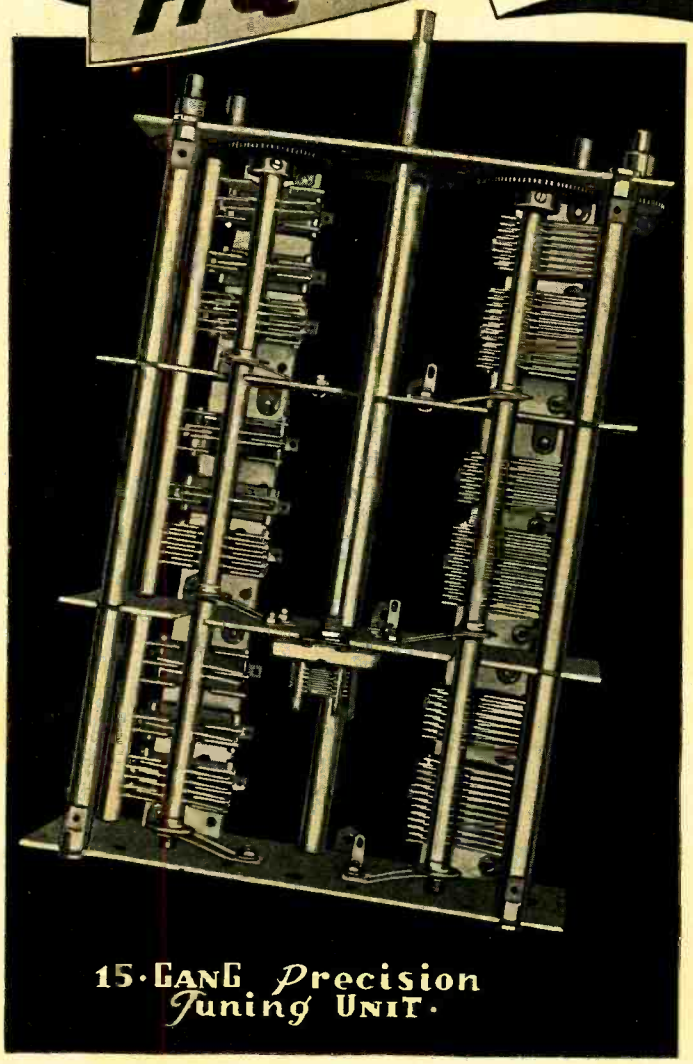
INSIDE STORY of the HQ-120-X



15-Gang Precision Tuning Unit.

DESIGNING a receiver on paper is a relatively simple job. Making a mechanical reproduction, however, is quite another story. As an example, the I.F. amplifier in the "HQ-120-X" is sensitive to 1 kc. without the crystal and less than 100 cycles with the crystal in. This means that the tuning condenser must be no less than perfect for it must tune to one part in more than 300,000 at 30 mc. This calls for *pure rotational* motion. With the principle used in watch making as our guide, we installed a single polished steel ball bearing at each end of the condenser rotor to eliminate all signs of play. The plates of the conderser were kept small and widely spaced to maintain accuracy under all conditions. Its electrical stability is insured by six sets of dual inlaid silver-to-silver contacts. To maintain a favorable L/C ratio the condenser has six main sections. To provide uniform band-spread there are nine sections in the band-spread portion. The use of precision gears permits 310° rotation of the dial for 180° rotation of the condenser, thus providing more comfortable tuning. It can be truly said that, "A receiver is no better than its condenser." Costly? . . . Yes. This condenser costs over 20 times as much as the usual remodeled broadcast unit. But it's worth the difference. Try an "HQ-120-X"!

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PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND

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As the spirit moves, we present in this column from time to time a bit of gossip about RADIO, its affiliated publications, and those who produce and distribute them.

"—From the private life of RADIO."

Advertising Rates

A few readers have inquired casually "just for curiosity's sake" about our advertising rates. Our advertising rate card is available for the asking, even if you don't contemplate buying any space (but please tell us so; then we won't pester you with "follow-ups").

The base rate is $125 per page or $9 per column-inch.

The average rate over a year comes to about $104 per page per issue because of the discounts allowed for consecutive advertising. Contemplated changes in the discount system may bring this down to $100 per page per issue.

On a *per month* basis these average figures become $89.29 and $83.33 respectively because RADIO, by omitting two summer issues, does not require advertising in the nonproductive season in order to earn maximum annual discounts.

Advance Tip

An increase in the cost of the binder for RADIO appears inevitable. If you're contemplating the purchase of one, better do so now while the cost is still $1.00 (express collect) in continental U.S.A.

Binder for "Radio Technical Digest"

In answer to a number of requests a binder is now available for the *Radio Technical Digest*. The cost is $1.00, express collect in continental U.S.A.; elsewhere, $1.25, postage prepaid. The binder is in red imitation leather, gold-stamped, and holds two years' copies.

Vacation (???)

Every summer when RADIO ceases publication for two issues, we receive a number of envious congratulations on our two months' vacation.

Well, that *was* the big idea, once. But it doesn't work out that way. Except for the normal two weeks' vacation for each employee, we seem to keep as busy as ever, "generating" the coming edition of the big RADIO HANDBOOK and maybe a little book or two, and getting ready a thousand and one time-consuming odds and ends for the fall and winter season when we just would not have time to take care of them.

Reminder

We remind those who have recently become readers of RADIO that we purchase usable technical articles of a constructional nature. A reprint on this subject is available upon receipt of a stamped, addressed envelope.

Warning

Manufacturers are warned to scrutinize carefully requests for free parts from Cicero, Ill., where a certain "bedridden" request-writer can usually be found in the corner poolroom.

RADIO itself requests no parts donations whatever; we buy all material used in our laboratory.

Cover

Comments will be particularly welcome on our new style of cover. Do you like it? It is surprising how few subjects in radio seem to be scenically interesting or to have eye-appeal. We confess some doubts as to how long we can "keep it up." If you have a suggestion (or a photograph) for a cover we'll be more than pleased to receive it. It doesn't have to have a direct bearing upon some article in the issue on which it appears but it should at least have a flavor about it of some phase of radio of interest to radio amateurs.

What Do You Want to Know?

This "colyum" was established to answer inquiries from readers, the answers to which really have no proper place elsewhere in the book, but may nevertheless be of some interest to other readers. Let us know what you would like to know. We'll answer if possible in due course.

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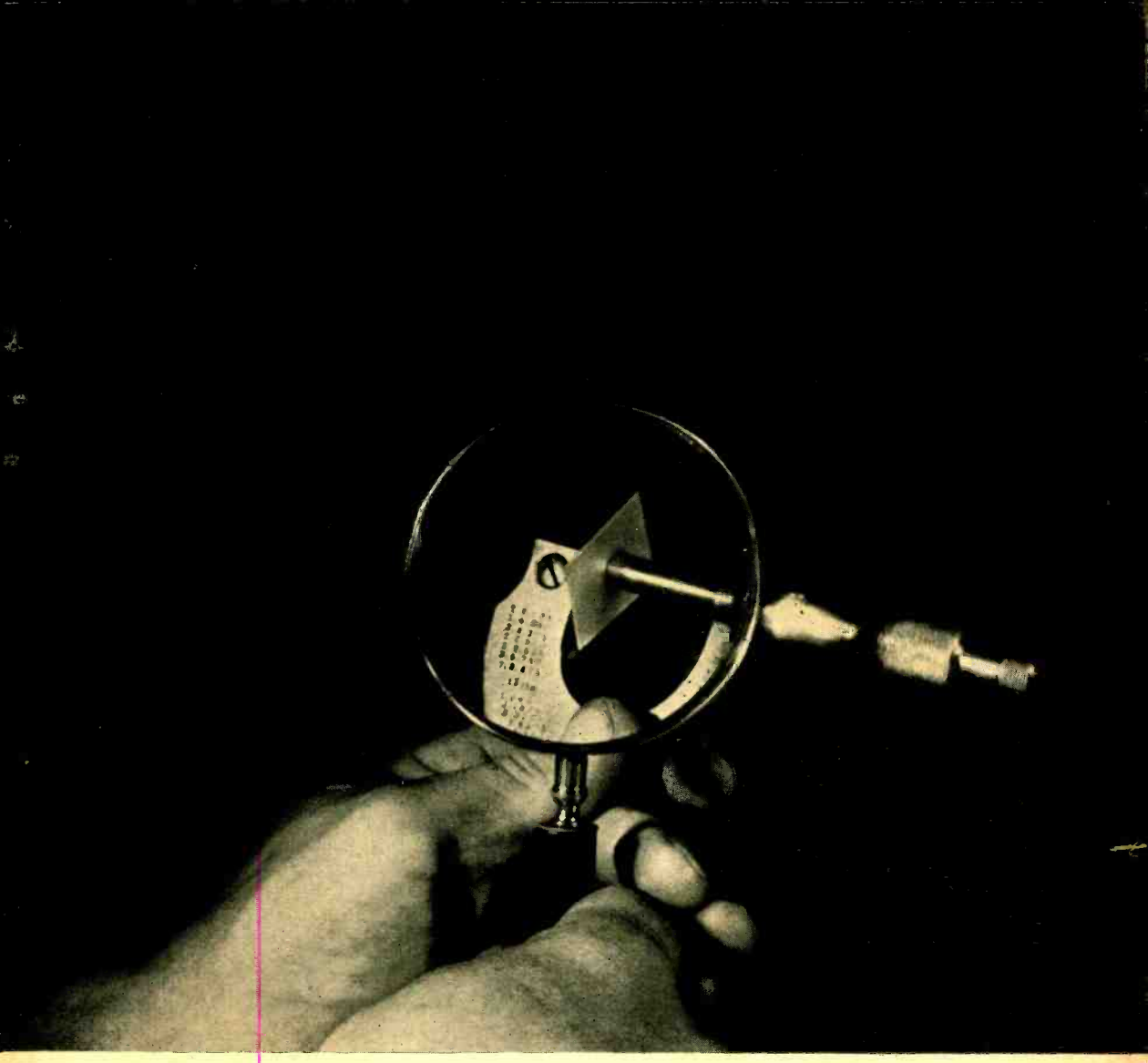

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Accuracy in the presentation of last-minute information and illustration is one reason for the popularity of today's leading technical radio publications.

By

The Editors of "Radio"

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RADIO

July • 1939 No. 241

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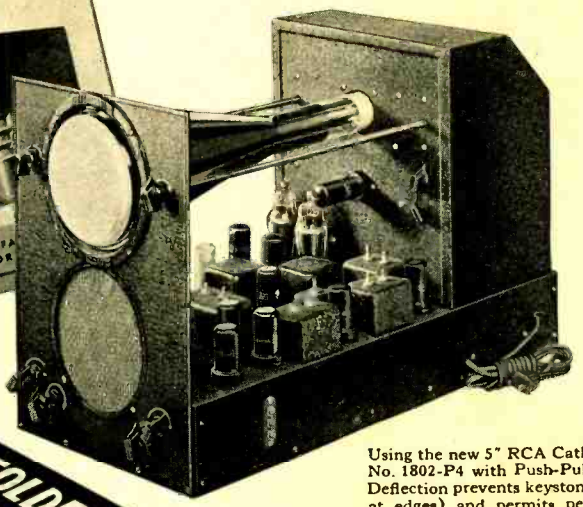

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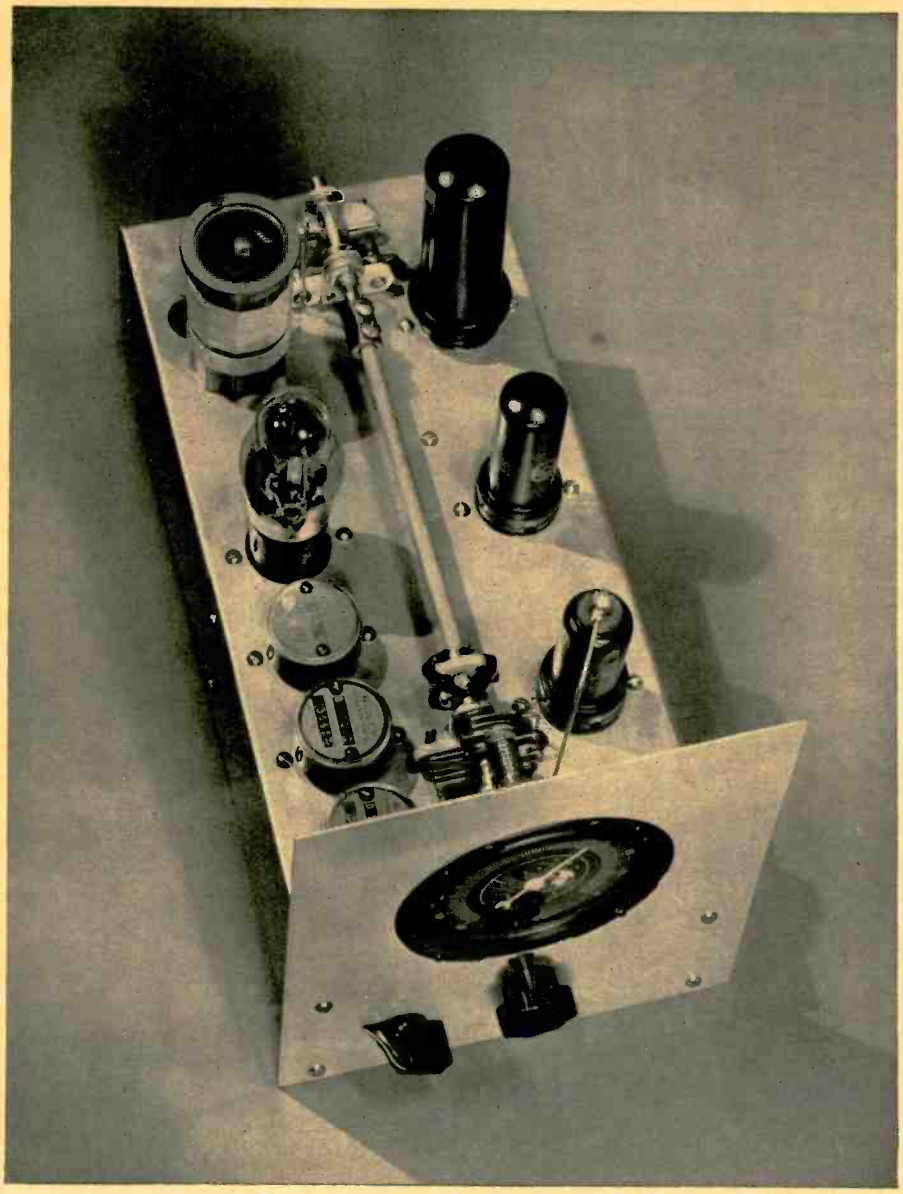

● Looking down from the front of the e.c.o. exciter described on the facing page. The single switch on the panel selects either the e.c.o. or any one of the three band-edge crystals provided. Ganged tuning of the oscillator and output stages assures equal output over the complete frequency range.

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Simplicity in an

ELECTRON-COUPLED EXCITER

By LEIGH NORTON, * W6CEM

Here is an exciter allowing the use of any one of three crystals or e.c.o. at the flip of a single switch. An unusual circuit in the oscillator precludes any difficulties due to r.f. feedback from the transmitter.

It has become common practice to begin any article on variable-frequency exciters with a paragraph or two of remarks about the sour-sounding e.c.o.'s which have been so evident on the higher-frequency bands of late. This type of e.c.o. is usually said to be "in the majority." Whether it is or not is hard to say but at least it attracts the greatest attention.

In any case, the owners of poor e.c.o.'s need not be further berated. Anyone having had experience with the common e.c.o. arrangements can appreciate their difficulty. In one form or another the variable-frequency exciter seems to be here to stay; the problem is to bring its quality up to the same high standard as the rest of the equipment in most modern transmitters.

The four major causes of poor signal quality from e.c.o.'s were given last month by Perrine.[1] Probably the most serious of these causes and the most difficult to "tie down" is r.f. feedback from the transmitter. It can be safely said that 75 per cent of the e.c.o. troubles can be traced directly to this one cause. The e.c.o. usually sounds fine in itself but the minute it is subjected to a strong r.f. field from the transmitter the result is a signal closely resembling that from a 1926 vintage transmitter.

There are two obvious methods of licking the r.f. feedback problem in the e.c.o. One of these is to thoroughly shield the complete e.c. exciter and to use complete r.f. filtering in all power leads to it. This method becomes an individual problem with each exciter, however, and the simpler method of arranging the e.c.o. circuit so that it is not adversely affected by r.f. feedback has been found to be much more suitable in an exciter intended for use in a large number of amateur stations and under various conditions of operation.

The description of an e.c. exciter that follows this design principle is the subject of this article. It has been tested on numerous transmitters and under varying conditions of r.f. feedback and line voltage drop under keying and in all cases has given a good account of itself. R.f. feedback was carried to extremes by locating the e.c.o. less than a foot from the final amplifier plate coil of a kilowatt transmitter and also by connecting an antenna to the power supply for the exciter and introducing enough r.f. so that good sized arcs could be drawn from the exciter chassis and power connections. Having proved itself entirely satisfactory under such adverse conditions, it should be of interest to those contemplating building variable-frequency exciters.

This exciter utilizes an oscillator operating in the 160-meter band followed by a class-A isolating stage and an output stage which doubles to 80 meters. The output frequency range is 3500 to 3650 kc. Gang tuning between the oscillator and the doubler provides equal output over this band. The 3500 to 3650 kc. range allows full coverage on 20 and 40 meters and, as there is some leeway on the high-frequency end of the dial, coverage of the low-frequency half of the 10-meter band. The rest of the 10-meter band may be covered by simply resetting the two "bandset" condensers in the exciter.

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* Associate Editor, RADIO.

[1] Perrine, "XEC" Transmitter Control, RADIO, June, 1939, p. 14.

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Circuit Arrangement

As has been often mentioned in contemporary radio literature, the weak spot in the conventional Hartley or Colpitts electron-coupled oscillator circuit is the fact that the cathode is "hot" for r.f. and at the same time closely coupled to the heater. Any r.f. from the transmitter or from succeeding stages in the exciter itself finding its way into the heater of the oscillator tube is coupled into the cathode and the grid tank circuit. When the heater is operated from an a.c. supply, this a.c. voltage is also coupled into the cathode and, consequently, the grid circuit. Anyone who has tried to get a good note from an e.c. oscillator in a superhet at 28 Mc. and higher should be familiar with this latter difficulty.

The solution to the hot-cathode problem is obvious—ground the cathode. By proper choice of a tube for the oscillator the cathode can be operated at ground potential for r.f. and the electron-coupling feature still retained. With the cathode firmly tied down to ground and thus acting as a shield between the heater and the rest of the tube elements and with a reasonable amount of shielding and circuit isolation in the exciter itself we have all the basic requirements for a universally applicable e.c. exciter.

6K8 Oscillator

A 6K8 was chosen for the oscillator. Due to the element geometry in this tube and to the manner in which the elements are connected internally, it lends itself admirably to grounded-cathode electron-coupled operation. The triode section is used as the oscillator and, as the triode grid is internally connected to the number 1, or injection grid of the hexode section, electron coupling between the oscillating section and the output element is obtained without the necessity of running the cathode hot for r.f.

There are several circuits suitable for use in the triode oscillator section of the 6K8 which allow the cathode to be grounded. The most suitable of these, however, seems to be the "tickler feedback" arrangement. This circuit is really a Hartley with the plate section of the tank circuit untuned. Its only disadvantage is that the plate-to-cathode and plate-to-grid capacity changes due to tube heating are not swamped out by the high-C tank circuit. Fortunately these capacities are quite small in the 6K8 triode section (3.2 $\mu\mu$fd. and 1.1 $\mu\mu$fd., respectively) and the absolute variations in capacity due to heating are insignificant. One of the major advantages of the tickler-feedback circuit is that it allows the use of a grounded-rotor tuning condenser —almost a necessity if hand-capacity effects are completely to be eliminated.

Additional stability in the oscillator is obtained by tapping the grid down on the coil as suggested by Lampkin.[2] Tapping the grid one-third of the way down the coil is equivalent to using slightly greater than twice as much C with the grid connected to the end of the coil. This effect holds true in regard both to the effect of input-capacity variation due to element spacing changes with tube heating and effective input capacitance variation due to changes in plate resistance caused by changes in plate voltage or loading.

Tapping the grid down the coil causes small separate tuned circuits to be formed; these circuits may lead to parasitic oscillations if the tapping is carried too far. With the tap one-third of the way down, however, there is no tendency toward parasitics.

Temperature Compensation

A 500-$\mu\mu$fd. zero temperature-coefficient condenser is used across the whole grid coil to provide an effectively high-C 160-meter oscillator section. Also across the grid coil is a 100-$\mu\mu$fd. midget variable air condenser for band setting. Various combinations of zero and negative-coefficient condensers were tried across the oscillator coil to determine their advantages, if any, in stabilizing the oscillator in respect to room-temperature changes. Strangely enough, it was found that the oscillator was much more stable without the negative-coefficient condenser. With the negative-coefficient condenser in the circuit, the slightest current of cool air, caused by opening a window or even by walking past the exciter and thus circulating the air, would cause the frequency to take a sudden dive. This effect was undoubtedly due to the fact that the small zero-coefficient condensers had less mass and heated and cooled more rapidly than the coil and rest of the oscillator components.

Since the exciter was not designed to be a frequency meter and in view of the fact that its stability without the compensating condenser (under the conditions usually encountered in amateur shacks) was equal to crystal for periods of one to two hours, it was decided to omit the temperature-compensating unit.

It will be noted from the diagram that the hexode section of the 6K8 beside functioning as an electron-coupling section between the

[2] "An improvement in Constant-Frequency Oscillators," *Proc. I.R.E.*, March, 1939, p. 199.

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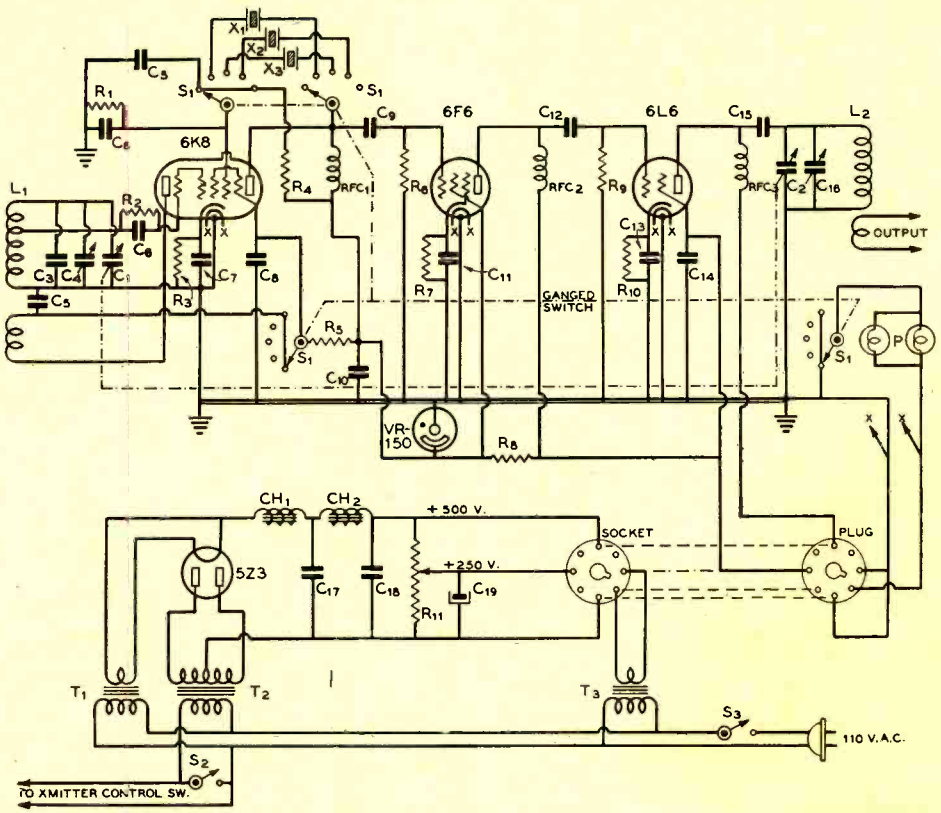

Wiring diagram of the electron-coupled exciter.

C_1—75-μμfd. midget with one stator plate removed

C_2—20μμfd. midget

C_3—500-μμfd. zero-coefficient ceramic

C_4—100-μμfd. midget

C_5—.005-μfd. mica

C_6—.0001-μfd. mica

C_7, C_8—.005-μfd. mica

C_9—.0001-μfd. mica

C_{10}, C_{11}—.005-μfd. mica

C_{12}—.0001-μfd. mica

C_{13}, C_{14}, C_{15}—.005-μfd. mica

C_{16}—100-μμfd. midget

R_1—50,000 ohms, ½ watt

R_2—100,000 ohms, ½ watt

R_3—500 ohms, 1 watt

R_4—300,000 ohms, ½ watt

R_5—10,000 ohms, 10 watts

R_6—100,000 ohms, ½ watt

R_7—500 ohms, 10 watts

R_8—2500 ohms, 10 watts

R_9—100,000 ohms, 1 watt

R_{10}—500 ohms, 10 watts

S_1—Four-pole, five-position, two-section isolantite tap switch

S_2, S_3—S.p.s.t. toggle switches

X_1, X_2, X_3—Band-edge crystals—near 3500, 3600 and 3650 kc.

L_1—Grid winding—22 turns tapped at 7 turns from "hot" end; feedback winding—16 turns. Both windings of no. 22 d.c.c. close wound on 1¼-inch form. ⅛-inch space between windings.

L_2—25 turns no 22 d.c.c. close wound on 1½-inch form. Link winding—8 turns no 22 d.c.c. close wound, spaced ¼-inch from plate winding.

RFC_1—2.5 mhy.

RFC_2—8 mhy.

RFC_3—2.5 mhy.

Power Supply

C_{17}, C_{18}—4-μfd. 600-volt oil filled

C_{19}—8-μfd., 450-volt electrolytic

R_{11}—25,000 ohms, 80 watts

T_1—5 v., 3 a.

T_2—1400 v.c.t., 150 ma.

T_3—6.3 v., 4 a.

CH_1, CH_2—25 hy., 140 ma.

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oscillator section and the next stage is also used as a Pierce oscillator for crystal-controlled operation on the band edges. Either 80- or 160-meter crystals may be used for this purpose. The operation of the three sections of the switch which make the change from e.c. to crystal will be described in a later section.

A paramount requirement of a successful e.c. exciter is that there be absolutely no reaction between the frequency-determining section and the output circuit. Reaction between these two portions will almost certainly result in chirps in a c.w. transmitter where the load variations on the stage preceding the keyed one will be reflected back through the transmitter and exciter and into the oscillator.

In this exciter, circuit isolation is provided by a class-A stage between the oscillator and the output stage and also through the use of a baffle shield under the chassis separating the oscillator circuit from the rest of the components. The shielding is probably an unnecessary refinement, since its removal during tests caused no noticeable reaction between circuits. The class-A stage, however, is a very effective isolating element. Mounting the output coil above the chassis, and the oscillator coil below, as shown in the photographs, also provides a good deal of isolation.

In spite of the fact that the shield apparently was not necessary for circuit isolation it was retained as it serves to keep heat generated by the resistors in the rear section of the chassis from reaching the oscillator section. All of the 10-watt resistors specified in the parts list are mounted in the rear compartment. The small resistors R_1 to R_4, inclusive, which do not become noticeably warm during operation, are mounted in the oscillator section.

Class-A Stage

The class-A stage is an untuned affair, operating with a resistor across the grid circuit of the 6F6 and an r.f. choke in the plate circuit. If a wider variety of chokes were available, it might be possible to use chokes in both the grid-return and plate circuits. With commonly available chokes in both circuits, however, the 6F6 has a tendency to oscillator t.p.t.g. fashion at a low frequency determined by the inductance of the chokes. Even with dissimilar chokes in the two circuits, such as a 2.5-mhy. one in one circuit and a 8-mhy. unit in the other, the stage is not entirely stable. With a resistor in the grid, however, the stage is quite stable; as the cost of a resistor is considerably less than that of an r.f. choke a resistor was used. That the stage is actually operating class A may be easily verified; there is no change in plate current to the 6F6 when the excitation is removed.

As an added precaution toward the elimination of the effect of a varying load on the oscillator, the screen of the 6F6 is supplied 150 volts of regulated voltage from the VR-150 voltage regulator. The regulated 150 volts is also applied to the 6K8 output plate and, through a resistor which drops it to 80 volts, to the plate of the triode oscillator section.

Plate voltage of 250 volts for the 6F6 comes from a voltage divider in the power supply. The tap on the voltage divider is separately filtered by an 8-μfd. electrolytic condenser. As it is this voltage which is dropped to 150 volts and regulated for the oscillator, the oscillator receives well filtered voltage. Due to its regulating action, the VR-150 also acts like a good sized section of additional filter on the stages receiving regulated voltage.

Output Stage

Following the class-A 6F6 is the 6L6 output stage. The circuit for this stage is quite conventional and it needs no discussion. Shunt plate feed is used to allow the tank and "bandspread" condensers to be grounded. Screen voltage for the 6L6 is taken from the same 250-volt tap on the voltage divider that supplies the 6F6 plate. The full 500 volts from the power supply is used on the 6L6 plate. This stage operates as a doubler when the crystal selector switch is on the e.c.o. position or on the crystal positions with 160-meter crystals. With 80-meter crystals the stage operates as a straight amplifier, giving slightly more output than the e.c.o. setting. Since there is no tuned circuit in the grid of the 6L6, and it is separated from the e.c. and crystal oscillator stage, which contains the only other tuned circuits in the unit, by the class-A stage, there is no necessity for neutralization.

A 20-$\mu\mu$fd. condenser across the output tank ganged with the oscillator tuning condenser allows the output to be kept at peak across the whole tuning range.

Switch Action

A single four-section five-position selector switch takes care of all the switching operations when changing from crystal to e.c.o. and between the three crystals available. Two sections of the switch are in the control grid and plate circuits of the 6K8 hexode section.

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The center three contacts on these select any one of the three crystals available. The two end contacts on the grid section are connected together, and when the switch is thrown to the end, or e.c.o., position, positive voltage is fed through R_4 and to the control grid. This small voltage on the hexode control grid raises the e.c. output considerably.

The third and fourth sections of the switch each have their end contacts connected together, while the rest of the contacts are left blank. In the e.c.o. positions one of the sections applies plate voltage to the triode section of the 6K8 and the other connects the dial lamps across the filament supply.

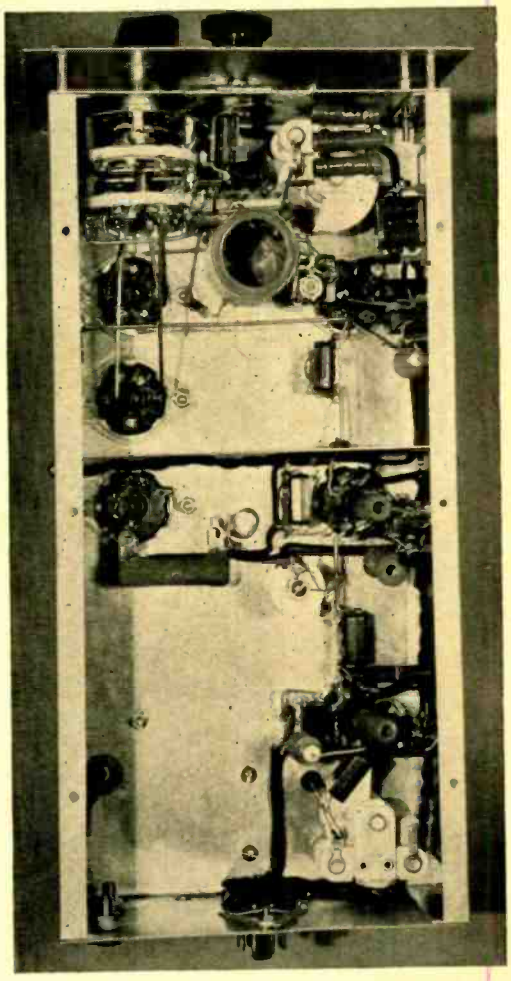
Chassis Layout

The two photographs show how the parts are arranged on the chassis. The chassis measures 12 x 6 x 3 inches. The three tubes are spaced evenly along the right side. The left side mounts the three crystals, the VR-150 regulator and the output coil, from front to back, in the order named. At the center of the chassis near the front and rear edges are mounted the two "bandspread" condensers, C_1 and C_2. These are ganged together by couplings and a length of quarter-inch shafting.

The under-chassis layout is shown in the bottom-view photograph. The 100-$\mu\mu$fd. oscillator bandsetting condenser, C_4, is between the 6K8 socket and the front of the chassis. It is mounted through the chassis so that the rotor shaft is available from above. The oscillator coil, which is wound on a 1¼-inch diameter form with the prongs cut off, is secured to the underside of the chassis at the center of the oscillator compartment. All of the wiring is short and direct, where possible. Heavy wire is used for all leads falling within the field of the oscillator coil and these are firmly tied down at each end.

The 500-$\mu\mu$fd. zero-coefficient fixed oscillator padding capacity is mounted by its leads across the terminals of the 100-$\mu\mu$fd. air bandset condenser. A brass sleeve over a long screw holding the 6K8 socket in place is used to hold the tie-point which supports the coil end of the oscillator grid leak and condenser combination.

The shield across the underside of the chassis separates the entire oscillator circuit from the rest of the unit. Beside providing electrical separation, this shield also acts as a baffle to keep the heat generated by the various dropping and cathode resistors from reaching the oscillator section, as has been discussed before. A row of quarter-inch vent holes in the bottom plate (not shown in the photographs) and across the rear drop of the chassis allows free circulation of air through the *rear* section of the chassis.



In this bottom view most of the "underside" components are visible. The zero-coefficient oscillator tank capacity may be seen mounted across the oscillator bandsetting condenser at the front right. As this photograph was taken looking directly down on the exciter, only the edge of the shield between the oscillator and amplifier-doubler compartments shows.

• • •

The wiring and arrangement of the class A and output stages are conventional and need no detailed discussion. The placement of the various parts is clearly visible in the photographs.

Front Panel

The front panel, which measures 7 x 8 inches, is separated from the chassis by four

[*Continued on Page 90*]

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Figure 1. The frequency standard is entirely self-contained. Outputs are provided on 100, 10, and 1 kc. at the jacks on the right, and any stage may be switched off by means of the toggle switches along the bottom. The audio gain control (lower center) regulates the level of the 1000-cycle output. The correction control (left) permits variation of the crystal frequency plus or minus 8 cycles on the fundamental.

A Portable

By

RUFUS P. TURNER,*
W1AY

The importance of knowing *exact* frequencies has increased with the growing popularity of e.c.o.-controlled transmitters. Contributory likewise to the current state of frequency consciousness is the amateur's increasing interest in radio physics and the more or less recent appearance of the new Federal regulations. All in all, the present situation, wherein the most exacting demands are made on frequency measuring gear, it is a far cry from the state of the art fifteen years ago when absorption wavemeters were universally used for frequency measurements and the accuracy of the most refined versions of these instruments was perhaps a quarter of one per cent. Apparatus in use at present permits the reading of radio frequencies within a very few hundredths of one per cent, performing the dual function of frequency generator and frequency identifier.

The initial progressive step was the laying aside of the absorption wavemeter, which identifies frequencies by virtue of its wavetrap action, in favor of electronic frequency meters which generate frequencies over a continuous range. With such a meter, used in conjunction with a heterodyne detector (monitor), it it possible to identify unknown frequencies by the highly accurate beat-note method. Since the electronic frequency meter is fundamentally a simple vacuum-tube oscillator which has been made as stable, electrically and mechanically, as is practicable, it still possesses most of the vagaries of the self-excited oscillator and has been replaced when greater accuracy is desired by systems embodying stable crystal control.

The simplest crystal-controlled checking device that has been employed for amateur calibration work has consisted of a low-powered crystal oscillator operating on 1750 kc. to provide harmonics at the low ends of all of the amateur bands. The utility of this instrument has been limited by the single spot frequency it provides in each band, and wherever great accuracy is dictated, we have drawn upon the experience of the commercials and laboratories and chosen a crystal frequency so low that its harmonics will be closely spaced throughout

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Construction and operating data for a secondary frequency standard employing a high-stability 100-kc. crystal oscillator and two multivibrators. This instrument is equivalent to several hundred crystal oscillators on spot frequencies throughout the radio spectrum and furnishes two crystal-controlled audio frequencies as well.

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FREQUENCY STANDARD

the various bands to provide a large number of checking points. Fundamental frequencies of 50 or 100 kc. have become conventional for this purpose, and amateur practice has been to employ the more readily obtainable 100-kc. bar.

A 100-kc. crystal oscillator provides spot frequencies every 100 kilocycles apart, these points extending to quite a high frequency before they finally grow too weak to be useful for the calibration of receivers, monitors, and variable signal generators, or the identification of unknown signals or presetting of an e.c.o.-controlled transmitter. These standard frequency points will have the same percentage accuracy as the controlling crystal. It is easily possible to attain a degree of stability not possible with an electron-coupled frequency meter or similar self-excited calibration oscillator. Thus, the single 100-kc. oscillator furnishes the equivalent of hundreds of separate signals, each generated by a separate high-stability oscillator.

Simplest Standard

It will be apparent from the foregoing discussion that the most rudimentary form of frequency standard may actually employ only the basic unit of a conventional standard: a 100-kc. oscillator controlled by an accurately ground, low-drift crystal. It is imperative that the crystal operate on exactly 100 kc.; since various factors may bring about variations from this frequency, means must be provided for correcting the fundamental frequency. Generally this is accomplished by mounting the crystal in a variable-gap holder or by making some circuit component variable in order to shift the crystal frequency a few cycles above and below 100 kc. A few cycles change will be sufficient to correct for error due to the temperature coefficient of the crystal, shifting of tube characteristics, or ageing of the crystal or circuit components.

The correction is made by bringing a suitable harmonic into zero beat with a satisfactory standard frequency signal, generally zero-beating this 50th harmonic (5000 kc.) with the 5-Mc. standard frequency signal broadcast regularly from the National Bureau of Standards station, WWV. The accuracy of the WWV signal is better than one part in five million (1 cycle at 5000 kc.) and the standard oscillator may be calibrated against it as ac-

Figure 2. Inside the "Kc. Box." The special crystal unit, oscillator, multivibrator, amplifier, and rectifier tubes may be identified with the layout diagram, figure 6.

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curately as it is possible to indicate zero beat. After careful correction, the standard oscillator will maintain its calibration within a few cycles over long periods of use.

Such a simple frequency standard is already in use in a number of amateur stations and service shops. It is limited in its usefulness, however, since it is very often necessary to have calibration points closer together than the 100-kc. spot frequencies, and it is for the purposes of supplying these intermediate points that recourse is had to the Abraham-Bloch multivibrator. One or more multivibrators controlled by the standard oscillator comprise a more complete frequency standard.

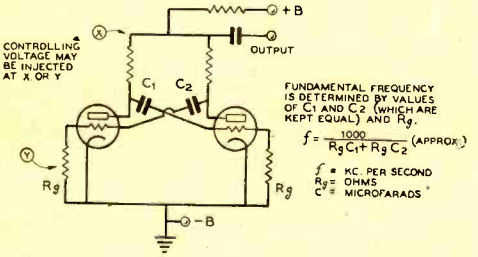

Figure 3. Basic multivibrator circuit and the approximate equation of its operation.

The Multivibrator

The multivibrator, a type of relaxation oscillator none too familiar to most amateurs, may be regarded simply as a *frequency divider* and as such performs a function opposite to that of the more familiar frequency multipliers (doublers, triplers, quadruplers, etc.) found in amateur transmitters. Its circuit is surprisingly simple (see figure 3) and the cost of parts is so low that it hardly appears worthwhile to eliminate it from the amateur's frequency standard.

Operating alone, the multivibrator has little value. Its oscillations are highly unstable and ragged, as may be observed by listening to one of its harmonics on a selective receiver. It can, however, be controlled by a stable crystal oscillator, even when the latter is operating on a harmonic of the multivibrator fundamental, and in this controlled state the roughness of the output disappears and the multivibrator locks into step. In the controlled state, the multivibrator emits a signal on its own fundamental frequency (determined by the values of resistance and capacitance in its circuit[1]), this being a subharmonic of the crystal frequency and possessing the same order of accuracy as the crystal oscillator. It is possible to synchronize a given multivibrator on more than one submultiple of the controlling frequency and the desired output frequency must be selected by adjustment of one of the grid resistors, made variable for the purpose, as will be pointed out later.

The multivibrator output is unusually rich in harmonics, a property which suits it ideally to the production of standard frequency points at high radio frequencies. At the same time, most multivibrators are operated at fundamentals which are audio frequencies and these are highly useful where accuracy of frequency rather than purity of wave form is desired. Successive multivibrators, each controlled by the preceding one, may be used to supply low frequencies all the way down to one cycle per second.

Multivibrators have been synchronized on 1/40 the controlling frequency, but for maximum stability and control, the frequency division is seldom carried out in a single multivibrator stage beyond 1/10 the controlling frequency. A 10-kc. multivibrator controlled by a 100-kc. standard oscillator provides crystal-controlled output on 10,000 cycles and its harmonics appear as spot frequencies equally spaced betwen each two adjacent 100-kc. points. The 100-kc. oscillator-10-kc. multivibrator combination is common in most complete standards. Multivibrator stages operating on lower frequencies than 10 kc. are employed primarily as generators of accurate audio frequencies, since their harmonics are too closely spaced for convenience in radio measurements.

The portable frequency standard shown on these pages employs a highly stable 100-kc. crystal oscillator and two multivibrators, one operating on 10 kc.; the other on 1 kc. Outputs are provided at 100 kc., 10 kc., and 1 kc.

[1] "A Convenient Method of Referring Secondary Frequency Standards to a Standard Time Interval," Clapp, *Proc. I.R.E.*, Feb. 1929; "Notes on Multivibrator Adjustment," Ephraim, RADIO, May, 1936; *Engineering Bulletin E-6*, p. 25, Bliley Electric Co.; "A New Type of Frequency Checking Device," Grammer, *QST*, June, 1938.

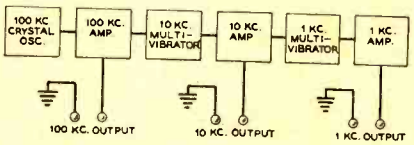

Figure 4. Functional block diagram of the complete standard.

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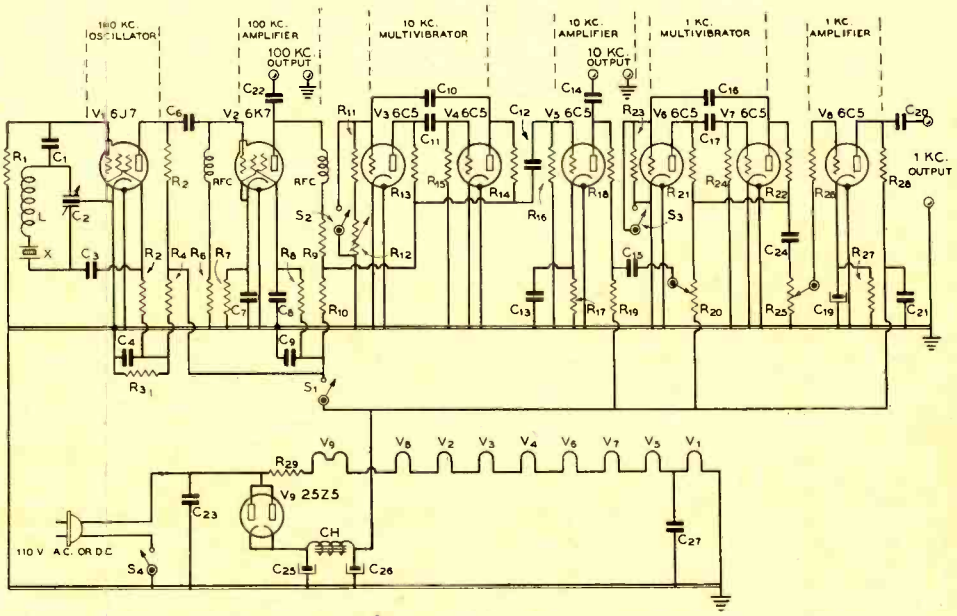

Figure 5. Schematic of the frequency standard with a.c.-d.c. power supply.

X, L—Bliley SOC100 crystal unit

C_1—0.01-µfd. 200-volt tubular

C_2—350-µµfd. per section broadcast midget variable

C_3—0.01-µfd. 200-volt tubular

C_4—0.1-µfd. 200-volt tubular

C_5—0.1-µfd. 200-volt tubular

C_6—.001-µfd. mica

C_7—0.1µfd. 200-volt tubular

C_8—0.1-µfd. 200-volt tubular

C_9—0.1-µfd. 200-volt tubular

C_{10}—.002-µfd. mica

C_{11}—.002-µfd. mica

C_{12}—.001-µfd. mica

C_{13}—0.1-µfd. 200-volt tubular

C_{14}—0.1-µfd. 200-volt tubular

C_{15}—.001-µfd. mica

C_{16}—.002-µfd. mica

C_{17}—.002-µfd. mica

C_{18}—.001-µfd. mica

C_{19}—10-µfd. 50-volt electrolytic

C_{20}—0.1-µfd. 200-volt tubular

C_{21}—0.1-µfd. 200-volt tubular

C_{22}—0.1-µfd. 200-volt tubular

C_{23}—0.1-µfd. 200-volt tubular

C_{24}—0.1-µfd. 200-volt tubular

C_{25}, C_{26}—40-µfd. 150-volt midget electrolytic

C_{27}—0.1-µfd. 200-volt tubular

R_1—1 megohm, ½ watt

R_2—½ megohm, ½ watt

R_3—100,000 ohm, 1 watt

R_4—0.14 megohm, 1 watt

R_5—½ megohm, ½ watt

R_6—½ megohm, ½ watt

R_7—1500 ohms, ½ watt

R_8—300 ohms, ½ watt

R_9—50,000 ohms, ½ watt

R_{10}—50,000 ohms, ½ watt

R_{11}—2500 ohms, ½ watt

R_{12}—5000-ohm wirewound potentiometer

R_{13}—20,000 ohms, 1 watt

R_{14}—200,000 ohms, 1 watt

R_{15}—25,000 ohms, ½ watt

R_{16}—½ megohm, ½ watt

R_{17}—2500 ohms, ½ watt

R_{18}—50,000 ohms, ½ watt

R_{19}—50,000 ohms, ½ watt

R_{20}—10,000-ohm wirewound potentiometer

R_{21}—250,000 ohms, 1 watt

R_{22}—20,000 ohms, 1 watt

R_{23}—150,000 ohms, ½ watt

R_{24}—150,000 ohms, ½ watt

R_{25}—½-megohm wirewound potentiometer

R_{26}—1000 ohms, ½ watt (necessary only if in a particular layout adjustment of R_{25} causes 1-kc. multivibrator frequency to jump)

R_{27}—2500 ohms, ½ watt

R_{28}—100,000 ohms, ½ watt

R_{29}—132-ohm filament-dropping resistor in line cord

S_1—S.p.s.t. toggle switch (100-kc. on-off switch)

S_2—S.p.s.t. toggle switch (10-kc. on-off switch)

S_3—S.p.s.t. toggle switch (1-kc. on-off switch)

S_4—S.p.s.t toggle switch (power switch)

CH—30-henry, 50-ma. midget b.c.l. filter choke

RFC—2.5-mh. 125-ma. radio frequency choke

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Amplifiers are placed between each stage for the purpose of isolation and building up the output voltage from the driving stage. The power supply is a.c.-d.c. since it was projected to use this instrument "on location" in a locality where both types of power are supplied. While voltage regulation of the plate and screen power supply and temperature control of the crystal are strongly recommended, these refinements were sacrificed for portability in this application. A functional block diagram of the unit is shown in figure 4.

Circuit and Mechanical Features

The 6J7 crystal oscillator is a highly stable modified Colpitts circuits in which the crystal is arranged as a filter in the frequency determining tank. Since the crystal impedance is lowest at its resonant frequency and rises very rapidly at all other frequencies, the crystal assumes control when the tank circuit is tuned to its frequency, or very close to this value. The circuit would oscillate at a frequency very close to 100 kc. if the crystal were not in the circuit, such are the proportions of the tank coil, L, and the tank condenser, C_2, (see figure 5).

The tank coil is built in the holder with the 100-kc. bar, the entire assembly being supplied as a unit (the Bliley SOC100), which is shielded and fits into a standard 5-pin tube socket.

The tank condenser, C_2, is a split stator, 350-$\mu\mu$fd.-per-section broadcast midget employed here as the correction control. This condenser permits variation of the crystal frequency over the narrow range of plus or minus 8 cycles at 100 kc. (plus or minus 400 cycles at the calibration frequency 5000 kc.). The crystal frequency drift due to temperature is less than 3 cycles per Mc. per °C.

The crystal oscillator is followed by a 6K7 resistance-coupled tetrode amplifier which serves to boost the low output voltage from the crystal stage and to isolate the oscillator and first multivibrator stages. This amplifier has been biased higher than is customary and radio-frequency chokes have been inserted in its grid and plate leads to accentuate the higher harmonics. On-off switching of the 100-kc. section of the standard is accomplished by a s.p.s.t. toggle switch, S_1, which interrupts the common B-plus lead to 100-kc. oscillator and 100-kc. amplifier.

100-kc. output is delivered to banana jacks on the front panel of the first amplifier. A portion of the r.f. voltage developed across the amplifier plate resistor, R_9-R_{10}, is injected into the plate circuit of the 10-kc. multivibrator to synchronize the latter.

The two 10-kc. multivibrator tubes are 6C5's in an asymmetrical circuit with grounded cathodes. The variable grid resistor, R_{12}, is a 5000-ohm wirewound rheostat with a slotted shaft mounted through the top of the chassis for screwdriver adjustment. The two feedback condensers, C_{10} and C_{11}, are mounted very close to the tube socket terminals and must be of good grade mica type.

The 10-kc. multivibrator is followed by a 6C5 resistance-coupled amplifier which isolates the 10- and 1-kc. multivibrators and delivers controlling voltage to the latter. The 10-kc. output jacks are connected to this amplifier. A portion of the r.f. voltage developed across the 10-kc. amplifier plate resistor, R_{18}-R_{19}, is injected into the plate circuit of the 1-kc. multivibrator through the synchronizing control, R_{20}, a 10,000-ohm wirewound potentiometer, which, like R_{12}, is mounted with a slotted shaft extending through the chassis top for screwdriver adjustment.

The 1-kc. multivibrator resembles the 10-kc. ditto except that its grid circuits are symmetrical and synchronization is accomplished by the adjustment of the variable plate resistor, R_{20}, instead of a variable grid resistor as in the 10-kc. multivibrator. This arrangement was found by experiment to afford more positive control and greater stability.

The 6C5, 1-kc. resistance-coupled amplifier stage following the 1-kc. multivibrator, delivers 1000-cycle output to the proper front panel jacks. The half-megohm variable grid resistor in this stage is the audio gain control occupying the lower center front panel position.

The multivibrators are separately controlled by s.p.s.t. toggle switches, S_2 and S_3 respectively, which short out one grid resistor in the *off* position. This arrangement allows plate current to be drawn constantly and contributes to the stability of the crystal oscillator.

The heaters of all of the tubes are wired in series *in the order shown* in figure 5. No shielded leads are employed in the customary positions (output connections, etc.) since the small capacity between conductor and shield has been found to by-pass some of the useful higher r.f. harmonics. For the same reason, all output leads are kept away from the chassis and other grounded parts and large jack holes are cut in the front panel.

All wiring is as rigid and direct as possible. The operator who duplicates the frequency standard might well keep in mind when wiring up the parts that a measuring instrument is being constructed and that floppy, roundabout wiring will contribute markedly to the unreliability of the unit.

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The filter is mounted beneath the chassis and close to the 25Z5 socket. In this unit, the choke is a 20-henry, 75-ma. broadcast midget type and the filter condensers each 40-μfd., 150-volt. The filament-dropping resistor, R_{28}, has a value of 132 ohms. A standard line-cord with self-contained resistor "lead" is used here in order to keep as much heat out of the interior of the unit as possible. It may not be possible to find a 132-ohm line cord resistor as a stock item, in which case the next largest size may be cut down with the aid of a reliable ohmmeter.

The unit is mounted on a 7"x10"x2" plated steel chassis and 7"x10" aluminum panel. Aluminum was used for the panel simply because it engraves sharply. The correction condenser is mounted rigidly on the chassis and adjusted by means of a special vernier mounted behind the panel and controlled by a front of panel knob. This vernier is a National A-dial mechanism. The case shown in the front view photograph was formed from 0.060" steel and spot welded. It is fastened to the front panel with five 6-32 machine screws, three spaced along the top edge and two on each side. Three more of these screws spaced along the bottom hold the panel to the chassis, and three similarly spaced hold the rear of the case to chassis. The mounting screws are finished in the same paint as the panel (or case) in order to avoid conspicuousness.

A liberal number of large holes are punched in the back of the case to permit ventilation, since the nine tubes in the unit generate considerable heat that must be carried away from the crystal. There is argument in some circles that it is more advisable to box up such an outfit as this tightly and allow the inside temperature to reach its peak level before using the instrument; however, measurements made here do not indicate that this peak temperature is a constant value.

In the writer's own application, it will be observed that the case has no lid. It is seldom necessary to go inside the cabinet, except for adjustments to the multivibrator frequency control resistors and two holes are provided (see top of cabinet in figure 1) for the insertion of a long blade screwdriver for this purpose. The front panel of the writer's instrument is finished in baked black wrinkle; the case in baked Western Electric grey wrinkle.

It is not necessary to make a Chinese copy of the layout and mounting shown here, since the instrument is not at all critical as to layout. The individual builder may exercise his own ingenuity with regard to layout and front panel arrangement without introducing any complication. Every available square inch of space has been used in the arrangement shown and it is hardly possible to reduce the size of the unit unless a double or triple deck scheme is used.

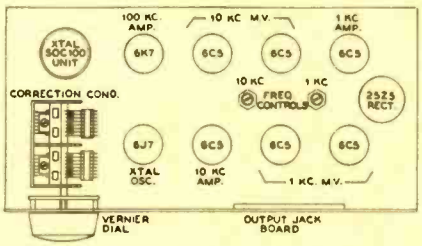

Figure 6. Mechanical layout of the standard, looking down on the chassis.

Calibration and Use

After all wiring has been carefully checked and the tubes and crystal unit inserted, the frequency standard must be corrected and adjusted. For this purpose a good receiver covering either the 80- or 160-meter band and tunable also to 5000 kc. must be warmed up and disconnected from its regular antenna to prevent picking up outside signals.

First, determine that the 100-kc. section is operating by switching on the power supply, switching off all but the 100-kc. section, setting the correction condenser, C_2, to half-scale and locating the 100-kc. harmonics in the receiver which must be set for *c.w.* reception in the 80- or 160-meter band, (beat oscillator switched on if the receiver is a superheterodyne). The standard is coupled to the receiver by connecting a length of wire between the ungrounded 100-kc. output jack and the receiver antenna post. With most receivers, sufficient coupling will be obtained if the insulated end of the lead is simply looped around the antenna post. But if the signal intensity is too low with a particular receiver, additional coupling may be obtained by making a direct connection and, if necessary, also connecting the grounded 100-kc. jack to the receiver ground post.

If the 100-kc. oscillator and amplifier are operating correctly, strong harmonics of 100 kc. should be heard as the receiver is tuned through the band. There will be three of these harmonics in the 160-meter band (1800, 1900, and 2000 kc.) and six (3500, 3600, 3700, 3800, 3900, and 4000 kc.) in the 80-meter band occurring at the approximate dial settings for these frequencies. In order to establish that the points heard are 100-kc. harmonics and

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not outside signals, the 100-kc. switch may be thrown off and on. If the point disappears with the switch in the off position, it is a standard harmonic.

Correction of Frequency

If the 100-kc. stages are found to be operating correctly, the crystal frequency may now be corrected to exactly 100 kc. in the following manner:

1. Switch off all stages of the standard, but leave the standard power on (to keep the filaments lighted) and keep the 100-kc. output jacks connected to the receiver.

2. Connect a good outside antenna to the receiver and switch off the beat oscillator (if the receiver is a superhet) or cut out all regeneration (if the receiver is a regenerative t.r.f.).

3. Tune in sharply one of the standard frequency transmissions from WWV. These transmissions are made according to the following schedule:

A. 5000 kc. modulated at 440 c.p.s. daily except Saturdays and Sundays. 4:00 p.m. to 2 a.m., e.s.t.

B. 5000 kc. unmodulated except for short 1-second standard time pulses at 1000 c.p.s.
Every Tuesday and Friday (except legal holidays) 10:00 to 11:30 a.m., e.s.t.

C. 10,000 kc. unmodulated except for short 1-second standard time pulses at 1000 c.p.s.
Every Tuesday and Friday (except legal holidays) noon to 1:30 p.m., e.s.t.

D. 15,000 kc. unmodulated except for short 1-second standard time pulses at 1000 c.p.s.
Every Tuesday and Friday (except legal holidays) 2:00 to 3:30 p.m., e.s.t.

E. The transmissions under B, C, and D are also made on Wednesdays at the same hours but with 30% modulation at 1000 c.p.s.

It is recommended that the 5000-kc. signal be employed since 100-kc. harmonics grow markedly weak by the time higher frequencies such as 10,000 and 15,000 kc. are reached, although finer correction is possible at the two higher frequencies.

4. When the WWV signal has been tuned in carefully, switch on the 100-kc. section and listen for a beat note between the proper harmonic of the crystal oscillator and WWV. If no beat note is observed, the crystal is oscillating exactly on 100 kc., but it is not likely that this condition will obtain, some low-pitched heterodyne being audible in virtually every case. Even if zero beat is indicated at the start, as a fortunate circumstance, it is a good precaution to make certain by swinging the correction condenser to produce a beat note.

5. Slowly adjust the correction condenser until zero beat with WWV is obtained. It will be observed that the beat note obtained in the very beginning is so low in frequency that the correction condenser need be rotated over only a very small arc to reduce to zero beat and swing to the other side. It is emphasized here that this adjustment is a very important one that should be made with the utmost care; the accuracy of the standard can never be any better than the precision with which zero beating is carried out. For this reason, it is strongly recommended that zero beat be indicated by an oscilloscope rather than by ear, since the human ear reaches its low-frequency threshold of hearing a considerable number of cycles higher than actual zero beat. The condition of absolute zero beat indicates that the correction is complete; that is, that the crystal is oscillating exactly on 100 kc.

Synchronizing the Multivibrators

After the correction has been completed, disconnect the receiving antenna, switch on the beat oscillator of the receiver and make a note of the dial settings for the various 100-kc. harmonics in the 80- or 160-meter band. The multivibrators are now synchronized with the corrected 100-kc. oscillator as follows:

1. With the 100-kc. section running, if the 10-kc. multivibrator is switched on (1-kc. multivibrator off), and is operating correctly, a number of somewhat weaker intermediate signals will be observed between each two 100-kc. harmonics. There will be nine such intermediate points if the multivibrator is synchronized at 10 kc. Eight intermediate points indicate that the multivibrator is locked in step at approximately 11 kc., and 10 points indicate that it is synchronized at approximately 9 kc., etc. To synchronize at the desired frequency, 10 kc., R_{12} is adjusted slowly, noting that at particular settings of this resistor the frequency of any one of the intermediate points will *suddenly jump* to a new value. (This characteristic frequency jump is an indication of correct operation—smooth variation of frequency with the adjustment of R_{12} indicates absence of control by the injected 100-kc. voltage). Increasing R_{12} will decrease the frequency of synchronization, and vice versa. The correct setting of R_{12} will give 9 standard frequency points between any two adjacent 100-

[*Continued on Page 85*]

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The Overgrown "LAZY H"

By W. W. SMITH,* W6BCX

The array affectionately called the "Lazy H" is, and justifiably, the pet of many of the top-flight dx men. Merely by increasing slightly the length and spacing of the elements and untransposing the phasing section, the Lazy H can be used on two adjacent bands and fed by an untuned line without need for a matching stub.

A large number of the fellows whose calls are found right up at the top of the WAZ list swear by the "Lazy H" array, and with good reason. The superlative performance of this array, dubbed the *Lazy H* because it looks like an H in supine repose, was pointed out in this magazine three years ago, and its sundry virtues have been plugged at various times since. The Lazy H may be lying down, but it doesn't lie down on the job. Ask such dx potentates as W6CUH, W6GRL, W6QD, or W4DHZ, just to cite a few staunch advocates. The array has high radiation resistance, is 100% horizontally polarized, is a low-angle radiator, and is easy to erect.

High radiation resistance means low voltages and a broad resonance curve, which permits use of inexpensive insulators and enables the array to be used over a fairly wide range in frequency. The fact that there is no vertical component in the polarization means that pickup of man-made noise will be minimized when the array is used for receiving. Many supposedly horizontally polarized arrays do not cancel the vertically polarized component completely except at zero and certain other vertical angles.

The Lazy H is essentially a four-element colinear-cophased "curtain," giving a fairly sharp bidirectional pattern, with an apparent power gain on 10 and 20 meters (where low angle radiation is required) that will make you wish you had put up one sooner.

* Editor, RADIO.

Evolution of the "X-H Array"

It is a well-known fact that the directivity and gain provided by two colinear half-wave dipoles can be increased by separating them so that the current loops are somewhat over a half wave apart. Likewise Brown[1] has shown that greater broadside directivity and gain occur when a half-wave radiator is lengthened to 230 degrees. The latter applies to a vertical radiator worked against earth, but by arranging two such radiators horizontally so that they work back-to-back,[2] two factors contribute to an increase in gain over the usual arrangement of two colinear dipoles where the radiators are each 180 degrees long and the current loops separated by one half wavelength. The extended arrangement derives an increase in gain both because the elements are 230 degrees long instead of 180 degrees, and because the current loops are separated by 280 degrees instead of 180.

Referring to Mr. Brown's charts again, we see that cophased dipoles in a curtain arrangement do not show maximum broadside directivity or gain at the common 0.5 wavelength spacing, but at approximately 0.65 wavelength spacing.

Observation of the dimensions of the array in figure 1 will show that the radiating element lengths have been increased to 230 degrees and that the spacing has been in-

[1] Brown, "Broadcast Antennas," *Proc. I.R.E.*, Jan., 1936, p. 53.

[2] Romander, "The Extended Double Zepp," *QST*, June, 1938, p. 12.

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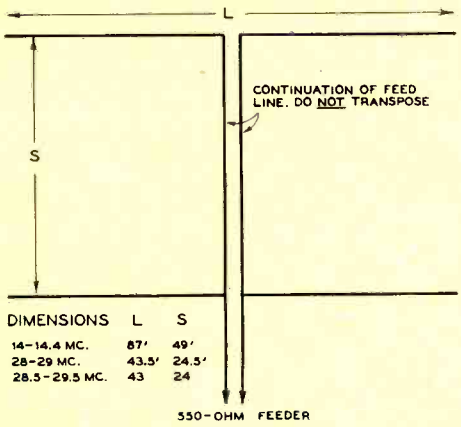

Figure 1. The X-H Array. Good results can be obtained using the array on half frequency. Thus the 10-meter array can be used on 20 meters and the 20-meter array on 40 meters. Let the phasing section (length S) hang loosely, so that the actual separation of the elements is slightly less than dimension "S".

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creased to approximately 0.7 wavelength; otherwise it looks exactly like the familiar Lazy H with two exceptions: the phasing section is not transposed and no matching stub is used.

Increasing the element lengths and spacing beyond 0.5 wavelength results in parasitic lobes being radiated both in a vertical and a horizontal plane. However, the magnitude of these lobes is small, and effects of their presence can be ignored; the advantage of greater horizontal and vertical directivity and increased gain are of much greater importance. It is comparatively easy to increase the gain of any array which does not have much gain to begin with; but when the gain of an array already having a gain as high as that of the Lazy H can be raised several db, it is really an accomplishment. The modified version of the Lazy H array that does just this has been dubbed the X-H (expanded, extended H).

Two-Band Operation

The X-H array can be used with good results on *half* (not twice) frequency with no changes whatsoever, thus permitting two-band operation.

The gain at half frequency will not be as great as when the array is used on its regular frequency, but there is still gain over a regular dipole. The general shape of the pattern is the same on both bands, but it will not be so sharp when the array is used on half frequency. In other words, when a 10-meter X-H array is used on 20 meters, the feed line will still be sufficiently well matched and the array will still be directional broadside, but neither the gain nor directivity (both vertical and horizontal) will be as great as on 10 meters.

Summary of Advantages

Summarizing the advantages of the expanded Lazy H over the conventional version, we have the following:

1 - Greater horizontal directivity
2 - Sharper vertical directivity of main lobe, minimizing fading
3 - Increased gain
4 - Can be used with good results on half frequency with no change, permitting two-band operation
5 - Untuned feeders require no stub or transformer on either band.

Standing Waves

The business of standing waves for some reason has become a bugaboo to many amateurs. It is nice to have a "flat" transmission line—a line which has uniform current—but it is *not* necessary for high efficiency. There can be very little radiation or pickup by a *balanced* two-wire line spaced not more than 6 inches; so the only item with which we have to concern ourselves is to make sure neither the current nor voltage reaches excessive values.

If the current excursions along a line do not exceed 3 to 1, we safely can ignore the standing waves, provided the line is inductively coupled to the output stage. If the line is clipped directly on the output tank, it is a different matter; the losses in the line may still be low, but unless the line is an integral number of half waves long it will couple reactance into the output tank. If one prefers to clip the line directly on the output tank, it is a simple matter to lengthen the line to the next integral number of half waves and thus avoid the reactive effect and consequent detuning of the tank circuit.

In the X-H array, two-band operation called for a compromise in the point of attachment for the feed line. To give a perfect match on both bands, the line should have a surge impedance in the neighborhood of 250-300 ohms. A line of this surge impedance is awkward of construction, and as standing waves will not be bad enough to be serious when a 550-600 ohm line is used, the latter was decided upon. A perfect match may be obtained on *one band* with the 550-ohm feeders by sliding them up the phasing stub a short distance or fanning them out a

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little either side of the center of the bottom section. Unfortunately it is necessary to slide the feeders one way for one band and the other way for the other band. The point of attachment shown is a compromise which will result in current excursions of about 3 to 1 on both bands.

If the slight reactance appears objectionable, the line should be made an exact integral number of half waves long on the lowest frequency band. Thus if a 10 meter X-H array is to be used on both 10 and 20 meters, the line should be a multiple of 34 feet. If used only on 10 meters, the line may either be made any multiple of 17 feet, or else tapped to a point on the array that will give a perfectly "flat" line. The point can be determined by experiment.

Construction

While the X-H array tunes quite broadly and therefore is not especially critical as to frequency or length, it is nevertheless a good idea to use copper-clad steel-core wire for the array to assure permanency of installation. Cut the elements exactly L/2 long and make the phasing section exactly S long. Soft-drawn wire stretches alarmingly when subjected to continued strain, and should not be used. Hard-drawn copper will suffice for a 10-meter installation, but in a 20-meter installation steel-core wire is advised because of the greater span and weight. If the cost is prohibitive, use steel-core only for the upper horizontal element. There is much less strain on the rest of the array, and *hard-drawn* copper will do for a 20-meter job in a pinch if the *upper* elements are steel core.

Do *not attempt to pull the phasing stub tight,* as it is impossible to do so without having considerable sag in the top section and a bad arch in the lower radiators. It does not hurt to allow the phasing section to whip around a little; so let it hang loosely. It is better to have slightly less than rather than slightly more than 0.7 wavelength spacing. If you try to pull the phasing section tight the mean element spacing will exceed 0.7 wavelength.

The bottom of the array should be at least 10 feet above ground for either a 10- or 20-meter array. There is little point in going higher than this if the antenna is in the clear, but the array may be raised to advantage if surrounding objects seriously "hem in" the lower section of the antenna. Do not raise the 20-meter array any more than necessary to get the bottom section in the clear, as the vertical radiation pattern is already low and quite sharp, and raising the array high above

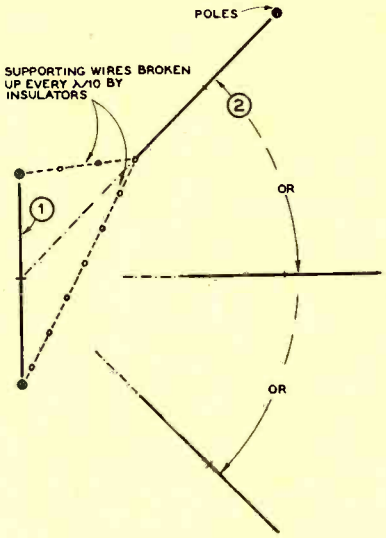

Figure 2. Illustrating how two dipoles or arrays with horizontal elements can be supported from three poles with a minimum of coupling between the two systems. This is an important consideration if maximum directivity is desired.

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effective earth lowers the angle of radiation still further. Thus on 20 meters it is possible to get the antenna *too* high for medium distance work (1500 miles), though on 10 meters the array can be put as high as you want to go. Sixty-foot poles will be about right for the average 20-meter installation and 35- or 40-foot poles for a 10-meter job. When a 10-meter X-H is used on 20 meters, the vertical directivity is not sufficiently sharp that one need worry about getting the array too high.

In order to obtain the proper phase relationships in the X-H, that portion of the feed line connecting the upper and lower sections of the array—sometimes referred to as the *phasing section*—is not transposed as in the case of the conventional Lazy H.

One effect of the sharp vertical directivity obtained when the X-H is used on the band for which it was cut (resulting from the 0.7 wavelength spacing) is reduced fading. This in itself is an important advantage.

Two

If two X-H arrays, or dipoles or most any arrays for that matter, are used to cover four directions, one array will excite the other as

[*Continued on Page 81*]

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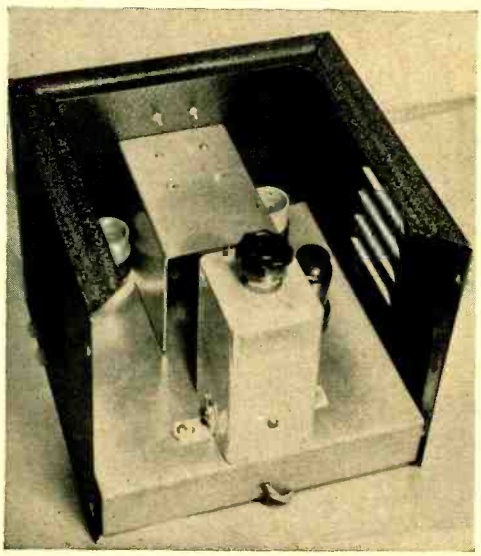
AN 1852 CONVERTER

for Fixed-Station Service

By E. H. CONKLIN,* W9BNX and
VICTOR RUEBHAUSEN,** W9QDA

The improvement in signal-to-noise ratio and sensitivity obtainable through the use of a converter for u.h.f. reception has been proven by past designs. Herein is described an improved plug-in coil converter for fixed-station use employing the new 1852 tube as mixer.

Although convinced that the 954 acorn tube is not surpassed as a u.h.f. amplifier or mixer we recently became desirous of experimenting with the 1852 as a medium-u.h.f. mixer where a fairly high intermediate frequency may be used. A simple converter following some of the design suggestions of recent RADIO articles[1] was built up to study the possibilities of such an arrangement for regular home-station usage. Results were quite satisfactory in that ten-meter signals were better than in the modern communications receiver alone that was used as an i.f. channel, and five-meter reception was far superior. Where such converters are to be used, the 1852 and 1851 types have much to recommend them when it is desired to use an intermediate frequency of 1500 kc. or higher.



Rear view of the 6C5-1852 converter showing the U-shaped shield in place mounted atop the two-section tuning condenser.

Construction

The photographs will illustrate the layout. A small stock cabinet and the chassis designed for it formed the basis for the unit. Mounted in the center of the panel is a small 25 $\mu\mu$fd. per section dual-stator variable. The section nearer the panel, tuning the mixer input, has only one remaining stator plate; the rear portion, for the oscillator, has all but two stator plates removed. This condenser is mounted with the four tapped holes in the frame pointing upward. These holes are then used to support a shield which in addition to covering the condenser also acts as a baffle between the two coils.

Directly back of the tuning gang is the 1852 mixer; to the left is the oscillator coil, and to the right, the mixer coil. The can behind the 1852 contains a tuned output coil and a few turns to provide link coupling to the receiver

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[1] Dawley, "A Five- and Ten-Meter Converter, RADIO, Dec., 1938, p. 22; Gonsett, "Ten-Meter Auto-Radio Converter," RADIO, Jan., 1939, p. 52; Dawley and Norton, "Improved U.H.F. Mobile Converters," RADIO, May, 1939, p. 9.

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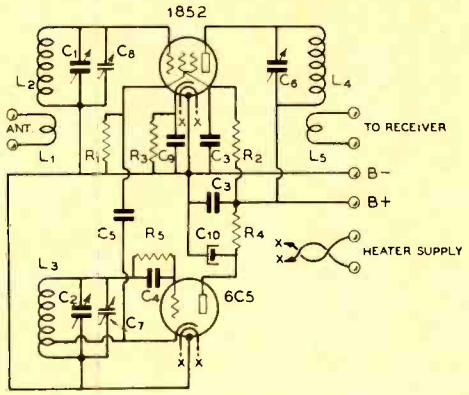
General wiring diagram of the 1852 converter.



C_1, C_2—Dual 25-μμfd. midget (see text)
C_3—.01 mica
C_4, C_9—.00005-μfd. mica
C_6—100-μμfd. midget
C_7—25-μμfd. air trimmer
C_8—17.5-μμfd. midget
C_9—.01-μfd. mica
C_{10}—8-ufd. 450-volt electrolytic
R_1—25,000 ohms, ½ watt
R_2—40,000 ohms, 1 watt
R_3—1500 ohms, 1 watt
R_4—1500 ohms, 1 watt
R_5—5000 ohms, 1 watt
R_6—50,000 ohms, ½ watt
L_1—3 turns at cold end of L_2
L_2—5¾ turns on 1" form spaced dia. of wire for 28 Mc. 3 turns on 1" form spaced dia. of wire for 56 Mc.
L_3—4¾ turns on 1" form spaced dia. of wire for 28 Mc. 3¾ turns on 1" form spaced dia. of wire for 56 Mc. Cathode tapped ¾ turn from cold end on both bands
L_4—30 turns close wound on 1" form
L_5—4 turns at cold end of L_4

used as an i.f. channel. Below the tuning gang is a 15-μμfd. trimmer on the mixer to eliminate tracking problems on separate bands.

The Circuit

Several triode oscillator circuits were tried. The tickler type was subject to pulling when the mixer was tuned, but the cathode-above-ground type operates satisfactorily. This concurs with the results given in other articles on the subject. The minimum number of turns between cathode and ground necessary for oscillation gave best results; 4¾ turns on a one-inch form for ten meters and 3¾ at five meters, with the tap ¾ turn up, are used. The oscillator is on the high-frequency side of 28 Mc. and on the low side of 56 Mc. Some difficulty with hum was experienced until an additional resistance-capacity filter was provided for the oscillator plate supply.

All oscillator leads should be made rigid to avoid shock detuning of the circuit. The ground leads are all brought to one point, which is even more advisable in the mixer circuit where an extra fraction of an inch in the cathode lead, common to both the grid and plate returns, is undesirable in that it has effects upon the input circuit and gain similar to electron transit time.

Suppressor injection is used through a 50-μμfd. or smaller coupling condenser. The 1852 mixer was considerably superior to the 6L7 it replaced, having less conversion noise and considerably more gain. The mixer grid coils, wound on one-inch forms, have 5¾ turns on ten meters and three turns on five; this is in contrast with larger coils possible with an acorn 954 mixer. The antenna coil, for link coupling to a resonant circuit, was first interwound with the grid coil; this made tuning broad due to the heavy loading of the input circuit by the antenna. Three turns at the ground end were better. The r.f. input and output are connected to tip jacks at the sides of the unit.

The cathode bias resistor can be 1000 to 2500 ohms, somewhat larger than recommended. This reduces the loading effect on the input circuit with a slight loss in tube gain, the result being an improvement.

The output circuit consists of a tuning unit mounted in a shield can, coupled to a four-turn pick-up coil which is link coupled to the receiver used as an i.f. channel. This link could be a concentric line or shielded pair to good advantage; it picks up enough signal to give a beat note if the receiver is tuned on a continuous carrier and running wide open. A clear spot just off 6 Mc. is used with this converter.

Adjustment

The first step in lining up the converter is to adjust the output circuit to resonance with the receiver used as an i.f. amplifier. This is easily done inasmuch as the receiver noise, due both to shot effect in the mixer tube and signal or background racket at the i.f., increases when the circuit is brought in tune. The oscillator can be tuned around to locate a signal, but an easier way to set the oscillator is to listen for it in an all-wave receiver and set it at 28 Mc. plus the i.f.

When this adjustment has been made, there remains only to line up the mixer input circuit on outside noise or on a signal, using the trimmer on the panel (which also acts

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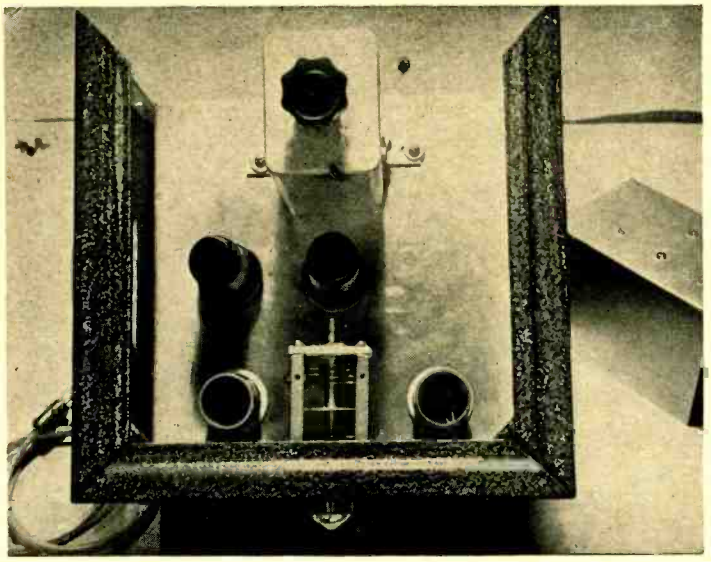

Looking down on the top of the converter—the U-shaped shield has been removed from the top of the tuning condenser and can be seen alongside the box. The tube between the tuning condenser and the output i.f. is the 1852; the 6C5 is alongside it and the two coils plug in on either side of the condenser.

as a gain control). This was done when the ten-meter band was open, and proved to be quite easy. Ordinarily it will be necessary to obtain proper antenna coupling, inasmuch as high antenna pick-up and transfer to the mixer input will be important in determining weak-signal sensitivity and signal-to-noise ratio.

Signal-to-Noise Ratio

When a receiver is used at successively higher frequency bands, it is generally necessary to run up the gain. Tube or other noises then become more apparent because the signal input or r.f. amplification falls off, and the increased gain amplifies the noise. In a somewhat similar way, when a converter is placed in front of a receiver, the converter itself amplifies circuit noises in its first stage and gives the impression that the whole layout is noisier. This is not necessarily so, because the gain in the receiver can be reduced inasmuch as the signal, too, has been amplified. Likewise, if the a.v.c. is left on, the receiver noise is suppresed by it on a very much weaker signal than would operate the a.v.c. if fed directly into the receiver rather than through the converter.

Many amateurs are misled on this point. A quiet receiver may indicate an absence of amplification instead of a good signal-to-noise ratio. If each stage has reasonable gain, the set noise will be determined in the grid circuit of the first tube, whatever its function, and it will fall off substantially if the grid clip is removed. It follows that a high ratio of signal to set noise, in a good receiver, is determined by the nonregenerative gain ahead of the first plate circuit—primarily antenna pick-up, coupling and amplification in the grid circuit and tube. Regenerative gain increases the noise proportionately and does not improve the signal-to-noise ratio any more than does running up the i.f. gain.

The disadvantage of the 1852 or 1851 as the first tube in a receiver lies in the fact that it acts like placing a relatively low resistance—let us say 500 ohms—across the first tuned circuit, making a good tuned circuit act like a poor one. Other factors bring the gain up to where some amplification can be obtained at five meters when none is produced by other standard tubes. As already mentioned, the acorn tubes have advantages which make good tuned circuits—after the tube has been placed across them—possible at much higher frequencies, thus resulting in more gain and an improved signal-to-noise ratio.

See Buyer's Guide, page 98, for parts list.

●

The Don Lee Broadcasting System has made application for a license to construct a one-kilowatt television transmitter in San Francisco, Calif. The Don Lee System has had a transmitter in operation in Los Angeles since about 1931 and, if the application is granted, the television service will be extended to San Francisco to make this the second Pacific coast city to enjoy television. The Crosley Corporation has also made application for a one-kilowatt transmitter to serve the Cincinnati area.

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Top view of the complete r.f. section. The vibrapack supply is mounted on the small outrigger to the right. The two 6A4's, the two 112-A's can be seen in addition to the crystal, the filter condenser, the modulation choke and the output tank coil which are mounted above chassis. All other components, including coils, are mounted below chassis.

FILAMENT TUBES

in the Mobile Transmitter

By RAY L. DAWLEY,* W6DHG

Many excellent mobile 28-Mc. transmitters have recently been described, but when it came time to install one in the author's automobile it was found that past designs did not quite fit the bill in respect to certain features. In the first place it was desired that the tubes in the transmitter be of the filament type. It didn't seem economical or desirable that the heaters in the transmitter be left on between perhaps widely separated periods of transmission. With filament-type tubes it is possible to apply both the filament and plate power at the same time whenever it is desired to transmit. There is no battery drain due to the transmitter heaters between transmissions.

Other things that were felt desirable in the transmitter were that the modulated stage be a push-pull *amplifier* at the output frequency, that the exciter operate with low crystal current and with a 7-Mc. crystal, and that instead of incorporating its own modulator the unit be modulated by the audio channel of the auto receiver.

All these features have been incorporated in the unit shown in the accompanying photographs. The result has been improved reliability, greatly reduced total battery drain when in the transmit position, and improved overall efficiency.

Tube Line-Up

The tube types employed may seem slightly unusual but their suitability to the requirements of the job has been proven by some months of actual operation as a car installation. The oscillator tube is a 6A4 connected as a tri-tet with a forty-meter crystal and output on twenty. The succeeding doubler to ten is another 6A4 and its plate circuit is inductively coupled to the grid circuit of the final amplifier. The final, which runs at 18 watts input, 300 volts at 60 ma., consists either of a pair of '01-A's or 112-A's. The filaments of all tubes are operated directly from the 6-volt line.

The circuit of the exciter is quite conventional but differs from common practice somewhat in the values of the components employed. The values of the components, particularly the resistors, were arrived at after considerable experimentation and must be duplicated if best operation is desired. The high values of grid leak on the oscillator and doubler stages were found to give best harmonic output with minimum drain from the power supply.

The oscillator cathode coil, L, consists of two pieces of no. 20 d.c.c. wire wound paral-

* Technical Editor, RADIO.

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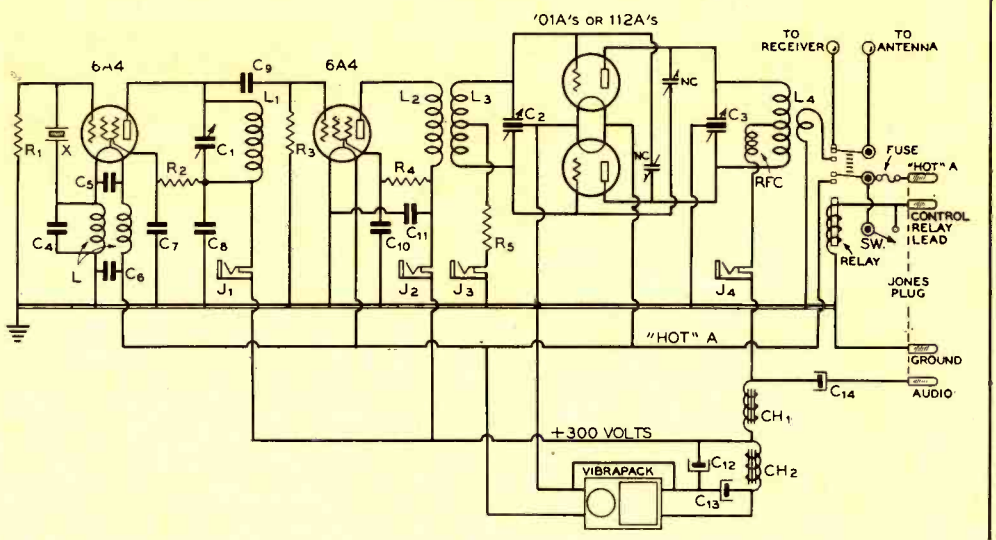

Diagram of the 28-Mc. mobile r.f. section.

C_1—50-μμfd. air padder variable
C_2—50-μμfd. per section, split stator
C_3—35-μμfd. per section, split stator
C_4—.0001-μfd. mica
C_5, C_6—.002-μfd. mica
C_7, C_8—.01-μfd. 400-volt tubular
C_9—.0001-μfd. mica
C_{10}, C_{11} — .01-μfd. 400-volt tubular
C_{12}, C_{13}—Dual 10-μfd. 450 - volt elect. (ultra-compact)
C_{14}—4-μfd. 450-volt elect.
NC—25-μμfd. max. air padder condensers
R_1—250,000 ohms, ½ watt
R_2—100,000 ohms, ½ watt
R_3—250,000 ohms, ½ watt
R_4—40,000 ohms, ½ watt
R_5—10,000 ohms, 1 watt
RFC—2.5-mh. 125-ma. choke
SW—S.p.s.t. switch
J_1, J_2, J_3, J_4—Closed circuit jacks
Relay—D.p.d.t., 5.5 volt d.c. coil
CH_1—10-hy. 110-ma. choke
CH_2—8-hy. 150-ma. choke
Coils—See text
X—7125 to 7500 Kc. low-drift
Fuse — 20 - ampere auto type

lel to each other for 17 turns. This coil is fixed tuned for proper operation of any 7-Mc. crystal by the .0001-μfd. mica condenser, C_4.

The 14-Mc. output coil for the oscillator, L_1, consists of 16 turns of no. 20 d.c.c. Both L and L_1 are wound on 1-inch diameter bakelite forms. L_3, 10 turns of no. 14 enamelled, self-supporting and 1 inch in diameter, comprises the grid coil of the final amplifier. L_2 consists of 8 turns of hookup wire on a ½-inch diameter and is placed inside L_3 to provide coupling from the 6A4 doubler plate to the grid circuit of the final. This method of coupling was found to give the most satisfactory transfer of energy from the doubler to the final amplifier grids.

The final amplifier plate coil, L_4, is made up of 8 turns of no. 14 self-supporting, and is wound upon a 1¼-inch diameter. The coupling coil to the antenna circuit is made up of two turns of no. 14 with spaghetti tubing slipped over it.

Power Supply and Controls

Plate power is supplied to the entire unit by a single 300-volt 100-ma. vibrapack. The voltage is filtered by a single choke and one of the new dual 10-μfd., 450-volt electrolytic condensers. In addition, a modulation choke is placed in series with the plate voltage lead to the final amplifier. By feeding the audio from the auto receiver through the condenser C_{14} to the top side of this choke it is possible to obtain high percentage modulation of the final amplifier.

The four jacks for metering the various circuits of the transmitter, and the control shafts for the three tuning condensers are brought out to the front drop of the chassis. On the back drop are mounted the receptacle plug for storage battery power, control and hot audio leads, the fuse, and the switch which allows the transmitter to be turned on for tuning up. Into the two antenna con-

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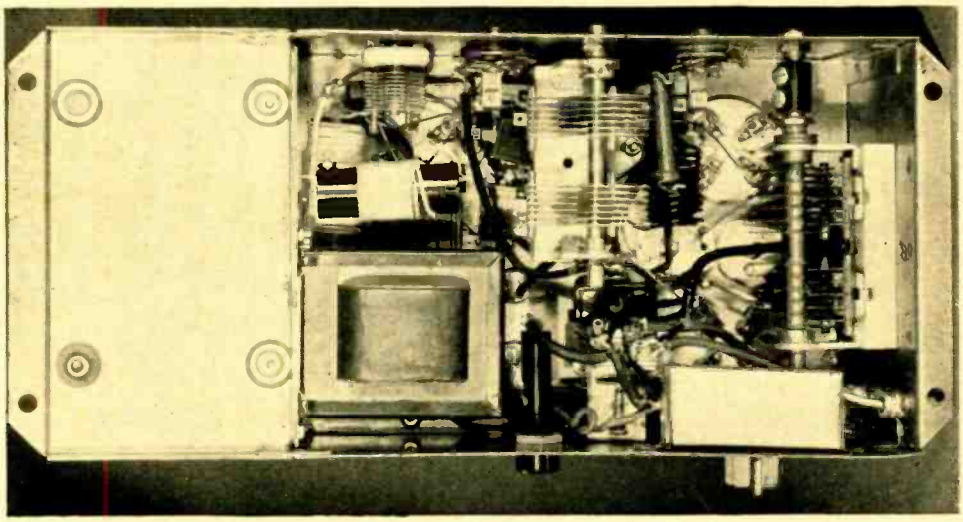

Under-chassis view of the unit. Although the components appear to be quite crowded, the chassis is actually four inches deep which allows them a reasonable amount of breathing room. The cathode and plate coils of the oscillator are mounted one above the other and at right angles on the left wall of the chassis. The grid coil of the final, with its inductive coupling to the plate of the doubler, is mounted upon the leads of the grid tuning condenser in the center of the chassis.

nectors at the end of the chassis are inserted the leads that go to the receiving post on the converter and the lead that goes to the 8-foot vertical radiator.

The control relay is a d.p.d.t. 5.5-volt affair and is mounted vertically directly behind the split-stator grid tuning condenser for the final amplifier. It is important that this relay be capable of consistent operation on 5.5 volts if difficulty is to be avoided when the battery becomes slightly discharged. Some of the commercial "6-volt" relays are not so reliable when there is only a 5.5-volt supply.

Notice that the 20-ampere fuse is between the input terminal and the relay. Should the fuse blow due to an overload everything within the transmitter will be cold.

Operation

The installation of mobile transmitting equipment has been quite well covered in the past. Suffice to say that the lead to the antenna (an 8 to 10 foot vertical "fish pole" has been found to be best) should be short and direct, that the leads to the battery should be of very heavy conductor and, if possible, there should be an auxiliary battery directly at the transmitter. It is only necessary to parallel this battery with the regular car battery to keep the auxiliary one fully charged (provided the generator can handle the additional integrated energy drain of the transmitter). All battery leads should be heavily armored to reduce any possibility of a short on the 6-volt line. Also, it is advisable to run an additional lead directly from the chassis of the transmitter where the end of the pickup loop is grounded to the frame of the car. The bolt used for this purpose can be seen on the end of the chassis in the top view photograph.

Tuning Procedure

Tuning the transmitter is conventional and need not be covered in detail. The voltage on the vibrapack should be reduced (by turning the tap switch on the side of the pack) and an opened plug inserted into the plate circuit of the final. Then the milliammeter should be inserted into the plate jack of the 6A4 oscillator and its plate condenser tuned for dip. The meter should then be moved to the plate circuit of the doubler and the same procedure repeated. The meter can then be inserted into the grid jack of the final amplifier and the amplifier can be neutralized by the grid-dip method. The two neutralizing condensers are mounted with their slotted ends projecting through the chassis between the two amplifier tubes. Both the '01-A's and the 112-A's neutralize quite perfectly.

After neutralization the plate voltage may be raised to the full amount and the opened plug removed from the plate circuit of the final. The current readings can be checked

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after the transmitter has been retuned throughout. The oscillator and doubler should each draw about 20 ma., the final grid current should run from 5.5 to 10 ma., the unloaded amplifier plate current should be about 20 ma. and of course it should be loaded to draw 60 ma.

The Auto-Set Modulator

The auto receiver is a 1938 model that ended up with a 6N7G in the output stage, driven by a 6J5G and a 6R7G. There are a number of popular auto receivers of the larger type that have ended up with tubes of the 6A6, 79, and 6N7 class that would have ample power output to modulate this transmitter fully.

This particular one (a Delco 668) was modified in the following manner to no detriment of its operation in the b.c. band: First the plate voltage lead that goes to the tubes ahead of the audio channel was determined and broken, two leads being brought out. A d.p.d.t. 5.5-volt relay and a single-button mike transformer were then installed inside the cabinet of the auto set. The two high-voltage leads were then connected to one set of the relay contacts so that the plate voltage would be applied to the r.f. tubes only when the relay was non-operated (the high voltage to the ten-meter converter was also taken from the lead going to the r.f. tubes in the auto set). Through this expedient the drain of the r.f. stages of the receiver and the drain of the converter is removed from the auto set power supply when full plate voltage is needed for use of the 6N7 (or similar tube) in the set as the modulator.

Then the lead going from the diodes to the control grid of the first audio tube is determined. The audio lead from the diodes is brought to one of the outside contacts of the other side of the d.p.d.t. relays and the center lead of this side is connected to the control grid so that when the relay is non-operated the original circuit will be completed through the auto receiver. The lower contact of this side of the relay is then connected to a voltage divider across the secondary of the mike transformer. This voltage divider can consist of a pair of ½-watt resistors and is usually needed because the gain of the audio channel of the auto set is more than is needed with a single-button mike. The correct values of the resistors can be determined by noting how much voltage is required at the grid of the audio tube with normal talking at the mike to modulate the transmitter fully. About one-fourth the voltage output of the transformer was required in this case. It is also advisable to shield all these leads quite carefully to avoid stray pickup. Also, do not mount the mike transformer too close to the power transformer of the auto set; it will almost surely pick up hum from this transformer.

The switching of the output stage of the auto receiver from the speaker to the transmitter was accomplished in the following manner: A 10,000-ohm 6N7 class-B output transformer is mounted upon the speaker housing of the auto receiver along with another 5.5-volt d.p.d.t. relay. The two plate leads to this transformer are paralleled with the plate leads to the speaker output transformer; the plate-voltage lead of the modulation transformer is not connected. One side of the 4500-ohm secondary of the modulation transformer is grounded; the other secondary lead is connected to the center contact of one side of the relay. The contact of this side of the relay that is closed when the relay is operated is run to the transmitter and connected to the "hot audio" pin on the input plug.

Then the ungrounded voice coil lead from the speaker output transformer is connected to the center contact of the other side of the relay. Then the contact on this side of the relay that is closed when the relay is *non-operated* is returned to the voice coil of the speaker. Thus the audio output of the speaker transformer goes to the speaker when the transmitter is off and the audio output of the modulation transformer goes to the transmitter when the rig is on. The unloaded transformer that is connected across the 6N7 under either condition of operation has been found to cause no ill effects.

The coils of all three relays—the one at the transmitter, the one in the receiver, and the one on the speaker housing—are connected in parallel.

Power Drain

The drain of the transmitter proper is just under 10 amperes; slightly over eight amperes for the vibrapack and about 1½ amperes for the filaments of the tubes and the control relay. This drain added to the approximately 7-ampere drain of the auto receiver when acting as a modulator gives a total of less than 17 amperes which is very low for an 18-watt rig. In addition it must be remembered that the auto receiver is now being employed as a part of the transmitter; the normal 6 to 8 ampere drain of the receiver when in the transmit position is eliminated. Also eliminated by using the audio channel of the receiver as a modulator are another

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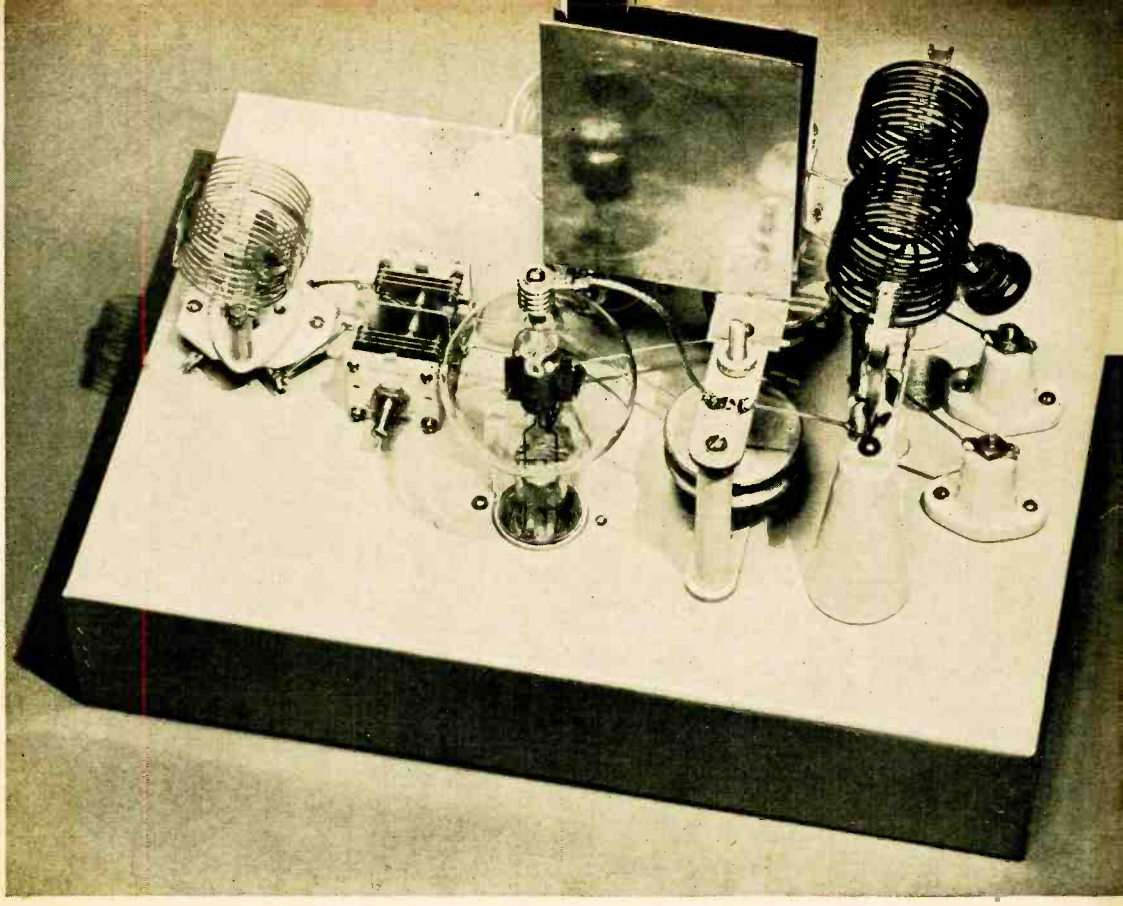

An INDUCTIVE-TUNED 75T Amplifier

The amplifier illustrated in the above photograph incorporates some of the very newest in amateur equipment—specifically, a pair of the new Eimac 75T's and the new Decker MRV variable-inductance plate coils. Aside from the fixed-capacity plate tank condenser, the amplifier is more or less conventional in design. One side of the filament is grounded to the chassis as is the rotor of the grid tuning condenser. The 7500-ohm, 20-watt grid leak is mounted below chassis.

The variable-inductance plate coils are of especial interest since the amplifier is built around them. These coils are designed for comparatively low-C operation on the 14- and 28-Mc. bands and are resonated to the desired frequency of operation by means of a slotted shaft on the end of the coil plug-in assembly. The coils proper are wound of copper-clad steel wire and have a tendency to be quite springlike. Then, to vary the inductance of the coil, the center turn is anchored for the plate voltage connection and the ends are pulled in or out by a silver-plated copper strip which is wound around the tuning shaft. When the shaft is turned in one direction the end turns are pulled out, the coil expands, and its inductance decreases; when the shaft is rotated in the other direction the coil contracts and the inductance increases.

The 20-meter coil is made only in one inductance, a value which will tune over a somewhat wider range than the band when used with a total of circuit and tank capacity of 20 $\mu\mu$fd. The 10-meter coils, however, are made in two ratings, one to tune with a total of tank and circuit capacities of 14 $\mu\mu$fd. and the other to tune over the entire band with only an assumed value of about 6 $\mu\mu$fd. for the circuit capacity. This latter 10-meter coil is designed for use with low-C tubes when operating at comparatively high plate voltages and low plate current.

The 75T's have a moderately low plate impedance and will operate very satisfactorily

[*Continued on page 81*]

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COMPACTING *the 3-Element Rotary*

By C. M. WEAGANT,* W7GAE

A description of a three-element rotary installation where the end eighth waves of each element have been bent down at right angles to reduce the overall space consumed by the array. Improved results in the form of less off-side radiation are claimed for the system.

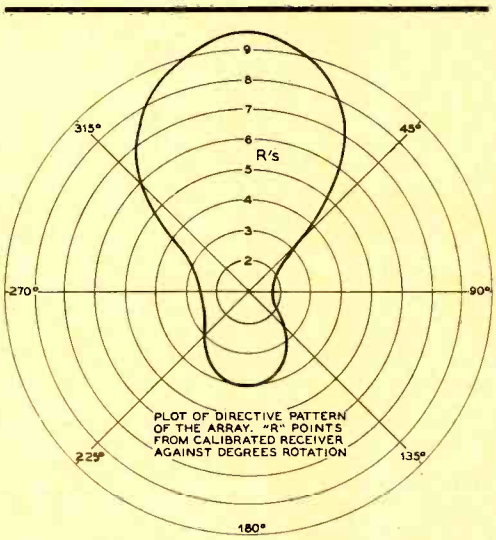
Finding the necessary space to put up a standard three-element 20-meter rotary beam is often more easily said than done. At W7GAE it was practically impossible, so it was decided to try a bit of compacting. After some experimentation, it was found that by turning down the end eighth waves (the end quarters of each half-wave element) the space required was not only reduced to half of its former value, but also the directivity improved. Bending the elements in this manner does not materially reduce the horizontally polarized power radiated in the forward direction since the current flow in the end eighth waves is very much less than in the center quarter.

A field strength meter was set up about 100 feet from the antenna when it was tuned up. It was only necessary to rotate the beam through about 10 degrees before the reading would drop noticeably. The pattern was much sharper than that obtained at another station using a standard three-element array. In that instance, it required about 22 degrees of rotation to make an appreciable difference in meter reading.

Front-to-Side Discrimination

Bending the end quarters of the elements down drops the radiation on the sides down at least 6 R's, a power reduction of 5000 to 1, or 36 db. A straight three-element job only drops the side radiation on an average of 12 to 24 db, a power reduction between 16 to 1 and 250 to 1. This increased drop is probably due to the fact that there is vertical cancellation from the end sections as well as horizontal cancellation from the center. The front-to-back ratio is about the same as that of a standard three-element array, 30 db, or a power reduction of 1000 to 1.

A number of tests were made to determine the directive characteristics of the array. They were made with the cooperation of a local amateur, using his station, 5 miles away, as a receiving point. The results are shown in the accompanying chart.



PLOT OF DIRECTIVE PATTERN OF THE ARRAY. "R" POINTS FROM CALIBRATED RECEIVER AGAINST DEGREES ROTATION

Dx stations report R9 to R9 plus when the beam is on them. When it starts around, the signal goes down quite fast to R3 in the noise level. Many stations think the rig is off entirely, until the beam swings back

* 4110 N.E. Fremont St., Portland, Oregon.

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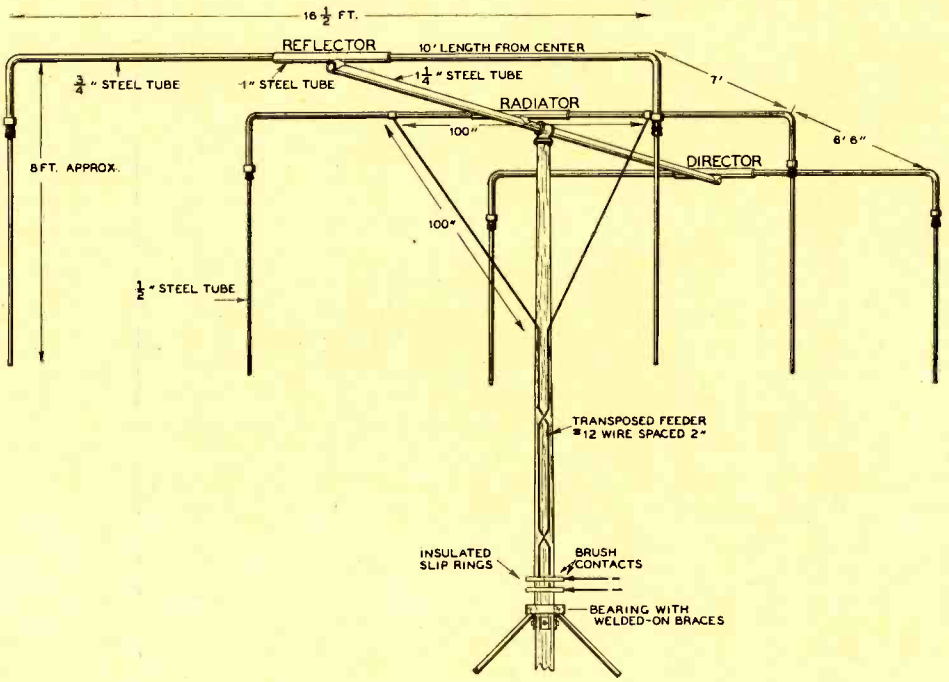


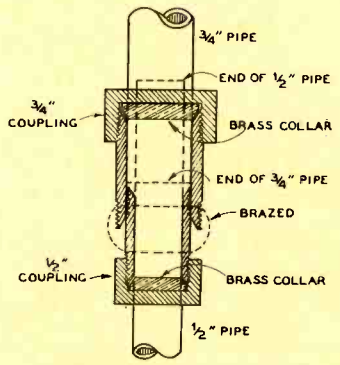
Working constructional diagram of the compacted three-element array.

around. A lot of them say that this is the first W7 that they have been able to work. U. S. stations all show as much change as the local test and many report even more.

Construction

The beam is constructed entirely of galvanized steel tubing. The sections are all brazed together, and there are no insulators to crack or lose power, and no wood structure to rot in wet weather or twist out of shape in the wind. The total horizontal area required for installation is only 13½ by 16½ feet. The beam, complete with cross member and all fittings, weighs around 70 lbs.

The main cross member is of 1¼-inch steeltube. This has a tee brazed onto it which is of the proper size to fit over the top of the supporting pole. Three 3-foot pieces of 1-inch steeltube are brazed at the proper intervals along this main member, and at right angles to it, to hold the three elements. The elements themselves are made of ¾-inch steeltube and are bent down about 8 feet out. The tunable sections of the elements are ½-inch steeltube, telescoped at one end into the ¾-inch sections and flared out so as to make a tight fit. The couplings used to hold these two sections at any determined point are shown below. They are made by taking the nut and brass ring assemblies from one end of both a ¾-inch coupling and a ½-inch



Method of joining and brazing a ¾-inch and ½-inch steeltube coupling to form the ¾-to-½ reducer for the end sections of the array.

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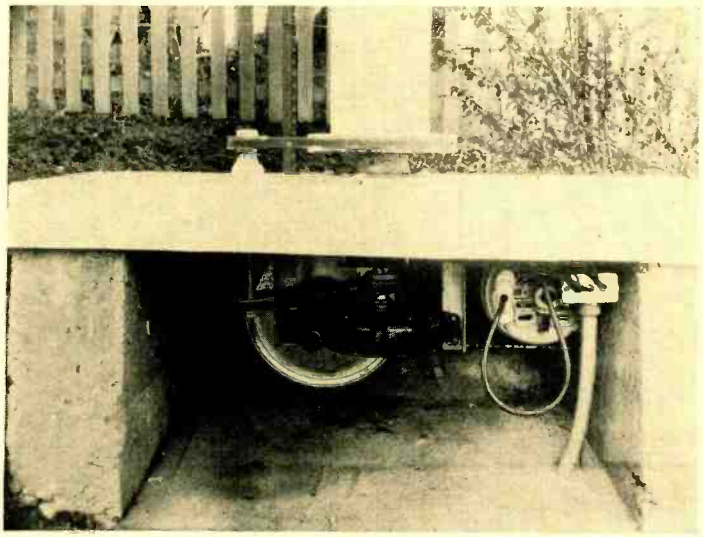

The permanently installed rotating arrangement for the beam. See text for description.

coupling, and then sliding the ½-inch part into the ¾-inch and brazing the junction. The remaining ring in the ½-inch section may have to be filed out slightly to allow the smaller pipe to go right on through into the larger.

When completed the array can be coated with Nu-Enamel clear or aluminum enamel or clear lacquer to protect the galvanizing.

Feeding the Array

Any type feed line may be used. The delta distance is 100 inches for the 2-inch spaced transposed no. 12 wire line shown. For EO-1 or concentric feed, the correct delta distance is about 48 inches. Copper straps are used as feeder clamps on the ¾-inch radiator. The length of the radiator for the center of the band is 33'8". The director should be 31'9", and the reflector 35'4". These lengths differ just slightly from those for a straight beam.

The rotating pole was installed about two years ago, and has been very successful. It is of Douglas fir and is 40 feet high. The base is 5½ inches in diameter, while the top tapers to 2¼ inches. A ball bearing from the rear axle of a White truck is located 10 feet up from the ground. Around this is a steel ring to which three 1-inch pipe supporting members are welded. The lower ends of these latter are set in concrete. The bearing has a 6-inch inside diameter. Four pieces of strap iron are electrically welded to the inside so that it may be securely fastened to the pole.

The slip-ring feed system shown with its protective cover.

Slip Rings

Above the bearing on the pole are two collector rings. These are made of 1-inch sections of 6-inch diameter brass pipe and are set away from the pole by stand-off insulators. The feeder wires connect to these from the array. Two Ford copper starter brushes are mounted on insulators so that they ride on the rings. This system has been in use for nearly two years with a one-kilowatt transmitter, and has caused no trouble at all. There is no sparking with the transmitter on and no noise in the receiver when the beam is turned while using it for receiving.

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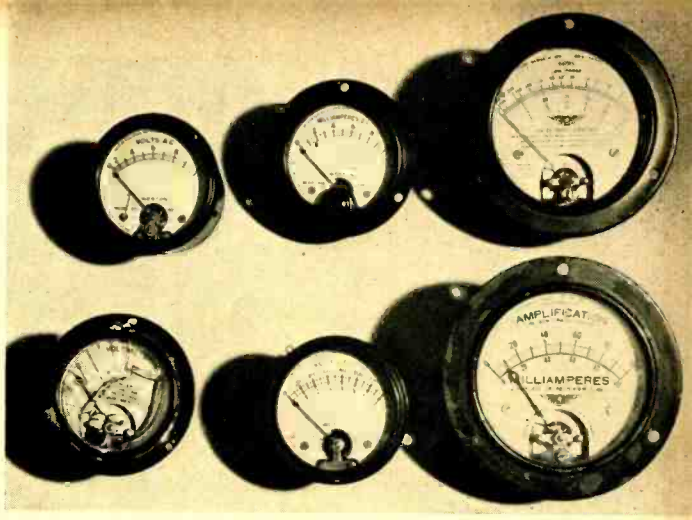

The three meters in the bottom row are typical of the good quality instruments which are available at a reasonable price from parts stores which handle used equipment. All are in doubtful shape but are well worth being revamped. The top row shows three similar instruments after they have been overhauled and recased. They are good for many years of trouble-free service and are, in most cases, considerably better than new meters of the less expensive variety.

MULTI-METERING *the Transmitter*

By EMILE MILLES*

A continuous knowledge of the operating conditions within each of the circuits of the transmitter can help greatly in prolonging the life of the components and in increasing the reliability of the rig. Individual metering is too expensive a solution for the average amateur; multi-metering does not expose the operator to dangerous circuits, is highly reliable, and is much less expensive than any other system of measurement.

Every amateur should know the current and voltage readings in the grid and plate circuits of the major stages in his transmitter. A periodic check throughout the various stages will avoid many parts failures and will give a satisfying feeling that all's well in the rig. The transmitter should be checked in advance of every session on the air, and especially so if it has been idle for a week or more. Periodic checks of the meter readings against readings known to be correct will keep the operator thoroughly informed as to the condition of tubes and components in the rig. These regular checks keep the commercials on the air day in and day out over long periods of operation; leaving the air for repairs is an infrequent occurrence among the broadcasters. Amateurs, on the other hand, very often have their transmitters fold up in the middle of a QSO.

Those frying noises in the vicinity of the plate transformer can be stopped by intelligent metering before they have a chance to develop into serious trouble. The majority of us are unable to afford a large number of meters, so we'll have to make one or two do everything. The plug-and-jack method is far too dangerous and rather slipshod to say the least. But there is a much better system that is easily applicable to amateur transmitters.

When the junk man departed with the plate transformer for the final, it was immediately decided that the rig would be made foolproof, and it has been. As it now stands, every portion of the rig can be checked while transmitting and only one meter requires watching. You've guessed it; we *are* talking about meter switching.

Selecting the Instrument

Choosing the one meter for a rig is fairly simple. Any well-made meter whose sensitivity is higher than 10 ma. will do. If economy is a factor, dig up one of those two-inch Weston meters that were used in the battery sets of the 1920's. These meters are of excellent quality, have good bearings, and will give reliable service. Most of them are five-volt meters with a sensitivity of 8 ma.

* 1650 W. 36th St., Los Angeles, Calif.

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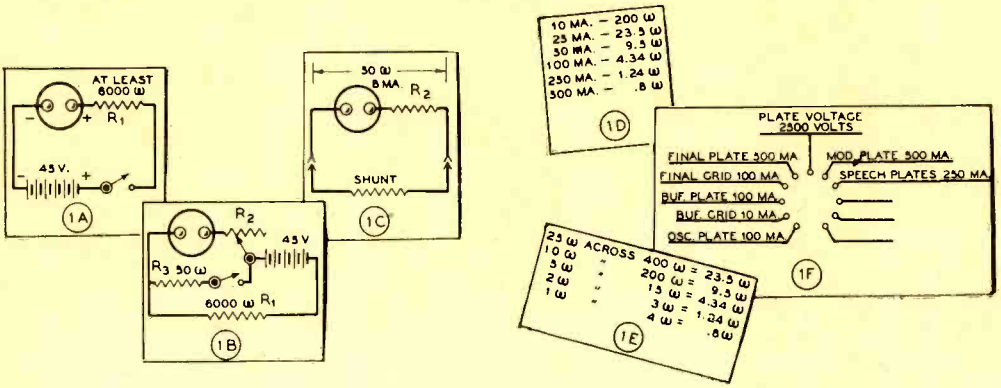

Figure 1.

Determining Meter Sensitivity

Determining the sensitivity and resistance of the meter is a simple process. The sensitivity can be determined quite easily by using the circuit in figure 1A. Using a 45-volt battery, put about 250,000 ohms at R_1, just in case it's a microammeter. If the deflection is too low to be usable, gradually reduce the value of resistance at R_1 until full-scale deflection is approached. Dividing the resistance into the voltage will give the current flowing in the circuit. In one case, the resistance which was close to full scale deflection was 6000 ohms. Using Ohm's Law: I equals E divided by R, or 45 divided by 6000, which gives .0075 ampere. From this measurement we can safely assume that the full-scale sensitivity of the meter is 8 ma. Since meters generally are of even-milliamperes sensitivity we can assume that the current determined by this method will be accurate to the nearest whole number. If the meter is a voltmeter we can measure the resistance with an ohmmeter, and divide the resistance into the voltage of the meter to determine its sensitivity in ma.

Remodeling

Now that the sensitivity of the instrument has been determined we can start our remodeling process. Carefully remove the instrument from its case and hook it up as in figure 1A. Make and break the contact and notice the needle action. If the needle moves smoothly and always stops at the same point, the bearing is evidently passable, and should be left as is. If it shows a tendency to be erratic, the bearing will have to be tightened. Do not use an ordinary small screwdriver; borrow a watchmaker's screwdriver. Tighten the bearing a small fraction of a turn at a time, testing the needle action after each adjustment. Adjustments of the bearing which are too tight or too loose will be easily detected.

Any multipliers within the instrument should be removed. Examine the mounting carefully so that the leads to the moving coil will not be harmed. Now our meter is a milliammeter with a full-scale sensitivity of 8 ma. and has only the resistance of the moving coil. This resistance is generally too low to be used conveniently. For many reasons it is advisable to add resistance externally until we have a total meter resistance of 50 ohms. This can be done by using circuit 1B. With the switch open, note the reading of the meter. Then close the switch and cut in sufficient resistance at R_2 to drop the reading to exactly one half of the initial indication. The resistance within the meter combined with R_2 will be equal to the 50-ohm external resistor. A resistor at R_3 with an accuracy of at least 2% is advisable.

Since the basic sensitivity is 8 ma., shunts will be used to read higher currents. Suppose we require a 10-ma. range; 8 ma. will flow through the meter at full-scale deflection and 2 ma. through the external shunt as in figure 1C. The ratio can be stated as 8:2::x:50, so 2x equals 400; and x, which is the shunt value, is equal to 200 ohms. If a 25-ma. range is desired the shunt must pass 17 ma. and the meter will carry its same 8 ma. The ratio will then be 8:17::x:50, so 17x equals 400 and x will be 23.5 ohms. Any range can be figured by this ratio.

The table in figure 1D shows the shunt values for any of the common ranges using

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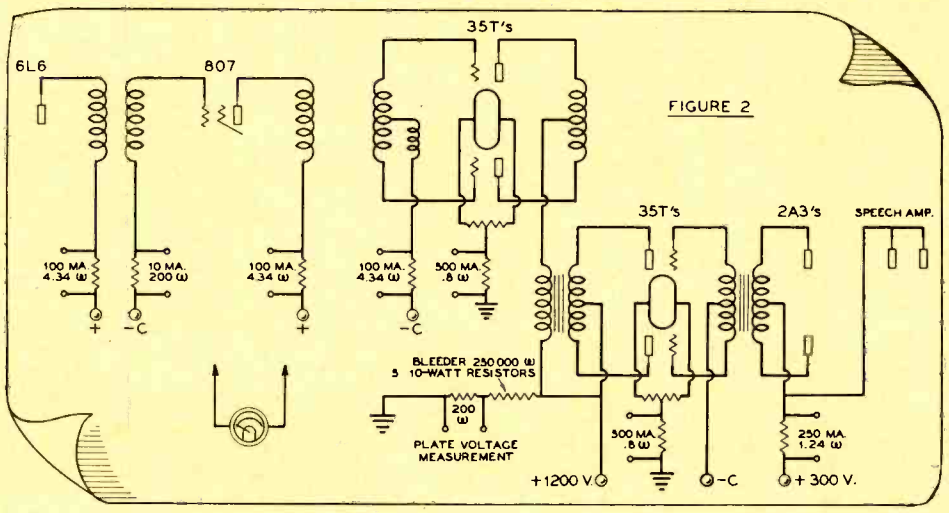

FIGURE 2

an 8-ma. meter movement with a total resistance of 50 ohms. Since these are odd values difficult to obtain, all the shunts except the 200-ohm shunts were made by paralleling two resistors of values easily obtained (see table 1E). Good accuracy can be obtained by checking with a standard milliammeter, and substituting different resistors for the higher values of shunt.

A Transmitter Application

A description of the system as used in a particular transmitter may clear up any difficulty. The transmitter in use at this station consists of a 6L6 oscillator-doubler into an 807 driving a pair of 35T's running about 1200 volts at 200 ma. The modulator is a conventional speech system with 2A3's driving 35T's in class B. An eleven-point two-gang non-shorting switch is used to read any circuit. The circuit (simplified) is shown in figure 2. This switch has adequate insulation for 600 volts as long as there is no r.f. or a.f. on it. In other words, the shunts must always be on the cold side of the r.f. choke and by-passed to ground.

The current reading for the total speech system will enable you to be sure everything is running class A, an absolute necessity for good quality when using a driver of this type.

The plate and grid currents of the final stage are the readings most indicative of what's going on in the rig. Occasionally, the meter is switched around during the evening to be sure that everything is running normally. A two-hour check was recently made upon the transmitter, loading the final with a dummy antenna consisting of a lamp bank. Readings taken every 10 minutes showed that the plate currents were creeping slowly. An audio oscillator was used to feed a constant signal into the modulator. Because of the thoroughness of the metering it was possible to make adjustments and to see the effect of such changes on the whole rig.

A change in several ground returns reduced the creeping but touching any part of the rack or the mike caused a flick in the current readings all along the lineup. Additional by-passing was installed, and a ten-ohm wire-wound resistor was put in the 807 plate lead. This eliminated the last trace of regeneration or parasitics. Every reading was steady with wide variations in the modulation. The plate voltage of any stage could be turned off with perfectly normal changes in the other stages.

R.f. feedback into the speech amplifier was quickly detected, using the speech amplifier plate current reading. With the modulator plate voltage off, the r.f. section was turned on and off, watching the speech amplifier plate current. By-passes and thorough grounding eliminated the wide variation in the speech plate current when the r.f. was on. With the speech system stable and free from r.f. all of the original carrier hum disappeared.

After a long period of experimentation, we finally have evolved a rig which we think is up to commercial standards, and *one* meter showed us the way.

●

Baked Ham

Q R X Gabriel
I'm comin' in on the beam
Another careless ham
Cooked by an electron stream

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PHONE BREAK-IN

with Loudspeaker Operation

By J. EVANS WILLIAMS,* W2BFD

In the December, 1938, issue Mr. Williams described a completely electronic voice-operated break-in system which had considerable merit. However, in common with other circuits of this type, the system had the disadvantage that the operator had to wear headphones as the sound from the receiver speaker would turn on the transmitter. In this article a circuit is described which blocks the speech amplifier when a signal is tuned in on the receiver thus allowing full-volume loudspeaker operation.

However attractive a new idea may appear on paper, a trial is required before the interested amateur is convinced as to its benefits and enlightened as to its shortcomings. At the time of writing the first article on "Phone Break-In without Relays,"[1] the writer was little aware of the interest that would be manifested by numerous amateurs who have since written him regarding the system.

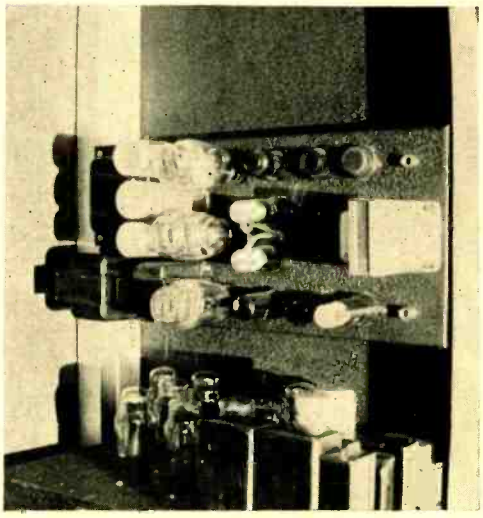
It has been suggested that phone break-in would be even more popular were it not necessary to wear earphones to prevent the receiver from acoustically operating the transmitter. Could loudspeaker operation be made practical, it would have several advantages over duplex. First, a number of people in the station can join in the rag chewing without wearing earphones. Second, visiting b.c.l.'s who find such difficulty in the usual method of "talk a while—listen a while" will feel more at home chatting with someone who can snap right back at them as soon as they pause. Third, two, three or a dozen stations in a net need but *one* frequency, yet all can talk and listen without touching a switch. In fact, with the loudspeaker system, one need not necessarily be near the microphone to control the transmitter.

* 68-06 61st St., Woodside, N. Y.

[1] Williams, "Voice-Operated Break-In," RADIO, Dec., 1938, p. 40.

Disadvantages of Present Systems

There are several disadvantages to conventional voice-operated break-in systems. If the receiver gain is advanced sufficiently to allow comfortable audibility, the received signal will have the same effect at the microphone



Looking into the transmitter rack. The additional silencing circuit is built into the speech amplifier seen at the center of the photograph.

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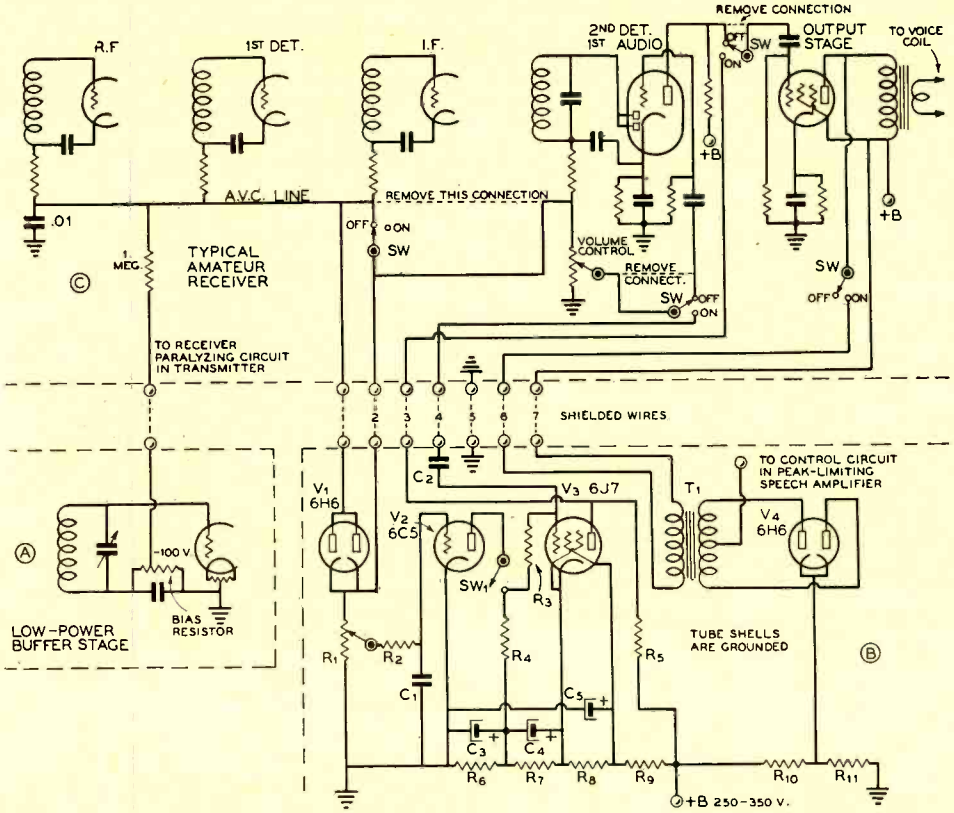

Figure 1. Section A is the circuit shown in December, 1938, RADIO which blocks the receiver when the transmitter is in operation. Section B is the new speech-amplifier silencing circuit.

C_1, C_2—.01-μfd. tubular
C_3—4-μfd. 50-volt electrolytic
C_4—20-μfd. 10-volt electrolytic
C_5—8-μfd. 150-volt electrolytic
C_6—See text

R_1—1-megohm potentiometer
R_2—500,000 ohms, ½ watt
R_3—1 megohm, ½ watt
R_4—50,000 ohms, ½ watt
R_5—20,000 ohms, ½ watt

R_6—2500 ohms, ½ watt
R_7—300 ohms, ½ watt
R_8—10,000 ohms, 5 watts
R_9—15,000 ohms, 5 watts
R_{10}—100,000 ohms, 2 watts

R_{11}—1000 ohms, ½ watt
T_1—Small driver transformer
SW—Four-pole double-throw switch
SW_1—S.p.s.t. switch to disconnect squelch circuit

as the operator's voice. That is, the local transmitter carrier will be emitted which, naturally, will result in the receiver being blocked. This in turn removes the source of the signal and causes the transmitter to turn off, thus producing a slow motorboating effect. If the speech gain is reduced, the system stabilizes but then it is necessary to speak very loudly or else the transmitter will fail to come on. A system is needed which will allow the receiver gain and the microphone gain to be independent of one another.

Blocking the Speech Amplifier

One possible arrangement, which is the subject of this article, is to paralyze or block the speech amplifier with a d.c. voltage derived from the rectified audio output of the receiver. At first thought there would seem to be a question as to whether the rectified receiver output would act quickly enough to block the speech amplifier before the signal from the speaker reached the microphone and succeeded in turning on the transmitter. Fur-

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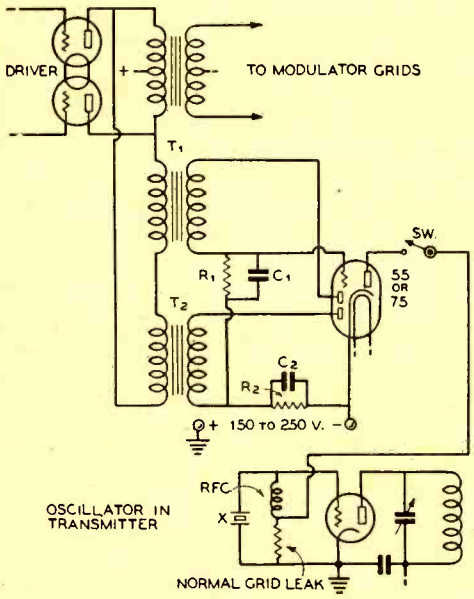

This circuit, which was originally shown in the December, 1938, issue of RADIO, is used to provide voice-operated transmitter control. If the circuit does not operate properly, either the primary or secondary connections to one transformer should be reversed to obtain the proper polarity.

T_1, T_2—Audio transformers, 1:1 to 1:3 ratio
R_1, R_2—500,000 ohms, ½ watt
C_1—.01-μfd. tubular
C_2—0.1-μfd. tubular
SW—S.p.s.t. switch to disconnect break-in system.

ther consideration will make it obvious that, with reasonable separation of loudspeaker and microphone (5 to 10 feet) the time required for a sound leaving the speaker to arrive at the microphone may be between 5 and 15 milli-seconds (sound travels approximately 1100 feet per second in air), whereas the time constant of the blocking circuit can be made very short indeed. Thus, the speech amplifier will be already blocked by the time the sound arrives. However, there are other obstacles, QRM and QRN. If there is any output from the receiver after the distant operator ceases to speak, this output (QRM, etc.) will be rectified and will keep the speech amplifier permanently disabled. To overcome this we can incorporate a squelch circuit; an old b.c. receiver dodge that silences the receiver audio circuit when the distant station's carrier ceases. By including a level adjusting control our receiver will be absolutely silent whenever our remote friend stops talking. Thus, whichever operator speaks first blocks his own receiver and the distant transmitter's speech amplifier. The receiver blocking circuit is reproduced from the December article[1] in figure 1A. Figures 1B and 1C show the speech amplifier blocking circuit and the method of connecting the two blocking circuits to the receiver.

Speech Blocking Circuit

Since the speech amplifier blocking circuit resembles a peak-limiting audio amplifier of the type now so popular to reduce overmodulation, any amateur having such a speech amplifier need but bring out one connection from the gain reducing circuit. In the writer's case the speech amplifier circuit was the one described in the November, 1937, issue of RADIO,[2] in which the gain-limiting tubes are in push-pull. The control stage in this amplifier consists of two 6J7's in push-pull with their suppressor grids tied in parallel and used as the control elements, thus forming a balanced-modulator circuit which does not amplify the blocking impulse. It is desirable to operate this stage of the amplifier in push-pull so that the blocking impulse from the receiver will not be transmitted and amplified, thereby turning on the carrier. Note that the connection of the blocking circuit to the speech amplifier in no way lessens its peak-limiting ability. This should be sufficient incentive for those amateurs who have fallen in step with the current trend toward automatic overmodulation prevention to make the few alterations necessary for automatic break-in operation.

The voice switching equipment (figure 1B) was built into the speech amplifier. It could just as readily be mounted on a small separate chassis, however. The only alteration to the receiver is to mount a 7-prong socket on the back of the receiver and to install a 4-pole double-throw switch (SW figure 1C). These are wired to the correct points in the receiver. Conventional operation can be secured by throwing this switch to the "off" position. A cable of seven shielded wires plugs into the socket at the rear of the receiver and connects it to the speech amplifier.

Circuit Operation

Operation is as follows: When the incoming carrier goes off, the d.c. voltage appearing across the receiver volume control ceases to

[*Continued on Page 93*]

[2] Dawley, "Peak Compression Applied to the Speech Amplifier," p. 11.

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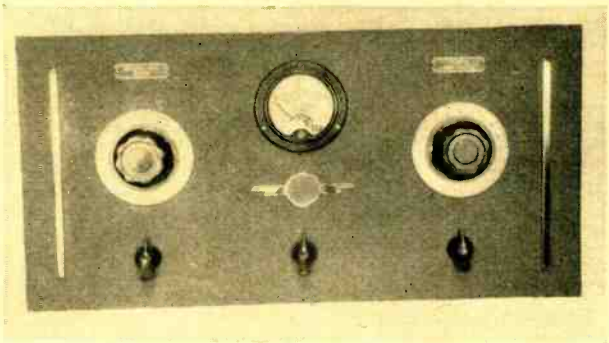
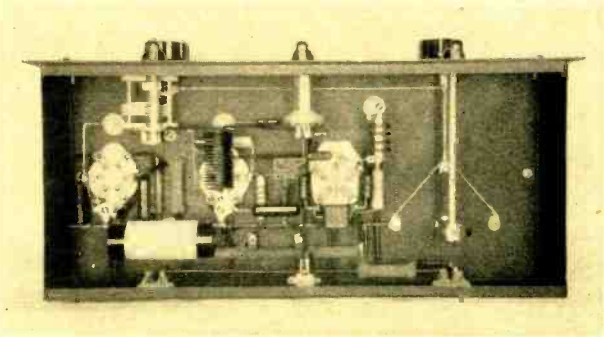
A DE LUXE "4-25"

For Relay Rack Mounting

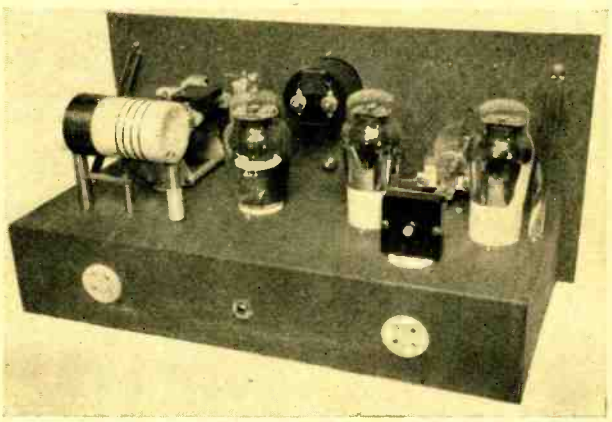
Wilbur C. Stevens, W8DLR, is responsible for this version of the "4-25" exciter in Sunday clothes. As the exciter was to be mounted in a standard width relay rack, a larger panel and chassis than specified in the original article were used and the parts spread out a bit.





To permit short leads, the two band switches are set back from the front panel and operated by extension rods. The final tank switch is mounted right at the tank coil (above chassis) and worked by means of the cam on the end of the extension shaft to the right.

The exciter is as neat appearing from the back as from the front. In this particular model no shield baffle was found necessary, though occasionally such a shield (between 807 and the 42's) will be found necessary. Full details on the "4-25" exciter, which delivers approximately 25 watts on 10, 20, 40, and 80 meters from one crystal, are given in the Dec., 1938, issue of RADIO.



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OPTIMUM SPEECH CHARACTERISTICS

• for DX

By J. W. PADDON,* G2IS

The experience of several years' radiotelephone operation in the 28-Mc. band showed that there was an optimum speech characteristic for dx work. We set out to determine the best a.f. overall curve for the modulator to bring signals through fading and interference with the highest degree of intelligibility.

Studying the approach to the problem showed that there were a number of factors outside the control of the investigator. To begin with: The bandpass characteristics of communications receivers vary. Then, no two people hear with the same response and, equally, their voices are never the same. And selective fading is sporadic and produces different effects. It was decided that an average characteristic could be isolated by correlating the opinions of a large number of stations as contacted under normal operating conditions.

It was obvious that the transmitter was the only factor that could be under the direct control of the investigator. In all technical problems it is essential to have a known basis of comparison—a reference level or "control." The first step, therefore, was to provide a transmitter having a known linear a.f. characteristic stretching well beyond the limits of useful voice frequencies.

The microphone used was a professional moving coil instrument of the highest quality. The preamplifier contained one high-μ triode tube after the microphone. This stage was resistance coupled to a medium-μ triode which, in turn, was parallel fed through a matching transformer to a 500-ohm line. The volume control was a potentiometer in the grid circuit of the second triode. The 500-ohm land line terminates at the transmitter some hundred feet away from the control position. The line-to-grid transformer actuates a low-μ output-type triode which drives the main modulator valve (tube), a Western Electric type 212D running class A and well below maximum rating. Transformer coupling is used in both the grid and plate circuits of the 212D.

"Gain runs" were taken by injecting tone from a constant-output beat-frequency oscillator into the microphone input of the modulator network. A portion of the field of the antenna was rectified by a simple diode and amplified to actuate a vacuum-tube voltmeter. The overall curve from microphone input to antenna is shown in figure 1.

The basic circuit of the amplifier is shown in figure 2—values are not given as the tubes used were British types which will not be familiar to the majority of the readers. Checks were made on "high fidelity" type broadcast receivers and from amateur stations who reported "broadcast station quality." These checks were more important than they seem. An a.f. amplifier can show an excellent overall characteristic with a pure sine wave drive and yet show up badly under speech modulation due to amplitude distortion, transient effects, etc.

In order to find our characteristic a variable-frequency correction filter was inserted in the 500-ohm line after the pre-amplifier.

* Bussock Hill House, Newbury, Berkshire, England.

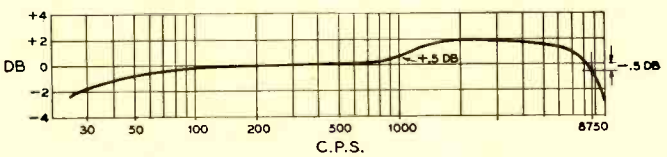

Figure 1. Overall curve — microphone input to field-strength meter.

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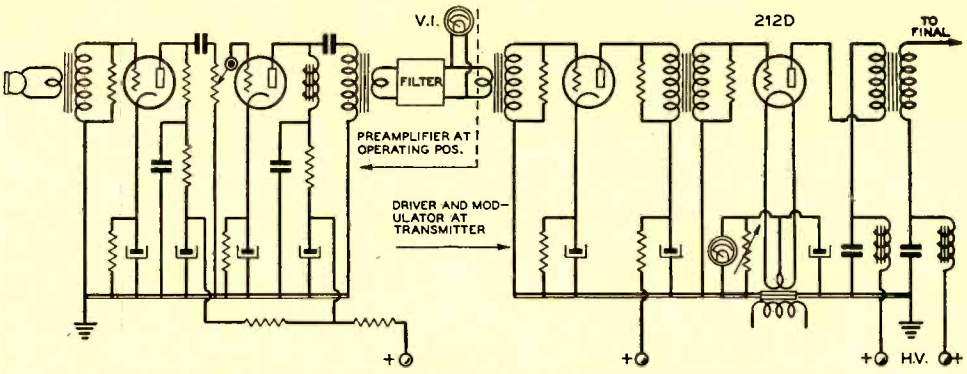

Figure 2. Simplified schematic of preamplifier, method of connection of filter and volume indicator, and the modulator at the transmitter.

A volume-level indicator was bridged across the line after the filter in order to keep the level constant. By varying the depth of setting and the ratio of setting of the correction filter practically any curve could be set up. The filter was loaned by a research organization. The circuit of the filter is not given as the complexity of the circuit and the precise inductance and capacity values specified place it beyond the building capabilities of the average amateur.

The test procedure was simple. A station was called with no correction in the speech circuit. When contact was established the observer was asked to get a good mental picture of the *intelligibility* (as opposed to quality) of the received signal under the existing conditions. Various filter settings were then tried and guidance sought from the observer. A return was always made to the linear setting between each change in the curve in order that the observer should not lose touch with his standard.

It was remarkable how the observers chose unerringly a typical curve. The limits between individual choices were very narrow. We can, then, assume that there is one optimum a.f. characteristic for optimum dx working. This characteristic has been arrived at purely by "cut and try" methods. No mathematical analysis has been attempted.

The bandpass characteristic of the receiver has great bearing on the high-frequency end of the voice spectrum. In most cases any changes above 4000 cycles were not apparent to the observer although the effect was quite pronounced in the linear monitor at the station. In some cases a sharp cutoff at 3000 cycles was not apparent to the observer and in one case—with a crystal filter in the circuit—the dip had to be brought down close to 1500 cycles before it was noticed.

We can therefore assume that, at the outside, 3000 cycles should represent the top limit of the high-frequency response required. If we assume a carrier with 9000-cycle modulation we will then cover from 28,221 to 28,239 kc. If we stick to our limitation of 3000 cycles—then the band is 28,227 to 28,233 assuming the transmitter frequency to be 28,230. The saving is 12 kc. If 20 stations are operating we have .24 megacycles of needless splash and splutter neatly amputated from the phone band.

No one wanted any bass at all. There was a certain wavering of opinion about the h.f. end of things but bass was enthusiastically ruled out by everyone with whom the test was made. As the bass end of the curve began to droop reports came in of rapidly increasing intelligibility and of an apparent increase in signal strength. It should be noted in passing that the voice used in these tests has a heavy bass characteristic. The final curve figure 3 shows a 24 db attenuation at 50 cycles and a steeply rising charac-

[*Continued on Page 94*]

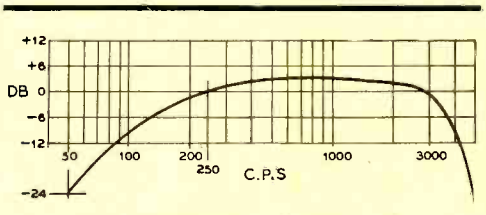

Figure 3. Optimum speech characteristic curve as determined from the experiments.

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HANG IT ALL

By ERIC T. LEDIN,* W6MUF

A beam an issue is a conservative estimate of editorial output in current ham magazines throughout the past year, and with each new beam the inevitability of an array in our own backyard grew but the actuality rested. Being first a bit lazy and, too, a thumb whacking, sliver garnishing office drudge, the time and engineering has been too much.

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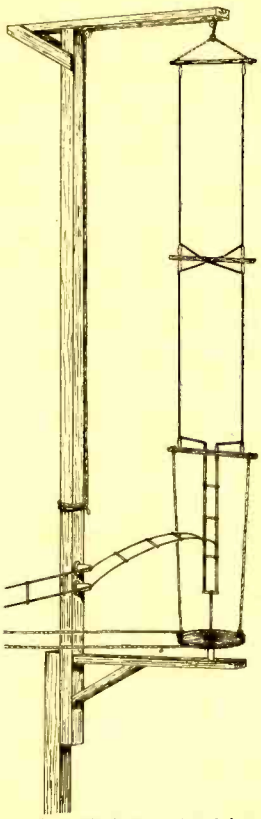

The beam is entirely supported by a cross-bar attached to the top of the supporting pole. A yoke at the top of the array keeps the elements separated and a bicycle wheel at the bottom allows it to be rotated either by a rope to the operating position or by any of the conventional motor drives.

It was not until seeing an array similar to that described in use at W6GZE, Robert S. Warren, that these objections were dissipated and the first nail driven. Here are the highlights:

Collect the following: an old bicycle wheel, sufficient plain antenna wire and insulators, some good rope, the usual spreaders, a 4" x 4" for the mast, and two lengths of quarter-inch copper tubing for a matching stub. That's all you need and here's what you'll get by simply "hanging it all": A beam with gain equal to any ham's dream, but occupying little space; Rotation through 180° without swivel joints, bearings, turntables, or magic; and rotation so smooth that one finger on the rope will do the trick. The above effusion may be pardoned since the design is not my own; to W6GZE goes the credit.

During many recent QSO's I have yet to hear a report lower than R9. The feeders were adjusted during a QSO, and with the beam being rotated the signal went from an R2 to an R9. This vertical beam really works!

Construction

The mast comes first and its height will be determined by the number of antenna sections desired. In this case one 20-foot length hangs the two-section array above the lettuce patch without a creak, even though lightly guyed. A ten-foot redwood four by four sunk about five feet in the ground makes a good base. (Any guy wires must be arranged so as to allow the beam to clear in a 180-degree arc.)

The elements of the beam and all dimensions are standard and sufficiently well publicized to warrant elimination from this discussion. For the less adventurous, a single section can be used with fair directivity, but since this is on the 56-Mc. band, three or four sections can easily be used, with corresponding increase in gain.

A rope halyard supports the entire structure and also affords a ready means of keeping all wires taut. The two ends of the lower spreader are tightly anchored near the outer rim of the bicycle wheel to serve the double purpose of keeping the array stable and furnishing the means of rotation.

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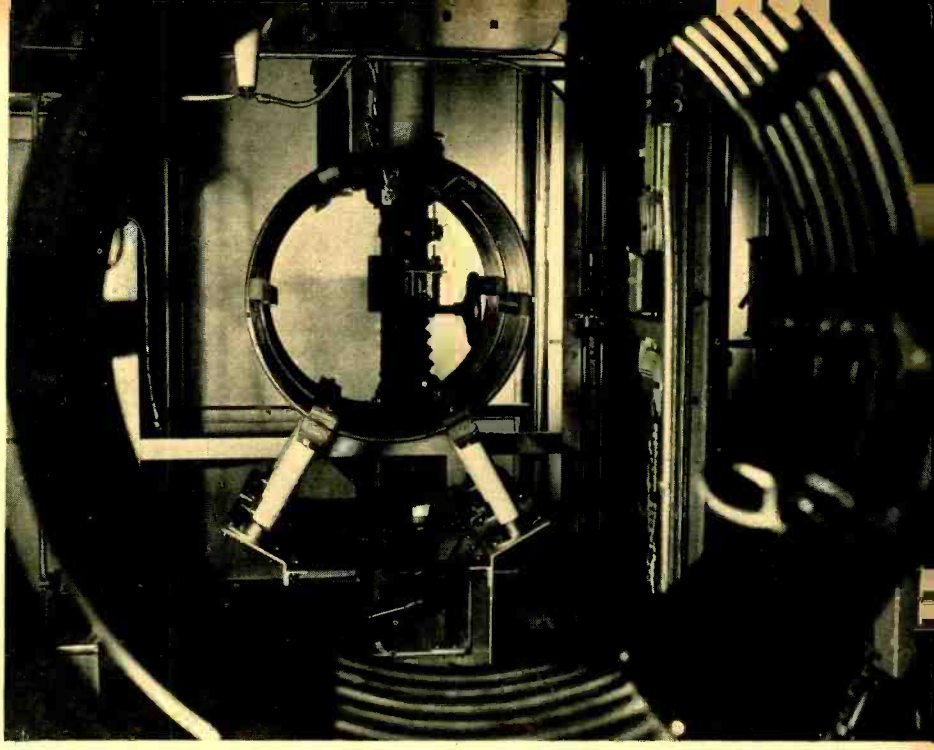

● Looking through one of the final tank coils into another one in the 50-kilowatt Doherty linear amplifier of KNX's new transmitter.

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W4CBY	39	138
W6DOB	39	138
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W6KRI	39	129
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G5BD	39	125
W7BB	39	123
W6HX	39	123
G5BJ	39	120
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W2CYS	39	117
G2LB	39	115
W4IO	39	115
W6FZL	39	112
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W6FZY	39	109
W6GPB	39	94
XE1BT	39	90
K6AKP	39	67
W1CH	38	150
W2BHW	38	149
W1BUX	38	145
W2GT	38	143
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W9FS	38	130
W3HXP	38	130
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W2GVZ	38	123
W3EPV	38	121
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W3DDM	38	116
W9UQT	38	116
W3GAU	38	115
W5KC	38	115
W8MTY	38	114
W9KA	38	114
W6VB	38	113
W2BMX	38	112
W8HWE	38	112
W2BXA	38	111
W6GRX	38	111
W3FQP	38	111
LY1J	38	110
W6HZT	38	110
W1AQT	38	109
W8KWI	38	108
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LU7AZ	38	107
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W8BOX	38	106
W9ADN	38	106
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W8LYQ	38	106
G2QT	38	106
ON4UU	38	104
W9CWW	38	104
G2IO	38	103
W8QXT	38	102
J2KG	38	95
G6XL	38	95
ON4FQ	38	92
W8GBF	38	87
W8OE	38	85
W9VDQ	38	79
W8KKG	37	127
W7AMX	37	125
J2JJ	37	123
W6GAL	37	121
W3GHD	37	116
W8ZY	37	114
W9RCQ	37	114
W6LYM	37	111
W8EUY	37	110
W3TR	37	109
VE2EE	37	108
ON4FT	37	104
W4MR	37	104
W9PTC	37	103
G6GH	37	102
W3AYS	37	102
VK2DA	37	101
W6FKZ	37	101
W6JBO	37	101
W3KT	37	101
W8KPB	37	100
W4DMB	37	100
W9AJA	37	99
W4EQK	37	99
ON4VU	37	99
W3EXB	37	98
ZL2CI	37	97
W6MHH	37	95
W1GDY	37	92
G2UX	37	91
W2BSR	37	90
W9NRB	37	86
W6MCG	37	84
W9UBB	37	77
W8AQT	36	120
W2BJ	36	116
G6NF	36	111
W6MVK	36	110
W6BAM	36	106
W8DOD	36	106
W9AFN	36	105
W8QDU	36	105
W1RY	36	104
G6CL	36	104
W5ASG	36	104
W9RBI	36	104
W6ITH	36	103
W8JSU	36	100
W6KWA	36	99
W8LZK	36	99
VE1DR	36	98
W8AAT	36	96
W6DLY	36	96
W3BEN	36	96
ZL1HY	36	95
W6NNR	36	95
G6YR	36	94
W7AYO	36	94
VE5AAD	36	92
W9KA	36	92
W9PK	36	92
W5ENE	36	91
ON4FT	36	90
W4ADA	36	90
W9LBB	36	90
W8JAH	36	89
W1APU	36	89
OK2HX	36	86
VK2NS	36	84
W8PQQ	36	83
W6TI	36	80
W6GCX	36	76
W7DSZ	36	73
W2GXH	36	71
W8OXO	35	113
W6GHU	35	103
SP1AR	35	99
W8CJJ	35	98
W6HJT	35	98
OK1AW	35	96
W8AAJ	35	96
W5PJ	35	96
W3RT	35	95
W9EF	35	94
W6AQJ	35	92
W9GBJ	35	92
VE5ZM	35	90
LU3DH	35	89
G6QX	35	87
W9ERU	35	83
ON4NC	35	82
GI6TK	35	80
W4ELQ	35	80
W6KQK	35	79
W9GNU	35	77
W6ONQ	35	73
SU1WM	34	109
W6HEW	34	103
K7FST	34	102
W8BSF	34	100
W1APA	34	95
VK2AS	34	94
W6MEK	34	94
W8HGA	34	93
W8LFE	34	93
W6NLZ	34	92
W8OUK	34	91
W2FLG	34	89
G6WB	34	88
W6CVW	34	88
VK2OQ	34	87
W9BCV	34	83
ZS1CN	34	82
VK2TF	34	81
W6MJR	34	81
ON4SS	34	80
W6HIP	34	76
W6PNO	34	76
VK2TI	34	75
W7AVL	34	75
ZL2VM	34	72
W6LHN	34	71
VK2AGJ	34	70
VK2EG	34	70
VE5MZ	34	69
VK2VN	34	63
W9QOE	34	56
W8ACY	33	104
W6GK	33	101
W6KEV	33	96
W6MEK	33	91
W6KUT	33	90
W8LFE	33	89
ON4HC	33	88
W6CEM	33	88
W2BZB	33	88
W9TJI	33	88
W6ANN	33	86
W8BWC	33	85
W6POZ	33	84
W2WC	33	83
VE4LX	33	82
G5VU	33	81
W6GCT	33	81
W6LCF	33	78
W6MVQ	33	77
W2FAW	33	67
VK2RA	33	65
ON4PA	33	63
K6CGK	33	62
VK2VQ	32	99
W6DIO	32	90
W4QN	32	90
W2BNX	32	88
K4FCY	32	88
W9FLH	32	80
W4FIJ	32	80
W9GKS	32	80
W9PGS	32	78
W6LEV	32	77
W1AB	32	76
W3CIC	32	75
G2FT	32	71
W6TE	32	71
W3GAP	32	70
W6LPR	32	67
W9DEI	32	66
W6KRM	32	62
W6OAQ	32	56
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PHONE

W3LE	38	112
W2AZ	38	106
F8UE	37	99
W6OCH	36	98
W3FJU	36	85
VE1CR	36	81
W6ITH	35	96
W9TIZ	35	93
KA1ME	35	79
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W3FAM	33	68
W6MLG	32	82
VK4JP	32	76
F8VC	32	74
W6OI	32	68
W6IKQ	32	67
VE1DR	32	59
W3EMM	31	88
W8LFE	31	78
G6BW	31	75
W2GW	31	68
W8QXT	31	67
W6AM	31	67
W8RL	31	67
F8KI	31	53
W9ZTO	31	53
W9QI	30	81
W2AOG	30	77
W9BEU	30	67
G8MX	30	65
W6MZD	30	52
W2IXY	29	93
W8LAC	29	81
W1AKY	29	80
ON4HS	29	78
W1HKK	29	77
W6FTU	29	75
W6NRW	29	60
KA1CS	29	59
W2IKV	28	77
CO2WM	28	73
W9BCV	28	68
W8AAJ	28	66
VE2EE	28	62
W4DRZ	28	62
W1BLO	28	62
W9RBI	28	61
W6NLS	28	61
W9RBI	28	59
W6GCT	28	56
W2HCE	27	76
W2IUV	27	68
W1JCX	27	68
G6DT	27	59
G5ZJ	26	77
W4BMR	26	67
W5ASG	26	62
W4EQK	26	61
W8QDU	26	61
W5DNV	26	60
VK2OQ	26	56
W4TS	26	54
VE4SS	26	50
W6FKK	26	47
K6LKN	26	46
W7EKA	26	45
VK2AGU	26	42
W3FQP	25	65
W8NYD	25	60
VK2TR	25	56
W8JK	25	47
W6PDB	25	44
W7AMQ	25	40
W6LYM	25	39
W6MXD	25	39
YV5AK	24	58
W8DBC	24	53
W9UYD	24	47
W6LPR	24	45
W6NCW	24	34
W6MVQ	24	32
W6GRX	23	43
W9ORL	23	38
W7ALZ	23	31

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DX AND OVERSEAS NEWS

Herb. Becker, W6QD

Send all contributions to Radio, attention DX Editor, 7460 Beverly Blvd., Los Angeles.

Here it is summer and nearly vacation time. I mean it is vacation time for you, too. RADIO does not publish an August or a September number. The next dx splash you will see will appear about the middle of September in the October issue. Just think what a vacation I'm giving you —two whole months. When your vacation is over I hope you have regained your lost zip, vigor and vitamins, and can then take the following ten issues of "DX" without flinching. But— don't think that we are going to sit around all summer and twiddle our thumbs. No sir, there is plenty to be done, and I hope we have a surprise for you in October RADIO.

RADIO'S DX Contest

We also will bring the details of RADIO's contest which is to be held over the last week-end in November and the first in December. Suggestions from you fellows are more than welcome and will be carefully considered by the committee in formulating the rules. It will be your contest and it will be your ideas that will be adopted. Remember, there will be 48 hours available on the week-end of November 25 and 48 hours the week-end of December 2.

Phone Chatter

It's too bad that Herb Cole, W1JCX, has to hop off and get married just when dx for him was getting easy. Oh well, if it must happen— I guess now is as good as anytime. Anyway, Herb, congratulations, and even though you won't get on the air for six months or so, we'll not forget you. This will give W1AKY a chance to creep up on him. AKY now has 29 and 81. K7GSC and K7AOC are anxious to hook up with South American phone stations. Both of the above are on the lower end of the phone band and if any of you are working any S. A. stations, ask them to keep an ear open for K7GSC and K7AOC—best time around 0200 to 0300 G.m.t.

This guy W3LE can't be held down. He pops up with several new ones—LZ7AN, CR4GO, ZB2B, VR1AR, VK7PA, VK9BA, J9DA and EA7BA. These give Lou 38 and 112 on phone. Lou wants to know if he should count EK1AF as a new country since the CN1 prefix was changed to EK1. My, my, wotta life. I'd have a good answer if I thought he was serious. W6PMB reports that VK7AB in Tasmania is on 10-meter phone every Saturday around 0230 G.m.t. His frequency is 28,005 kc. Another good one for the 10-meter phone boys is VK6MW,

W8DOD, Elmer Grabb, is one of the active dx'ers in the Honor Roll. His rig uses an RK20 with 100 watts input. To date he has 36 zones and 106 countries.

28,250 kc. He's in zone 29. G5ZJ has been off for a while but is back at it again.

W9QI worked CT2BP and EA7BA. It appears that the Spanish hams are again getting on the air. CT2BP, 14,150 kc., uses a pair of 6L6G tubes with 60 watts input. EA7BA was about 14,045 kc. F8VC grabbed a new one in VS7RA, making 32 and 74. Gene is doing nice work in the Marathon too with 25 and 49. W2AOG is on ten all the time, and so far this year he has 25 and 55. He says, "Who says 10 isn't hot?"

F8UE has finally landed VS8BA on Bahrein Island, zone 21. Says he called him at least 20 times. VS8BA is usually on every Sunday, 14,375 kc. Other new countries for F8UE are YN2MA, HH2B, VP3CO, G8MF, YL2CC, OH3OC, XU8ET, MX5B, EK1AI and CR6AE. F8UE now has 37 zones and 99 countries. He says dx has been good to him but power is necessary . . . at least 250 watts, and he runs 300 to his T55's, which feed an 8JK as the antenna. W4TS has been rather inactively lately but is planning to get after 'em again soon. Hal has a new 3-element rotary beam he's going to put on top of his 70-foot tower.

W6NMI says he's going to sail right along now . . . he has just purchased an HQ-120X receiver, and changed the rig to a pair of 100TH tubes. W2IXY adds VK4HN, OQ5ZZ and CX3BL which gives her totals of 29 and 93. W5CXH hasn't quite enough to make the Honor Roll but his 21 and 42 contain a lot of good dx. His latest are SV1KE, CN8AU, SU1MW and VK4HN. W1HKK has 29 and 77 for the Honor Roll, while his Marathon looks like 28 and 66. Dana says he approves of the new two-way phone

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rule. W9UYD has been doing nice work by hauling in these new countries: VK4HN, CT1KH, ZE1JZ, PA0BE, EI9J, CX1FB, K6PUL, SU1MW, PY2AC, ZS6DW and YS2LR. Walt now has 24 and 47.

We're still talking about phone . . . just in case you had forgotten. YV5AK reports that he has 24 zones and 58 countries on two-way phone. W6QLN is another who is on ten meters all the time and he has 22 zones and 33 countries. W1JNX does not quite make the Honor Roll but is doing very fine work and has 20 and 37. Keep it up. W8LFE, one of the prides of Columbus, has new ones: VK4HN, SP2HH and HA7P. This makes 31 and 78 for Higgy. He also admits he broke down and worked c.w. for a while, adding a few c.w. zones . . . we'll have to look into this.

W9TIZ is up two with VS6AB and VU2LJ giving L.C. 35 zones and 83 countries. L.C. says he worked a station signing, "Experimental Car No. 37 of the Mexican Border Patrol," at 1530 G.m.t. who claimed to be traveling 60 m.p.h. on the road to Monterrey. They reported using 25 watts and an eighth wave vertical. The "Eyebrow Lifting Club" will now lift their eyebrows. W6MWK is another of the "short and long skippers" using 28-Mc. phone . . . and has accumulated 21 and 26. This is since the first of the year. W4MS nabs two new countries making his total on two-way phone 42. This is not quite enough to list him in the Honor Roll but I'm sure he will be along soon. Incidentally, 4MS has a new first harmonic at his house . . . an l.y.l. Eddie's x.y.l. who is also a ham, W4AXF, and harmonic are doing fine. Congrats.

F8VC is happy after receiving a card from VS6AB. He now has 32 zones and 73 countries. In the Marathon F8VC has 23 and 46, which I would say was very good. W6ITH grabs off VK4HN for a new one. European phones on 20 are not especially common but recently during one of the better nights Reg worked G2PU, G2AV, GW3KY, ON4HS, F8GC, F8NT, G5LJ, F8QD, F8TU and F3XD. Even if these were divided into two p.m.'s it would still be good. W2GW is on phone a lot these days and claims 28 and 68, although he admits that if c.w. on the other end of the QSO would count, he would have 34 zones and 82 countries. Walt is doing OK though and intends to knock off a few more in short order. Walt says that EK1AF, ex-CN1AF, is still using 450 watts on 14,100 kc.

W6IKQ received the following on a card from VK2HV:

Now your mind is filled with venom,
And there is something you should know.
Why I sent you my QSL card, oh!!
Many weeks ago.
Perhaps the postman pinched it,
Or perhaps I am not quite sane,
So in case you think I am joking,
I am sending it again.

Now, durn ya, if you work VK2HV and you don't QSL *you'll* get one of these.

G6BW still grinds them out . . . new ones for Ben are FN1C, ES5D and OH2QM. Ben now has 31 and 77. He noticed during the eclipse on April 19 that there was an absence of W's but there were stations from PK4, KA, FN and VU . . . and they were very strong. W9TB is on phone now and says that he gets a kick out of talking to a lot of the old c.w. cronies. The other night there were visitors in the shack . . . and although W9LZG and W5BEN took turns at the mike, an occasional titter would come from the background . . . a touch of femininity, I guess . . . maybe.

W6MLG has forsaken the toothpulling occupation long enough to drive east . . . via the southern route. Beware, some of you fellows . . .

C. W. and PHONE — 1939 DX MARATHON

	Z	C
W9TJ	38	100
W9TB	36	88
W2AIW	35	93
VE4RO	35	79
G5BD	34	96
W8BTI	34	92
G2FT	34	76
W9NRB	34	68
W5ASG	33	85
W8LFE	33	84
W3HXP	33	77
W5PJ	33	72
W9VKF	32	86
W4FIJ	32	80
W6MEK	32	78
W6NLZ	32	65
W9CWW	32	62
W9ERU	31	68
VK2EO	31	67
W8AU	30	61
W1IED	30	43
VE5ZM	29	66
W9GKS	29	63
G3BS	29	55
W6TE	29	49
W6PKA	29	47
W1BGC	28	65
D4QET	28	62
G6CW	28	60
W9RBI	28	60
W8BWC	28	56
W6PNO	28	46
W6AM	27	71
W3EPV	27	67
W8LEC	27	41
K4FCV	26	67
W3HZH	26	65
G2IO	26	48
W2IZO	25	59
W3KT	25	57
W6BAM	25	54
W6GK	25	45
W5VQ	24	49
G8JV	24	47
ZL2VM	24	27
W8CED	24	46
W6LEV	24	41
W8OQF	24	37
ON4HS	23	57
W6ANN	23	45

PHONE

W6ITH	31	70
W9BEU	30	65
W8LFE	29	69
W6OCH	28	67
W1HKK	28	66
W1JCX	27	68
W6EJC	27	59
W8QXT	27	56
W3FJU	27	55
W1AKY	26	60
CO2WM	26	55
W4DRZ	25	62
W2AOG	25	55
W2IUV	25	49
F8VC	25	49
W6NNR	24	63
W6AM	24	53
W9RBI	24	41
W2AER	24	30
W2IXY	23	49
W8NYD	23	42
W6MEK	22	39
W6FKK	22	33
W6QLN	22	33
W6NMI	22	29

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I think he has his forceps with him. W6NNR, the statistical assistant, blew in today all out of breath with, "Gosh sakes, gee whiz, I'm in a hurry . . . got an awful lot of work to do . . . sure busy this week . . . looks as though I can only play golf FOUR days this week." After he hung around a couple of hours . . . I really believed him. Anyway, Guy worked a station signing XUOA who said he was on the far interior of China. Now we're wondering how far.

"WAZ" Honor Roll

For the benefit of the newcomers in the dx world, and Honor Roll aspirants, a few words might be in order. Those of you who do not have back issues of RADIO will please note. The Honor Roll consists of 360 calls. The first three columns, or 270 calls, are those of c.w. and phone totals. This group primarily was designed for those who are c.w. mostly, but occasionally operate phone, their results being reflected in the combined totals of zones and countries worked.

The fourth column, or 90 calls, belongs to the "phone only" group. These fellows operate exclusively, or a great deal of the time, on phone. Therefore this column was set aside for them. All phone contacts must be phone-to-phone . . . or, in other words two-way phone.

The number of zones required for entry into the Honor Roll is automatically set by the limitations of the highest 270 c.w. and phone, and then the 90 highest phone only. To enter your call it is only necessary to send to this department a list of zones and countries claimed, showing the call of at least one station in each. In case the total is not large enough to qualify, your list is filed and at a later date when you feel you have sufficient for entry, you need only send in the additions. We will add these to your original list. It is suggested that you keep a complete list of zones and countries you have worked. In this way you will have no difficulty in determining whether or not you have submitted them to us previously. Confirmations are not required, except of course when you WAZ. At the present time there are only two who have confirmed 40 zones.

You have a pretty good idea in regard to bootleggers . . . you know if so-and-so is a phoney or not. If you think he is then there is no use sending us his call . . . unless later on you do get a card from him disproving your earlier opinion. We too have a good idea what's going on in the world. The mail received from all points on the globe gives us a pretty good check on what is a good legitimate station . . . and vice versa. There have been times when some of the gang have sent in a swell sounding dx call in good faith. From information on hand we have found it a bootlegger and consequently have disallowed the station.

1939 DX Marathon

The Marathon is progressing very rapidly with W9TJ leading the way. To enter the Marathon it is necessary to send in a list of the zones and countries worked since the first of January, 1939. If your totals are sufficiently high to be included in the highest 50 c.w. and phone, or 25 highest phone only, they will appear in the next issue of RADIO. The Marathon closes December 31, 1939. The year is just about half over so there is plenty of time to run up in there. A fellow has to stay pretty active over the whole year in order to hold his place.

Dick Merrick, W6JBO, is one of the most popular of the W6's. The rig, which is a beautiful job of workmanship, uses a pair of 250th's with the usual kw.

The Brasspounders

There haven't been a great many new ones coming through for the oldtimers to work; therefore some of the high totals remain at a standstill. But naturally this has nothing to do with the newer dx men with lower figures in the Honor Roll. So, after all is said and done, dx keeps us on the move. Just because some of this dx news reported from time to time is not absolutely new, it doesn't mean that is is just "kid stuff." We all have to work it some time . . . and to the younger, shall we say generation, a lot of this dx is rare and hard to get.

Everyone cannot start gunning for dx with a kw. (California or otherwise) or with the best receivers and rhombics. But a lot of the newer boys are darn good op's and have a natural ear for dx. It is interesting to note the progress several have made during the four years that the writer has been grinding out this column. It will also

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be just as interesting to see the progress of them from this point on, and don't you think it goes unnoticed. Some day when I get a few more secretaries I'm going to show you some statistics on dx men that will make your eyes pop out.

Now for a little gossip from the c.w. gang. W3CDG reports the QTH of VK9RM as R. B. Monfries, Bulolo, New Guinea. Others for 3CDG are: K6ILT/KB6, VK6RU and SP1MJ. W8KE made a squawk last month about never having received a card from W6QQL in Nevada. It was recorded in this column, accepting his dare for publication. The irony of it was that just as June RADIO hit the press, we received a hufried note from W8KE that he had just received his card from W6QQL and wanted to recall the complaint. 'Twas too late, but I know QQL will get a kick out of it anyway.

W3TR says that conditions have been pretty punk but he is sure trying hard to make them good. If he does he says he will have some good dx to report. Let's hope for the best. W6REH is a new one in this "racket" but has caught on very quickly. In the first month on the air he has 13 and 15. When things pick up he will do the same.

U.S.S.R. Zones

W5PJ wants to know in which zone U9AL is located. Answer: zone 18. About a year ago we printed the calls of some of the boys in U.S.S.R. and their respective zones. Possibly it will be of value again. Stations located in Tomsk, Omsk and Novosibirsk, such as U9AC, U9AV and U9AL are in zone 18. Stations located in Sverdlovsk, such as U9MF and U9ML are in zone 17. For zone 19 it would be UO, that is, unless some U9 were operating portable, which I don't think would get by so well. U6SE is in zone 21 . . . and U2NE and U1AD are in 16 . . . as are U3, U4 and U5. Don't get these confused when determining your countries as the division of zones and countries are different. Refer to country list in January RADIO. Hope this helps yo' all. Even at the best it's rather puzzling to most of us.

A popular phone station is W1AKY and its operator is Ed Myrbeck. The final uses a pair of HK354's. Ed has 27 zones and 78 countries.

Some week-end I'm going to run over to U.S.S.R. and get this all straightened out.

Tom Cunningham, VO6D-VE2JK, is getting anxious to get back up into his ice-box in Labrador. Says there isn't another location like it. Give him a 201A and a "C" battery and he'll work anything from there. W6MEK has hooked KC6BVL and KD6QHX. KC6BVL is George Conklin from Frisco, and he's on Wake, 14,363 kc. Of course KD6QHX is on Midway, you know. W9GKS puts down a couple of new ones in his Marathon: VK7KR, OA4R and KD6QHX. 9GKS has 32 and 80 in the Honor Roll now.

Courtesy to DX

W9TJ had a swell ragchew with VU7BR, who says he had operated in the BERU tests but didn't do very much because so many W stations were calling him all the time. He gave up and wasn't on the air for two months. Fellows, that just shows what can happen when we try to break in on their tests, directional CQ's, etc. That explains why he wasn't in the last dx contest. What do you say we make it a practice of listening carefully to the dx man's CQ, or what he's doing, before giving him one of those frantic calls. I believe if we all used a little more discretion we would get more cooperation from the foreign dx'ers. They would undoubtedly appreciate it and in turn give us a better break at another time. I know it's pretty darn hard to sit and listen to some of this juicy dx and then not call him just because he is in another contest . . . or CQing for England or somewhere. But looking at it from their standpoint, it is just as important to them to take their contest seriously and make all the points they can as it is for us to try and land a new country. Has anyone any ideas? VU7BR is on both 14 Mc. and 28 Mc. He uses c.w. on 28,700 kc.

Looks as though Bill, W9TJ, is leading off the Marathon gang with 38 zones and 100 countries. Can you imagine those figures and the year only half over. We're just going to have to find more countries and zones for him to work. His Honor Roll totals are up to 39 and 149 . . . new ones being KD6QHX, U5YH, TA1AA and VQ1TR. W3HZH, ex-W1ZB, is up to 134 by grabbing LZ1ID . . . who says to QSL via HB9CE. W9TB reports that EA8AF is on again at 14,400. That's supposed to be Canary Islands; at least that's where he used to be.

Australia

From Australia VK4RC says, "Even after following RADIO for some time I can't work AC4YN." He adds that Europeans seem to be the easiest to knock over. The rig in use has an 801 final with 50 watts input. Antenna is a Jones "all band" matched impedance . . . and works very well on all bands but 160. After all, 160-meter dx is not just up our alley. The hardest spot to work into is South America, and he's hooked only one station on that continent.

Some time ago while VK4RC was visiting another VK's shack, they hooked up with a W6. This VK told the W6 he was using a pair of 210's in a "shove-grab" circuit. The W6 couldn't get the idea, and after a few minutes he asked

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The station of Dr. John R. Wortley-Talbot, G6WT, is very active on phone, especially on 28 Mc. The rig is a 500-watt job using 100th's in the final. One antenna is a three-element close-spaced array taken from the article in November RADIO.

the VK for an explanation. The VK said "shove-grab" meant "push-pull." The W6 got a big bang out of it . . . so much so that in a recent letter to VK4RC he said he was using a 6A6 as a "shove-shove" doubler. I guess he means "push-push." Robert says the dx contest sounded like the headquarters of a "numbers racket" gang. (I could add something to that.)

W3FQP is up with 38 and 111. He says that he worked U9ML in zone 18 . . . but of course he is in No. 17. FQP also has 25 zones and 65 countries on phone. A couple of the boys from St. Paul—W9IFW has 11 zones and 15 countries since the first of the year, and W9YCR has 18 and 21 in the period of time. W2IZO has saved up 30 zones and 74 countries worked in the last year and a half. Started with an 852 and 500 watts and then changed to a single 100TH. At this point he went to 20, and there began his best dx. Now he uses two 100TH's and is still batting them off very consistently. He and W2HCE and W2HHK go to Columbia and they sort of "co-operate" on their dx. In the Marathon he has 25 and 59. W6BIL has been gunning for dx for a short time now and wants to know if we count U.S.A. as a country. The answer is definitely "yes" . . . and a great big one at that

QRM Over Baltimore

W3AYS, who has held sway in Baltimore for a number of years, now has some nice neighbors who promise to help each other work some dx. Oh yeah!! I can imagine. Anyway, from one quarter to one mile of W3AYS's QTH "peace-fully" reside W3HXP (ex-W1CC), W3HZH (ex-W1ZB) and W3HWZ (ex-W1BDW). Golly, I wonder if I will ever get those new W3 calls memorized. Chas. says he visited W3HZH's shack the other days and asked about his antenna. Carl said he was using a 3½-wave V beam. AYS couldn't find it at first but finally it was located draped around in the trees and honeysuckle vine, etc. He's been trying to figure out if the "antenna" was meant to hold up the trees and vine, or the trees and vine to hold up the antenna. Which ever way it is Chase is convinced that Carl works the stuff . . . and might change his own antenna to that style. Even so, W3AYS has 37 and 102.

Caswell and Allison

W5BB relates that he has at last got his last Pacific Isle, KD6QHX . . . and naturally that means that W5VV worked him too, probably five minutes before . . .? Tom had a visit from B4UP who gave him a lot of low-down. B4UP has been at it a long time; wonder if he ever gets around in this neck of the woods. He was here once or twice several years ago. Wilmer got a letter explaining ZM1AA . . . the guy was there all right but was not licensed so has no cards to send. Ho hum. Better luck next time, Wilmer, on dx as well as other daily activities. BB has 38-134 and VV has 38-139.

W6MCG lives on top of the Hollywood hills . . . and that is one of the highest spots around here. It is a swell dx location; you almost don't need a transmitter . . . just key the power supply. Anyhoo, John has worked over 700 Europeans on 20 during the past two years. Power has never been much over 200 watts. He made some tests the other night when conditions were good and reduced the power to 4 watts and worked OH1NV, ON4XS, G3AH and ON4AU. Used his T4O buffer stage with oscillator supply on it. W8ACY gets two new ones in G6IA and YN1IP. W2GVZ gets LZ1ID to replace the not-so-good LZ1AA. Hope this is OK. Pat has 38 and 123. W2DZR has not just been reading detective stories since the first of the year because he has logged 21 zones and 44 countries. There are a lot of nice ones in the list too, such as CR4HT, CN8MS, FM8AD and FA3RY.

A few years ago a fellow breezed into town from Detroit. His name was Les Maurer, W8INY. He stayed around for a few weeks, helped me with a few antennas, worked a few W9's, visited a lot of hams, and then got the traveling bug again. He ended up at home but in a recent letter from Les we find that he entered the Naval Academy at Annapolis last july. He still has three years to go and I suppose the next time we see W8INY out this way he will be steering one of those big battleships around our ocean.

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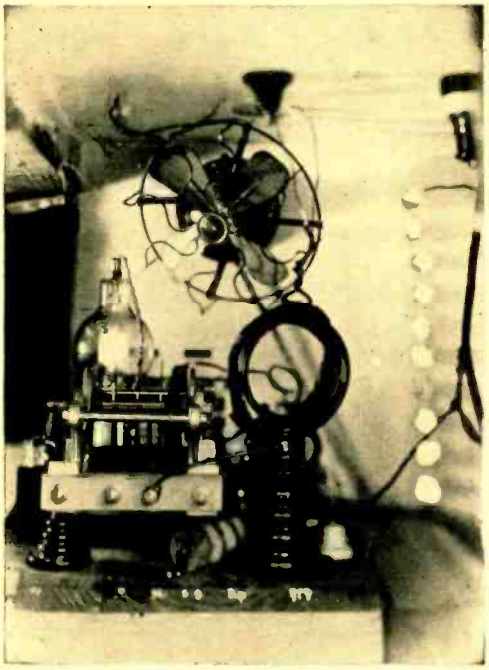

J2NF, one of the Tokyo gang. Note the electric fan to keep the 100TH at a cool "20 watts."

W6PKA tells us that his newest are KD6QHX (we expected this one), KF6JEG, XU6W, XZ2JB, VS2AL, YS2LR, K6ILT, VP5PZ, K7GSC, VS1AL and VU2FX. In the Marathon he has 29 and 47. W2LMN uses only 50 watts to an 807 but has done really well . . . 23 and 57. Only been on the air nine months. Sezze, "I've only 50 watts but for some unknown reason I have worked some dx. I haven't been able to work any Asians, but I guess the main reason is that I haven't heard any." Yes, they tell me that you should hear them before you work them . . . but I know of occasions . . . (period) W9VKF is up to 32 and 86 with CE3CB for the zone. He says he has an idea TA1AA and VR4AM are n.g. What do you think?

Bob Jardine, G6QX, got a couple of nice ones in YU7TE and LX1SI, on 14,388 and 7022 respectively. Bob gives the QTH of LX1SI as M. Schlitz, rue de Belval, Esch/Alzette, Luxembourg (G-D). He has been away from c.w. so long that there isn't much use for us to try to get him except on phone . . . 7022, 7040, 14,044 and 14,080. G6QX has 35 zones and 87 countries. By the way, Bob mentions that he received a card from LZ1ID from Sofia, Bulgaria (unlicensed). Two more countries are VU7BR and VK7GJ . . . almost missed 'em.

W6CVW in Tucson, Arizona, seems to find time to get new ones: ZD4AB, CN8AV, CT3AN, VP2LC, VK9RM, HI2AC, VS2AL, VP6MY, KF6DHW and HP1X. This gives Walt 34 and 90. His pal in crime, W6QAP, got up early for a change and surprised all the natives including himself by making WAC in 1 hour and 13 minutes. He admits it is no record but pretty good for the desert country. Bud also hooked TF3F and is now holding his breath. He is laying for VO6, VQ2 and SU . . . present totals 31 and 78.

In Poland SP1AR is doing his bit and the latest is K6PLZ for his 35th zone and 99th country. VK2EO is hung up with the Navy for a time so will probably be inactive except on occasions. He is at the Naval Radio Station and has about 200 kw. to play with sometimes, along with 20 and 10 kws. That must be where some of these miscellaneous kilowatts spring from.

W9CWW has three new ones in YS2LR, CT3AN and U8IB. Charley is sailing along in the Marathon with 32 and 62. W7ENW thought he had zone 2 when he worked VE5LD . . . but he's not there any more. However, Wally did work KF6PMO, YL2BB, U2NE, VP1JR, FP8AA, VQ3HJP and HH2ES. W8PQQ is taking EE at U of W. Va. and says he doesn't have much time for dx anymore but will make up for lost time during the summer. His newest, however, are YM4AD, SV1RX, PJ1BV, FB8AB, VQ8AL, J8CG, K6OVN, U9AW and a flock of others. Homer has 36 and 83. G6WB snagged J5CC for a new zone and HK1AA, VQ3HJP and J5CC for countries . . . now 34 and 88.

Long Beach and Its Power Leak

W6ANN says that he doesn't think that I have the worst power leak. He claims to have the daddy of them all. Says that all the gang in Long Beach either move to work dx or they just don't work any. W6AM and W6CXW are listed in Long Beach but they are not in the city proper, living a long way out of town . . . which explains their dx. Even with such bad all around conditions Bill has 23 zones and 45 countries in the Marathon.

This is a good spot to tell you that old Charlie Myers, W3SI, is no longer a bachelor. This may explain partially why you can't find him around the ham bands anymore. Then too he is busy at a b.c. station. W2IYO has new countries in VS2, VP2 and TG9. Dave adds them up to 39 and 119 now. He has cards from 38 and 107 . . . also said he worked a nine the other day who claimed he had never contacted "yours truly." Have him put up a rhombic. W6TE boosts his figures up some with five new ones. Now has 32 and 71. He has been fooling around with phone but says it sounds silly calling everybody "old man," etc. He'll be full-fledged when he starts using the term "handle" and "that's the dope on that."

Received some good info regarding FN1C in French India. He is Dave Patterson and the rig is a 6A6, 6A6 into an RK47 with an input of 135 watts. Frequencies most used are 14,084 and 14,200. Antenna is a close-spaced 2-element beam. Dave is a native of Dundee, Scotland, and is very anxious to QSO a VE. It seems that VE is a dead spot so far. FN1C and AC4YN hook up every now and then around 1230 G.m.t. FN1C

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is about 600 miles south of AC4YN. He confirms that 14,292 kc. frequency as being the one used practically all of the time.

J2JJ says that J8PG is now on the air at Port Arthur, now Dairen, Kantoshu, 14,230 T8. He claims that should be a different country as it is independent of Manchukuo. W9HLZ uses a T125 in the final and a gutter pipe antenna and has worked 23 zones and 28 countries since the first of the year. G5BD, Art, is still up near the top of the Marathon gang with 34 and 96, and his pal G2FT is not so far behind with 34 and 76. They are on the trail of OA4R at present and here's hoping. G2FT says they find dx snooping is better out of the band than in the band. W4QN squeezes into the Honor Roll this month by a whisker. If his letter had been received a day later he would have been sunk as his zones were not quite enough to make the grade. As it turned out, he nabbed the necessary amount to grab a spot. He has 32 and 90. As he puts it, he wanted to be among the 270 "dx hotshots." His latest are GW3AX, K4AAN, VQ3HJP, YL2CM, TA1AA, LZ1ID, VK9RM, K6ILT and VP7NT.

K4FCV came on the air August 7, 1938. Today he has 32 zones and 88 countries. For the Marathon it is 26 and 67. In the dx contest Ramon scored 114,228 points and an average of 17.5 QSO's an hour. His power is 300 watts. In case you are interested, his address is Box 3783, Santurce, P. R. W3KT says he needs zone 36 and the "other two." The other two must be 19 and 23. Well, his latest is ZC6RL, 14,340. W9YXO has 20 and 45 in the Marathon; just can't seem to get into the list though. W9YXO suggests that more attention be paid to the e.c.o. notes. Much has been said about sportsmanship but little has been done to clean up the notes. The only comment I have to make after that is this: Last month's RADIO contained a story by W6CUH which gave a lot of in's and out's of good e.c.o.'s. This current issue has more on the e.c.o. by W6CEM. It seems a good engineering practice to have a separate power supply, and voltage regulation if possible.

W5PJ writes frantically not to drop him off the list, as he just hooked VU2FO for his 35th zone and 96th country. Yes, he's still in there. W6OLU in San Diego has been working 40 meters and has a few there that might be of interest. J8CL 7150, J8CB 7200, J2CY 7260, XU8WM 7137, K6OCL 7155 (Guam), J8CH 7110, J8CJ 7136, XU8KO 7178, XU8BT 7144, PK1FK 7081. Vic says he worked most of those between 5 and 6 a.m. p.s.t. There's good ol' 40 for you. Gosh . . . I feel the urge again. It's a good thing I'm giving you a two months' vacation because you'd no doubt run into another "Back to 40" movement.

LA2X Discusses Doubtfuls

LA2X, a real honest-to-goodness dx man, sends in some fine information about a few doubtfuls. The following is taken from his letter: VU7BR, who is on around 14,340, is ex-G5TB, name Tevor John Brown. QTH is Bahrein Petroleum Co., Bahrein Island, Persian Gulf. He uses a 6L6 crystal oscillator and another 6L6 final with 20 watts input. Receiver is an old Phillips picked up at one of the bazaars of Bahrein Island. ZC6EC is back in England; he was old SU1EC. ZC6RL is in Palestine and on 14,335 kc. Best time is around 1700 to 1900 G.m.t. QSL via SU1SG. YI2BA and its present operator is Mr. A. Karin Mohd, Port Directorate, Basrah, Iraq. Mr. Mellon was the former operator and he went home to England. Usually around 14,270 and power is 250 watts. TA1AA is a big question (I'll say he is) and there has been no station who has received a card from him. G8II doesn't think he is in Turkey and ZB1R has never heard of him. HZ1A was heard every Sunday afternoon from October to February, 14,305. (Everyone who has worked this one will eventually get a card. Don't expect it too soon.) ST6KR is about the only active station in Sudan. PX1AA gives his QTH as Guldi Mann, Nicca 7, Andorra. This doesn't sound too good. VQ4CT has been heard of by VQ3HJP or others around there. VU2EU is Wm. H. G. Metcalfe, 3rd Indian Divisional Signals, Meerut, United Provinces, India. And now to Egil Aagaard, LA2X . . . many thanks.

W6KEV was very interested in his QSO with YV5AE. The best reason I can think of is that the second op is a y.l. Regardless, it gives him 33 zones. W3BXG drops us a line for the first time. He gives the QTH of OQ5RV as Maurice Derungs, 6 Av. Comite Urbain, Leopoldville, Belgian Congo. Also wants to know how he can work five more zones. I'm doin' all I can.

More from the Phone Men

G6LK puts a good sig into W6. He says that ZB2B at Gibraltar is on phone, 14,100 kc., and that ZC6HF is on about 14,130. W7BJS in Wyoming adds two zones in CE1AO and VU2CQ. For a new country in addition to the new zones he has VK7CL which gives George 23 and 40. W4DAA chalks up eleven new ones since last reporting, making now 34 and 71 on phone. Ernie gives the QTH of EK1AF as British P.O. Box 50, Tangier Zone. The QTH of EA7BA as on his card is Jose Maria Gill Guerra, Sagasta 33, Cadiz, Spain. KA1CS puts in his oar and says he has 29 zones and 59 countries. We're glad to hear from him and hope his dx enthusiasm continues. W2IUV worked OQ5ZZ and found out that he will try and work as many stations as possible after his set skeds with W2IXY. It appears that he starts coming through around 3:30 p.m. e.s.t. and stays in until around 7:00 p.m.

CO2WM Now in Honor Roll

At last there is a Cuban in the Honor Roll. CO2WM has worked 28 zones and 73 countries, and in the Marathon he has 26 and 55. Bill says he scored 113,204 points in the phone contest. That's a lot of points. Some of his best dx are EA7BA, OH2QM, FA8CF, OQ5ZZ, CT2BP, HB9DO, SV1CA, I1OG, VU2FU, PK6XX, CP1AA, KA1ME, KA1FH, ZL2BE. His contacts are two-way phone only and he runs 200 watts input.

[*Continued on Page 94*]

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The Amateur Newcomer

Antennas for the Beginner

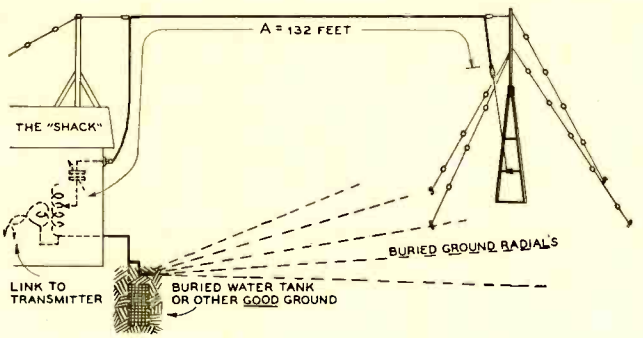

Figure 1. Recommended installation of the 132-foot piece of no. 12 wire for use as an antenna on 160-, 80-, and 40-meter bands when it is not possible to run the full flat top in the clear. A system of radials running out from the ground point and under the antenna is shown.

The newcomer to amateur radio, faced with the problem of choosing and installing the antenna for his first transmitter, is likely to become confused by the great preponderance of quite technical and prohibitively expensive antennas described in recent issues of the radio magazines. It should be emphasized that these complicated antennas are primarily for the veteran in the ranks who has exhausted the possibilities of the simpler types of radiators. An antenna system need not be complicated nor expensive to be a good and efficient radiator. It is only necessary that it be intelligently designed for the desired band of operation and that it be installed to the best advantage.

The majority of newcomers choose either the 80- or 40-meter band for their first transmitter if they plan to go on c.w., or the 160-meter band if they plan a phone rig. This is primarily because it is easy to get apparatus to work properly on these lower frequency channels, and also because more reliable contacts can be had with low power. A simply constructed and easily adjusted antenna which will give excellent results on all of these three bands is diagrammed in figure 1.

The radiating portion, "A," should be 132 feet of no. 12 solid copper wire and should be placed as high and "in the clear" as possible. This is very important for the 66-foot section in the center, as it is here that the current is highest (and hence the radiated energy greatest) on 80 and 40 meters. It should also be well insulated where "A" enters the shack, as this is the high-voltage point both on 80 and 40.

In a case where it is not possible to obtain a straight run for the 100-foot or so section that comprises the flat top, it will usually be found best (especially for operation on 80 meters) to bend back the end or to run it at an angle so that the center portion of the antenna will be highest and most in the clear.

The antenna should, of course, be as high as possible and as much in the clear of surrounding power wires, trees, etc., as it is possible to make it. A good mast for supporting the radiator is an "A-frame" made up of three pieces of straight-grained 2 by 4, 24 feet long. Such a pole will place the far end of the antenna about 45 feet in the air, allowing 3 feet for lap-over of the 2 by 4's.

Coupling Antenna to Transmitter

The most flexible method of coupling any antenna to a transmitter is through an antenna tank circuit, this tank to be link-coupled to the output stage of the transmitter. In addition to the advantage of ease of adjustment

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to suit varying transmitter and antenna conditions, such as coupling arrangement provides about as satisfactory a method as is known of eliminating harmonic radiation from the transmitter.

One side of the link should be grounded to eliminate capacity coupling from the amplifier tank coil to the antenna coil. In addition, the center of the antenna coil should be grounded when operating on 40 and 80. The bottom end of the antenna coil should be grounded for operation on 160.

By operation of the antenna circuit in this way, the harmonics that might possibly be capacity-coupled into the antenna system are by-passed to ground. In addition, the tuned circuit that couples to the antenna on all three bands will tend to offer a low impedance to ground at all frequencies except that to which it is tuned.

The antenna coil itself can consist of about 30 turns on a 2½-inch diameter form of no. 12 enamelled wire, spaced to about 3½ inches in length. The coil should be tapped at the center and about 2, 4, and 6 turns in from each end.

The tuning condenser for use of the antenna as a 160-meter Marconi can be a standard 365-$\mu\mu$fd. condenser of the type used in b.c. receivers. For voltage feed to the antenna on 40 and 80, the condenser should have a maximum capacity of about 150 $\mu\mu$fd. and should have a voltage rating of about 3000 volts. Either of these condensers will be satisfactory for operation with inputs up to about 100 watts to the final.

Ground for 160-Meter Operation

A good ground is a necessity for satisfactory operation of any antenna as a Marconi. Resistance introduced at this point can very easily dissipate a considerable portion of the output of the transmitter without ever having given the antenna a chance to radiate it. A quite satisfactory ground in soil of average moisture content can be obtained by burying an old galvanized water heater so that its top is 18 inches to 2 feet below the surface. A section of galvanized iron pipe, firmly screwed into the top of the heater, can be used to extend above the surface of the earth as the ground pipe. A good ground clamp should be fastened to the top of the vertical pipe and the wire to the antenna circuit connected to it. It is also advisable to run a separate ground lead for the transmitter and power supplies since there will be some r.f. voltage on the antenna ground due to the current flowing through it.

An excellent way of improving the efficiency of any antenna system is to run a system of buried radial wires under the radiator. These wires can be of no. 10 or no. 12 copper and should be buried 6 inches to one foot below the surface of the ground. The wires should be 50 to 100 feet long and any number from one to a dozen or so. Broadcast stations run as many as 200 in all directions radially from the central ground point.

Tuning Procedure

Since the antenna is series-tuned on 160 and parallel-tuned on 80 and 40, the tuning procedures differ somewhat for the different bands. Consequently they will be described individually.

For 160-meter operation, one side of the antenna coil should be grounded and the other end should connect to the tuning condenser which goes to the antenna. The link should be coupled by about 3 turns approximately to the center of the coil. The arrangement is illustrated in figure 2. The final amplifier should be tuned to minimum plate current (or the oscillator tuned slightly above minimum if crystal or to the desired frequency if self-excited) and a link loosely coupled to the output circuit of the rig. The plate milliammeter on the amplifier or oscillator should then be watched for a sharp rise as the antenna tuning condenser is tuned from one extreme to the other. The peak should come approximately in the middle of the range of the condenser. If the peak appears to come with the condenser set at maximum capacity, place a small .0001-μfd. mica condenser across the tuning condenser and see if the peak then comes within the range of the tuning condenser. If it still does not hit resonance, place another .0001-μfd. mica across the con-

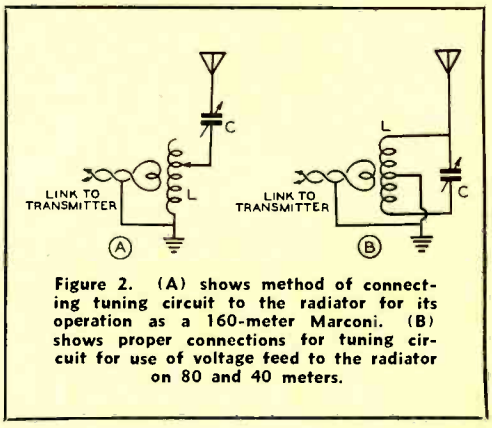

Figure 2. (A) shows method of connecting tuning circuit to the radiator for its operation as a 160-meter Marconi. (B) shows proper connections for tuning circuit for use of voltage feed to the radiator on 80 and 40 meters.

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denser and retune again. If the circuit begins to hit resonance with the condenser clear *out*, it may be necessary to tap down on the coil to hit peak.

When the antenna circuit has been tuned to resonance, couple it more tightly to the output tank circuit until normal plate current is drawn by this stage. For maximum loading, the link around the amplifier plate coil should be wound tightly around the center. A maximum of three turns is all that should be required.

If a current indicating device, such as a Christmas tree lamp or an r.f. ammeter, is placed in series with the lead from the antenna to the tuning condenser, maximum indication will be the point of maximum power transfer into the radiator.

In tuning up for 80, the whole coil is used with its center grounded and with the condenser in parallel with it. The antenna is connected to one end of the tank circuit, the circuit is tuned to resonance with loose coupling to the output tank, and the coupling is increased until normal plate current is drawn by the amplifier or oscillator. It may be necessary to retune the plate tank a slight amount after the coupling has been increased to the desired amount.

Tuning up for 40 is the same as for 80 except that the whole coil is not used. The two taps on the coil that are four turns in from each end are connected to the tuning condenser. The antenna can either be connected to one side of the tuning condenser or to one extreme end of the coil.

2½-Meter Mobile Transceiver Antenna

For beginners using a 2½-meter mobile transceiver, a good antenna is shown in figure 3. The six-foot (¾-wave) radiator may be made of hard copper or aluminum tubing, and

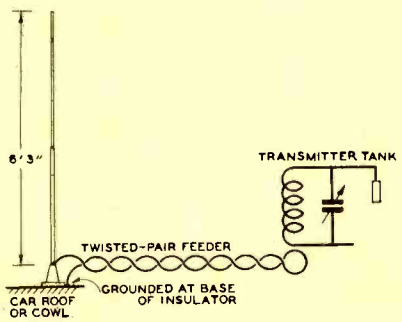

Figure 3. An efficient 2½-meter antenna using a ¾-wave vertical rod as the radiator.

should be mounted on the end of a strong standoff insulator. The whole assembly is then mounted on a high point of the car, such as the cowling between the hood and windshield or the roof. The bumpers are not the most satisfactory location for this type of antenna since the effective height is too low.

A twisted-pair feeder is used to connect to the transceiver. At the antenna end, one of the feeder wires is connected to the end of the antenna at the standoff insulator, and the other wire is connected to the car at the base of the insulator. At the transceiver end, the two wires are soldered together and taped to form a closed loop, which is placed around the transceiver coil *away* from the plate end.

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Short Circuits

Television on Wheels

A Philco television caravan is making a cross-country tour of the United States in what is believed to be the first attempt to acquaint the country at large with both television receiving and broadcasting at first-hand. The caravan will carry a portable television transmitter that is completely mobile and requires only a plug-in to a nearby electric outlet for its operation either indoors or outdoors. A number of television receivers are also being transported on the itinerary so that the broadcasts picked up from the transmitter may be shown in the cities visited.

Within the six weeks of this tour ten of the country's largest cities will be visited. The schedule from April 18 to May 9 includes Detroit, Chicago, Milwaukee, Minneapolis, and St. Louis in the order named. Following this series, an itinerary is being contemplated which would take the television caravan through the Western and Southern areas of the U. S. with journey's end at the Pacific Coast.

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Complete ball bearings only 1.5 millimeters (about 1/16 inch) in overall diameter are now being produced in Switzerland. These bearings, no larger than a pin head, are being used to replace jewel bearings in clockwork, meters and precision apparatus of all types. The bearings are said to show a great reduction in friction over the jeweled bearing. —Ohmite News.

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POSTSCRIPTS... and Announcements

Hamfest

Rock River Radio club will hold its annual hamfest in Firemen's Park, Waterloo, Wisconsin, on July 23. Reservations and complete information may be obtained from John Janczak, 112 W. Burnett St., Beaver Dam, Wisconsin.

New Outlet for Amateur Program

Ham Forum, probably the oldest radio program now on the air devoted exclusively to the radio amateur, can now be heard over station W9XTA, ultra-high-frequency broadcasting station located at Harrisburg, Illinois. The program consists of amateur news, technical information, editorial comment, miscellaneous information of interest to the amateur, and ham gossip. While the program has enjoyed great popularity with amateurs in Illinois and Indiana, this new short-wave outlet should increase the scope of amateur audiences markedly. W9XTA operates on a frequency of 26,500 kilocycles with a power of 500 watts; WILL operates on 580 kilocycles with a power of 5000 watts. This program is heard every Saturday at 1:15 p.m., c.s.t.

British 56-Mc. Tests

In July David S. Mitchell and M. C. Crowley-Milling (partners of GW6AA) are spending 5 days with a 56-Mc. station on the summit of Snowdon, 3560 feet above sea level. A petrol driven alternator power supply makes it possible for them to run a medium power c.c. transmitter.

While the possibility of transatlantic contacts is rather remote, 6AA would like to make schedules with any really serious dx station.

C.w. will be used for all long-distance attempts, with a sensitive acorn tube superhet for reception.

These tests take place from July 5 to 9. July 9 is the date of the Radio Society of Great Britain's 56-Mc. National Field Day.

British Summer 28-Mc. Tests

The Summer 28-Mc. Tests conducted by British amateurs are to be sponsored this year by the Experimental Section of the Radio Society of Great Britain. British stations will transmit at the times given below using both phone and c.w. Transmission will, as last year, consist of a three-minute call followed by a three-minute listening period, then another call and listening period if no contact ensues. Support is requested from 28-Mc. stations throughout the world. Reports may be sent to L. F. Coursey, Christ Church Vicarage, Cheltenham Spa., Gloucestershire, England.

British stations will operate at the following times from May 1, 1939, through September 17, 1939. All times are G.M.T.

Mon.	1230	1330	1500	1800		
Tues.	1230	1330	1500	1800	2000	
Wed.	1330	1830				
Thurs.	1230	1330	1500	1800	2200	
Fri.	1230	1330	1500	1800	2000	
Sat.	1400	1600	1800	2000		
Sun.	1000	1200	1400	1600	1800	2200

1938 VK-ZL Contest Results

Below are listed the three highest-scoring W's in each district and the VE winner in the senior section of the 1938 VK-ZL DX Contest. The highest scorers in each district reporting in the junior section are also listed.

Winner of the senior-section trophy for the highest score outside of VK-ZL was W9TJ with a score of 19,740. This score was obtained by making 118 VK-ZL contacts in 28 districts on three bands during the contest period, W6KRI, with a score of 19,376 points, was a close second in the trophy competition.

The junior-section trophy for stations outside of VK-ZL was won by VR4BA with a score of 8656.

VK2ADE finished far ahead in the competition for the highest-scoring VK-ZL station in the senior section. His score of 91,300 points was obtained from 205 contacts on two bands, and a multiplier of fifty-five. ZL1DV, with a score of 67,940 points, was runner-up in this section of the contest.

ZL4BB, who scored 27,118 points, nosed out VK4BB, 24,660, in the junior-section competition for high-scoring VK-ZL stations.

Senior Section

W1COM	912	W5EZA	3620
W1BFA	237	W6KRI	19,376
W2BHW	14,388	W6IOJ	16,150
W2HHF	6860	W6OEG	14,856
W2JWZ	4050	W7CMB	8702
W3BES	5580	W7DVY	7543
W3GEH	5060	W7ACD	1278
W3GHB	2178	W8OQF	2079

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NEW BOOKS

and trade literature

APPLIED ACOUSTICS, by Harry F. Olson, E.E., Ph.D., and Frank Massa, B.S., M.Sc. Second edition, published by P. Blakiston's Son & Co., Inc., 1012 Walnut Street, Philadelphia, Pa. 494 pages, 278 illustrations, washable fabric binding, price $5.50 in U. S. A.

This book is a practical guide to the design, construction, operation and analysis of modern acoustic and electro-acoustic apparatus. This new edition includes many important advances made during the past five years. A new chapter on Horn Loudspeaker Design covers the description and comparison of many types and structures and the application of horn loudspeakers. Chapters on microphones and direct radiator loudspeakers have been greatly expanded and include latest developments. New methods of acoustical measurements, new illustrations and a greatly expanded index have been prepared for the new edition of the book.

Although the field of coverage of the book is outside the interest and experience of the majority of radio amateurs, still those amateurs who are engaged in broadcasting, motion-picture, or public-address work will find the work a valuable addition to their reference libraries.

Bulletin T-1 of the Solar Manufacturing Corporation gives complete specifications and standards for the high voltage condensers necessary for television work. Full diagrams and specifications showing a variety of types adapted to various television uses are embodied in this bulletin which is available upon application to the company.

A new 16-page catalog, No. 500-D, on broadcast units has just been issued by Thordarson Electric Manufacturing Co. It contains practical and useful information on Thordarson transformers for all types of broadcast application, including the new and unique Automatic Voltage Regulators which automatically maintain constant voltage supply for plate, filament, or power transformers.

Also listed and illustrated are the Thordarson Tru-Fidelity transformers in three new groups, the "Major," "Bantam," and "Incher" series, available in high permeability chromium-plated drawn cases. Up to 85 db hum reduction is possible for most types. The "Incher" series with a flat frequency response within ±1 db from 40 to 12,000 c.p.s. are only 1¼" high (including lugs) and 15/16" in diameter.

Free copies of this catalog may be had from all Thordarson distributors or by writing direct to the Thordarson Electric Mfg. Co., 500 West Huron, Chicago, Ill.

ESSENTIALS OF RECORDING, first edition. Published by Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, Ill. 22 pages, 6" by 9", price 10 cents, plus postage.

The Engineering Department of Allied Radio Corporation, Chicago, has prepared a non-technical treatise on the essentials of recording which is now ready for distribution. The purpose of the bulletin is to furnish authoritative, non-technical information and advice on the problems and technique of recording on the most suitable type of equipment and what it costs.

The booklet explains the theory of modern recording in easy, readable language. An unusual new and helpful feature is a chart indicating a wide range of uses for recording equipment and a specific series of references to the equipment best suited for each type of recording requirement. Descriptions of various types of recorders and accessories are included along with discussions on cutting needles, recording discs and their characteristics, etc.

A supplementary section is also included to cover the requirements of those who have their own amplifiers and who desire to adapt existing equipment for successful recording. Data are included on the use of volume level indicators, proper matching, etc.

A complete and up-to-date vibrator guide, containing recommended replacements for all makes and models of auto radios and battery-operated household receivers is now available through Mallory-Yaxley parts distributors.

The 20-page booklet also contains a cross reference of Mallory vibrators by make and model of receivers, base diagrams and external views showing prong and lead arrangement, helpful information on practical vibrator servicing and testing with 'scope pictures, and a new article on auto radio installation and interference elimination in 1939 cars.

Ten new amplifiers by Thordarson are featured in their latest catalog No. 600-D. Streamlined, metal enclosures are shown in addition to the rich simplicity of the burl walnut cabinets so popular last season. Models range in size from 8 to 75 watts of audio power, including a 6-volt d.c. 115-volt a.c. mobile unit—all with unusually wide frequency response. Write the Thordarson Electric Mfg. Co., 500 West Huron, Chicago, Illinois, for a free copy.

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Dear Hon Ed Sir:

Scratchi are heer that RADIO are have such a good repatashon for knowing their stuffs tecknickly that are getting boatloaa of male every day from hams and s.w.l. who are inflicted with troubles and are want some slight free infirmation, such as compleet diagram and working drawing of 1 kilowatt phone transmitter that can be run from a 500-watt gas engine generator. Are also understand that because of stewpendous volyum of questions receive, inclooding dumb and otherwise, you cannot affording to take time to answer same except where pertane to possibull error in an article in your hon rag, on account of RADIO are in the publishing biziness, and not the infirmation free biziness for benefit of health only.

Now a grate idear are born to Scratchi. For sure some of these ham fellow would be willing to pay monies for infirmation and answer to their question by grate tecknickle whizzard like I, who are have engraved diploma and decree from corresponding skool.

Scratchi are figger that if you are willing to put him on the cuff for a few advertisement, he can build up a good bizness. I are not a betting man and never gambol, but are willing to bet that Scratchi Infirmation Service would be a colossus success. Are having the following idear for an ad.

> Are you having trouble getting your Fierce Oscillator to oscillate? Won't your double zip antenna toon up? Can't you match your feeding line to your fore halfs wave in fizz? Do your amplifier have paraletic oscillations? Just write to the S.I.S. and your trouble are over. Nominal fee payabul in easy monthly installments. No questions too tough for the Scratchi Infirmation Service.

Fact of the matter are, hon ed., it are just occur to me how to pay you if you are not want to trust Scratchi on the cuff for furst ad. Can give you a standing credit with the S.I.S. for the cost of ad. Even smarty fellow like you are sometimes have trouble in figger out the answer, and could make use of the souperior knowledge the S.I.S. are have at its disposal. In fack would be willing to give you special 40 per scent discount.

Respectively yours,
HASHAFISTI SCRATCHI

P.S. Please send one Radio Handybook and charge my acct. on acct. of will needing it when start the S.I.S. (for looking up the answers).

The Open Forum

Salinas, California

Sirs:

Enclosed is a snapshot of myself pointing to the license plate of my radio equipped motorcycle. As you can see, it is "73."

The plate has caused quite a bit of fun among the local hams, and with the recent publicity in the radio magazines I thought it might be suitable for publication in RADIO.

ANDREW W. MARTIN, W6UC
Sergeant, California Highway Patrol

McKeesport, Pennsylvania

Sirs:

After constructing several transmitters for the high frequencies, and chasing the "bugs" out of them until they settled down to work, a question came into my head and I have been wondering about it ever since.

[*Continued on Page 80*]

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U. H. F. . . .

By E. H. CONKLIN,* W9BNX

During the past several months, a series of ionosphere articles has appeared in RADIO. Some readers may wonder if they have any value from a practical standpoint, rather than for pure science. To be sure, practical construction and measurement have been covered in detail, but for purposes of determining whether conditions are favorable for u.h.f. communication, some simplification and clarification is possible.

Winter dx generally takes place via the F_2 layer, located at perhaps 230 to 350 kilometers altitude. It is of some interest to the problem to know what this height is, but only a slight familiarity with an ionosphere sounder will enable the user to recognize that a reflection shown on the cathode ray screen is from this layer because of the long delay between the direct and reflected signals. Usually, especially in winter, the reflection of 7-Mc. signals will be from it, so it will be relatively easy to identify without even calculating the time delay by any of the methods reviewed by Mr. Friend. On the other hand, any midday reflection on the 2-Mc. band will probably be from the E layer, only about 100 to 120 kilometers high, which will be much closer to the direct pulse.

The time of day that 7-Mc. signals start to be reflected, in the morning, gives a good indication of the whole curve for the day and times that the various bands may be open. Whether 28-Mc. east-west signals beyond 1200 miles will be received will be indicated. If ionization is unusually strong, indicated by the early appearance of vertical 7-Mc. reflections, 56-Mc. signals have a chance. North-south reception may require a lesser degree of ionization because lower latitudes may be more favorable to reflection. A day of magnetic storm when the higher frequency bands may be dead and the lower bands improved for dx but erratic, will be obvious from the unusual reflection phenomena.

In summer, sporadic reflections from the E layer may obscure the F layer, but knowing the progress of the reflection from one band to another, a hint is given of the probable opening of 28 and 56 Mc. for distances below 1200 miles. Nothing is learned from the time that sporadic reflections occur, apparently, except that strong ionization is often followed by additional hours favorable to 28- and 56-Mc. transmission. If E-layer reflections are seen when making observations on the 3.5-Mc. band, other than around noon when they are normal, one can switch to 7 Mc. to see if that frequency is returned vertically from the E layer. When it is, 56-Mc. work is more likely because the necessary 10-Mc. critical frequency may occur at the point some 500 miles away where your 56-Mc. signal will be reflected.

So the whole thing boils down to the elementary problem of what E and F layer reflections look like—and this will be obvious from the two different time delays encountered when operating at low and medium frequency amateur bands, and the time or band that gives reflections. No calculations, particularly, are necessary to make the ionosphere sounding apparatus serve a useful purpose. We have in it a close approach to an ideal mystery box—press the button to see in a peep-hole whether conditions are favorable.

(The following material has graciously been compiled by Harry Carr, W9LBK, Wheaton, in the temporary absence of Mr. Conklin.)

28 Mc.

Carroll Stegall, the well-known OQ5AE who has been spending a few months in this country, was down in Asheville in April getting a new mobile 28-Mc. rig installed in his V8 truck and trailer. While there he and W4AZV drove the rig up on a high hill, answered a CQ from Los Angeles and the W6 came right back with a QSA5 R9 report. Input to this mobile transmitter is 32 watts and W8JK has designed a directive antenna for use with it. OQ5AE will be using this outfit as soon as he reaches the African coast, about July 20, and expects to be able to contact this country with ease.

56 Mc.

W6QLZ, at Phoenix, Ariz., found the band wide open for working into San Francisco and Oregon from 8:10 to 9:05 p.m. on May 3. These distances are about 800 and 1000 miles. QLZ says that the short skip was present on 10 into San Francisco, W7, and as close as Reno, Nev., and Los Angeles. He observes that when a single hop is on, the fading is deep and slow, and that the multiple hop

* Associate Editor, RADIO, Wheaton, Ill.

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produces the gurgly, bumpy fade. In this case fading on 5 meters was deep and slow and no selective fading was noticed. W7AUO, W6QDU and W6LYN were positively identified and the station working W7AUO was heard but the call was missed. QLZ found that this reception was good on his "Clyde Directive Turnstile" antenna while no signals could be obtained on a long-wire zepp or a curtain antenna. All paths were direct and low angle. Moving the rotary 15° either way caused the signal to drop out. On May 4 the short skip was on again into Dallas, Uvalde, and San Antonio, Texas, between 10:00 and 10:15 a.m. W6QLZ's turnstile antenna mentioned above is the result of experimenting done by himself and Prof. Stone. He has had about twenty 5-meter beams and concludes that the 4-element turnstile is the best. It uses 0.12λ spacing for the reflectors with a ground screen 0.35λ underneath, which places the array well up the pole. Both rhombic and V type antennas have been discarded in favor of this type because of superior performance.

W8PK, in E. Bloomfield, New York, near Rochester, has had some interesting results in March and April after experiencing a total loss in the February 22 relay. He has gone back to the use of the HRO for 56 Mc. with a 954 r.f. stage and a 5-meter tank in the grid circuit of the first detector. The oscillator uses the second harmonic of the regular 10-meter coil. This arrangement has enabled him to get meter readings on numerous stations. At 10:30 p.m. on April 5 8PK logged W8CMK, Erie, Pa., calling CQ on c.w. and coming in RST 559. This was a distance of 145 miles from 8PK. A request for test schedules was mailed and 8CMK has been heard several times but no QSO had been completed except by use of 3.9 Mc. at 8PK and 56 Mc. at 8CMK for several cross band QSO's. W8RV, Buffalo, worked the Erie station in April. PK sends data showing that in his case a curtain array with 12 half waves in phase and aimed at Erie has been better for reception than an inverted "V" aimed in the same direction. He has also logged W8NOJ, in Erie, who is supposed to be using only 40 watts. On April 11 W8RV was worked for his first QSO with Buffalo.

On the morning of May 4 W8SCS, of Benton Harbor, Mich., overheard a QSO between W8CUQ, in Kalamazoo, and W5AJG in Dallas, Texas. AJG was strong on peaks but faded badly.

W5CXH, in New Orleans, uses his regular transmitter with a 100TH at 500 watts for his 56-Mc. work. He suggests that a very few changes in the final of a good 20-meter phone will adapt it to 5-meter operation. This should be an incentive to get more of the local 20-meter hams down on 56 Mc.

W8QKI, of Ashtabula, Ohio, had to take down his 12-element 5-meter rotary when he changed QTH. This beam had been putting out a good signal over a 125-mile radius with 200 watts to the 35T's in the final. He finds activity on five meters picking up with the following stations being within consistent range of Ashtabula: W8RV, Buffalo; W8CMK, W8NBV and W8GU, of Erie, Pa.; W8CIR, Alliquippa, Ohio, and W8SLU, of Auburn Heights, Michigan. Incidentally, QKI mentions that ten-meter phone contacts in the last year have brought him 42 countries in 20 zones.

W9ZJB, of Kansas City, has a new 56-Mc. beam, an H array of 4 half waves vertical. The local boys laughed at him when he told them of putting it up but results obtained seem to show the laugh is on them and he thinks there will be other beams there soon.

W9SMM, also of K.C., has a mobile job in his car, 100 watts xtal using a generator on the fan belt for 100 volts a.c. The transmitter is a pair of T20's in the final with 6L6 modulation and a quarter-wave grounded antenna. The receiver is a 3-tube superregen. On April 16 he and ZJB ran a test while SMM drove the mobile rig to St. Joseph, Mo., 60 miles air line. They worked two way for 30 miles and ZJB copied him for 40 miles before fading out. When SMM reached King Hill in St. Joseph he was again R4 in K.C. at ZJB. W9ZD there heard him also, showing that the jump can be covered, though they didn't contact him at that time. At Atchinson, Kansas, on the return trip, both ZD and ZJB were contacted for a 50-mile hop. They were both heard in Leavenworth also, but with the car in motion ZJB's sig from the beam was the only one that came through.

The Kansas City gang is ready for summer dx with 9ZD having 250 watts to the final and a superhet converter. W9AHZ has 300 watts on a pair of 50T's with a vertical J antenna and a super receiver. W9SMM has the 100-watt rig either in his car or in his fourteenth floor penthouse. ZJB suggests that by next year the 60-mile jump to St. Joseph will be easy.

W1JFF, of Newport, R. I., sends the calls of a few active W1's. He states he is member #114 of the Horsetraders, a 56-Mc. gang that has an air meeting each Tuesday night at 7:45. The active stations are W1LLL, W1IJ, W1JLK, W1KLJ, W1BKO and W1IXP in Conn., W1HRZ and W1JFF in R. I., and W1BJE and W1FZU in Mass. W1DEI, in

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Boston, seems to be on whenever the band opens up. JFF notices that it opens for the Connecticut-to-Rhode Island jump when the barometer goes high.

XE2FC, of Tampico, Mexico, expects to be on phone practically every Saturday and Sunday from 7 to 8 p.m. c.s.t., with 100 watts input. The signal will be xtal controlled near 57 Mc. and should make an interesting contact for W's. 2FC will appreciate any reports and with his RME69 and DM36 converter hopes to be able to QSO several U. S. districts this summer.

W8CVQ, in Kalamazoo, Michigan, reports a five-meter peculiarity observed April 24. He was in contact with W8MDA, Ann Arbor, Mich., from 7:30 to 7:45 p.m. e.s.t. with good signals both ways. After clearing with him he noted that from 8:00 to 8:25 there were no sigs that came through loud enough to get modulation though a number of wobbly beat notes were heard. The noise level went way down also. A second contact with MDA at 8:40 brought the information that practically the same thing had been true there for the period but that the band was again normal. CVQ had QSO's with W8BJG, W8NKJ, W8SLU, W8RHF, W8NXB and W8AZZ, all in the Detroit area during the same evening, which was clear and mild.

W8LRL's c.w. Logged in Germany?

W8LRL, Pittsburgh, Pa., has just received a listener's card from Germany reporting reception of his c.w. signals on five meters. The card has been long delayed in the QSL bureau, as the date of the reception was March 21, 1938, at 18.47 G.m.t., but W8NED, also of Pittsburgh, sends the dope and vouches for the agreement of the card and the log, as well as the story that goes with it. It seems that W8LRL had a new rig with 150 watts to a single-ended T55, supposedly on ten meters, and was using a horizontal antenna of two half waves in phase with zepp feed. After some days of absolutely fruitless calling he checked with W8RUE who informed him that he was actually on five meters instead of ten.

The information on the listener's card for date, time and frequency checks with 8LRL's log as being correct and was during the time he was unknowingly on five meters. The card reads as follows: "DEM3149/L—Radio W8LRL—Ur sigs hrd hr on 21 . 3. 38 Mez 18.47—clg CQ ten—RST 349 QRG 56890 QSB 2/3 vy—WX clear. Remarks: DR OM ur sigs hrd here on five. Pse QSL—Kurt Krause, Ostpreussische Str 7 Gotha/Thur." The story sounds logical. We hope it is true and that additional corroboration will come to light. After all, many great accomplishments of the past were more or less accidental.

W8SCS found the band interesting on the night of May 8. At 8:10 e.s.t. he heard a station he thought was W4EDD on 56.00 Mc. Later on he worked W8CVQ and at 10:15 heard W2KLZ (?) calling CQ. At 10:17 he heard W2AMJ CQ and W8SLU and W8LZN, in Detroit, answer him. Both sides of a QSO between W8RV, Buffalo, and W8NZ, in Battle Creek, Mich., were followed. W8SCS is in Benton Harbor, Michigan, and has a friend, W8RAE/8, in school in Kalamazoo. They have been keeping a sked at noon on 80 meters but lately the 80-meter signals have been so weak that they could not clear their traffic on that band so they have QSY'ed to 5 meters and have been able to clear nicely.

W8CVQ, Kalamazoo, Michigan, and W8NZ, at Battle Creek, Michigan, also found conditions good into Texas on the morning of May 4. They each worked W5AJG in Dallas, Texas between 10:00 and 12:50 a.m. e.s.t. His signals were fading badly, rapidly building up to R4 and 6 at times and then diving into the background. This occasion is the first observed sporadic E layer there for this year. 5AJG reported that he had found the band open down there several times in the previous two weeks. CVQ finds that Detroit stations are consistently in touch with the eastern shore of Lake Michigan. These include W8NKJ, W8IUD, W8QDU, W8NXB, W8MDA, Y8SLU, W8BJG and W8RHF. They do not hear stations from the Chicago area.

Comment from a goodly number of operators seems to indicate a much greater interest in c.w. on five meters than heretofore. Much of the interesting work done over this period (April 10 to May 10) has been on c.w. Distant carriers were often heard where modulation could not be picked up, which should indicate to some of the boys who are anxious to get a bit of dx a method by which it may be worked.

112 Mc.

W2KDB, of So. Ozone Park, L. I., reports a number of 112-Mc. stations in that general vicinity. W2KYT, W2KXC, W2LQD, W2LFL, W2JRL and W2EPD are operating around Garden City and W2JXS from Springfield. In So. Ozone Park W2APM has xtal control with a 6L6 final. W2TY worked mobile with W2KDB on a trip of about four miles with excellent results, although they

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found the characteristic swishing effect more severe than on 56 Mc. Inferior equipment may be the reason for less satisfactory results on 2½ than have been obtained there on 5 meters. In Brooklyn W2CWE, W2AOD, W2GGN, W2KXG, W2LGJ, W2LGS, W2LPJ and W2LUX are heard on 2½, with the best known dx there being done between W2JWC in the Bushwick section of Brooklyn and W2JRL in Franklin Square—about 13 miles.

W1SS, at Arlington, Mass., is on 2½ meters with 125 watts to a pair of HK24's. He uses a Johnson Q cut to 2½ and a one-ten receiver. W1BBM has heard his sigs out on Cape Cod, 80 miles away, and they hope to work this two way soon. 1SS reports thirty stations on this band near Boston with more coming on each week.

We hear from W9YEW of Chicago that he and W9UTS have the parallel rod rig of the April issue on 112 Mc. and that Chicago's north side will likely be hearing from W9LRT, LRM, SFW and YGW on this band. W8TEM of Hamtramck, Mich., reports that he and W8SLJ, W8SNN and W8SKE of the Detroit area are now active in the 112-Mc. band and that many others expect to be there soon. W8TCT, of Cleveland, with W8RJR and W8LWY are moving to 112 and expect to work both mobile and portable this summer. They have reason to hope for considerable 2½-meter activity among Cleveland hams.

W9ZGD, Milwaukee, Wis., finally had to take his own receiver up to Port Washington (20 miles distant) to prove that his 112-Mc. signals could be heard there. While there, using W9KOL's lazy H beam, he worked W9JPU, 14 miles away, and copied his home station which was operated by a brother ham.

From W3HWN we hear that the Harrisburg Amateur Radio Club has secured a new location centrally located on the highest point in the city. At present W3GEJ, W3FUM, W3HWY, W3EUC and W3HWN are active on five but a number of the members have constructed the 2½-meter transceivers described in the March RADIO and are active portable mobile. The club has made application for a station license and expects to be active both on 56 and 112 Mc. from the new location as soon as the license is received.

W1IYN mentions that his station, W1EOG, W1IKN and W1IZP all are active in the Marlboro, Mass. area around 9 p.m. on weekdays. All the Marlboro gang are using p.p. 45's in long-line oscillators. IYN also says that Boston is consistently heard with good signal strength over the 30-mile distance.

112-Mc. activity in the San Francisco Bay area is making steady progress. The first day on which a relatively large amount of activity was noticed was on Sunday April 2. W6QLR spent about five or six hours at his home QTH working individually and collectively W6KRM of Piedmont, W6POK and W6HTE of Berkeley and W6OJU of Richmond. W6QIS spent a good part of the day also at W6QLR's shack. W6KRM, W6OJU and W6HTE were all mobile using transceivers, and all dropped by W6QLR's shack at some time during the day. W6QLR is using a transceiver consisting of a 6J5G modulated by a 42. The antenna is a half-wave matched impedance on the roof. The location seems to be excellent for high-frequency operation, being in the hills above Oakland at about 1000 feet elevation, overlooking the entire San Francisco Bay area.

On Sunday April 9 W6OJU, W6PJK, W6NJJ and W6QLR were all mobile in the Berkeley hills. No other stations were worked. However, on Sunday April 16 W6OJU took up a position (mobile) on Mt. Diablo, about 20 miles east of the Berkeley hills. W6MIS, W6NJJ and W6QLR were all mobile in the Berkeley hills, mostly around Grizzly Peak. From that location W6QLR worked W6OJU on Mt. Diablo for about an hour with consistent R8 signals at both ends. Later W6OJU worked W6LJS in Santa Rosa and W6FTQ in Sebastopol, both over 45 miles from W6OJU's location. The QSO between W6OJU and W6LJS was heard by W6QLR with R7 to R8 signals from both stations, but so far the fellows in Grizzly Peak have been unable to work the stations in the vicinity of Santa Rosa. W6FTQ has been heard by W6QLR from Grizzly Peak with an R9 plus signal, and it is hoped that communication will soon be established.

Not much has been heard from the fellows on the San Francisco side of the bay. W6MZQ at San Mateo advises that he is building up 112-Mc. equipment, and is also interested in 56 Mc., having a xtal-controlled job with a 35T in the final on that band now. W6GZE, a veteran ultra-high-frequency operator, is expected on 112 Mc. soon from his location in San Anselmo, north of the Bay. It is hoped that some trans-bay contacts may be worked out on 112 Mc. in the very near future.

224 MC.

We understand that W8GU, in Erie, Pa., has been on a regular schedule each night for the first 15 minutes of each hour from 7:00 to 10:00 p.m. in this band—exact frequency

[*Continued on Page 92*]

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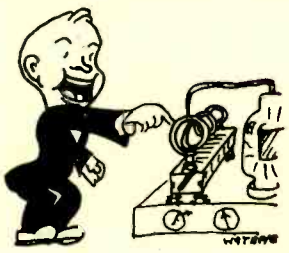
THE GYMNOTIDAE-PUSH

Don't be fainthearted about the above transmitter. It sounds highly technical but take heart, brother hams, any of you can build one if you happen to be in the fix my pal Merle and I found ourselves two years ago. For brevity we will call the transmitter gymno-push. A full list of parts will be found elsewhere in this manuscript.

It all happened about like this: Merle and I were trying to take the bugs out of a kilowatt c.w. job. Things were moving along in normal fashion until I touched my finger to the final tank coil. Merle had the power on and was holding the key down. I guess he didn't hear me tell him to "kill it."



" — I touched my finger to the tank."

It seemed years later when I woke up and took stock of what was going on around me. Everything seemed strange. Balmy breezes were caressing my fevered brow, monkeys were chattering in nearby coconut trees and Merle was standing over me somewhat bewildered and holding a pentode tube and a battered short-wave coil in his hand.

"Where am I?" I sputtered, spitting out a mouthful of salt water.

Merle deposited the tube and coil on the white sand, knelt over me, and started unwinding a couple of hundred feet of antenna wire from my neck and other parts of my body.

"Search me, Hal," he replied, "We're somewhere in the South Seas, though."

"What?"

"That's right. The boat was wrecked and we swam ashore to this island."

"What boat?"

"Why, our boat, of course. Don't you remember after you pulled that arc from the tank coil the doctor told you to take a long sea voyage? We went to Oakland and chartered the boat and fixed it up with a transmitter and receiver and started out. We hit a storm; the boat sank; and here we are. Just landed, so to speak."

Our island was only about five miles in length and a mile wide. There would be no danger of not getting enough to eat. Coconut palms and other tropical food-bearing trees grew in abundance. Fish were to be had for the catching and a little fresh-water stream ran from the peak of the island's solitary mountain. Altogether, the prospect for our continued existence looked quite promising.

An inventory taken of our worldly possessions showed that we had saved from the boat the following: One pentode tube, one short-wave coil, the antenna which had tangled up with me when the boat capsized, one can of water-soaked tobacco, one cigarette case filled with soggy cigarettes, one boy scout pocket knife and two dollar watches.

For a week we had a dandy time watching for rescue ships and exploring the island, but then we got that feeling all hams experience after throwing their rigs out of the shack and swearing by the prophets that they will never again look at radio equipment. We wanted to go on the air. We must go on the air. Here existence was not worth a tinker's dam unless we could get on in some manner. We could picture the stir a message from us would cause in hamdom after the world had probably given us up for lost. We must build a transmitter and receiver.

By H. L. JOHNSTON, W6ADQ, and M. R. MILLS, W6OJT

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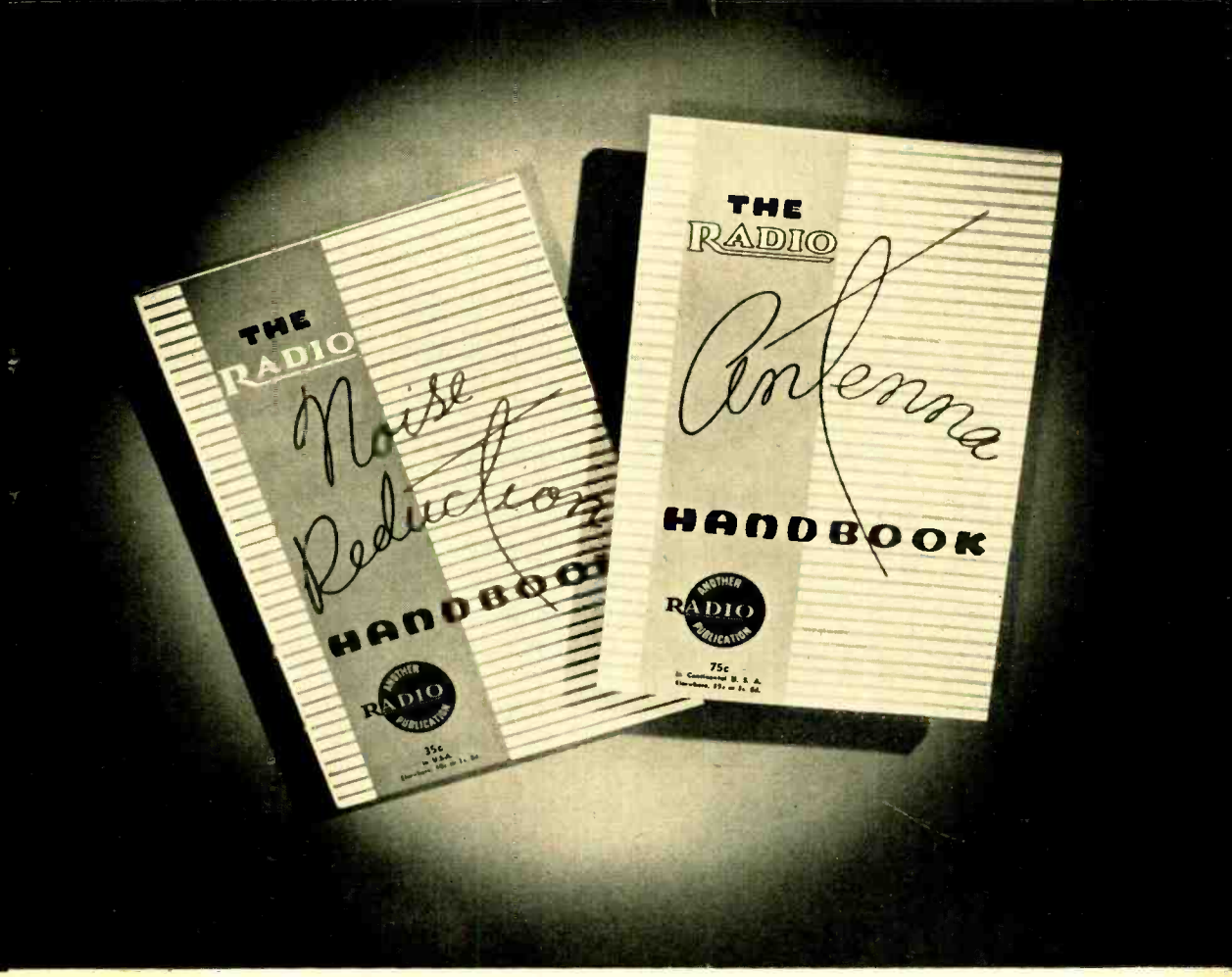

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Of course all you remember when that message did get through, for get through it did. What the world was most puzzled over, however, were the strange mutterings and whisperings that were mixed with our otherwise T9 note whenever we did go on the air. Read on. All will be explained in due time.

The first message the listening world received ran as follows:

"SOS SOS THIS IS HAL AND MERLE OUR RECENT CALLS WERE W6ADQ AND W6OJT FROM THE TALL PINES OF CALPINE SHIPWRECKED ON UNINHABITED ISLAND ZZZ HISS ZZZ TRY AND BRING COMPASS BEARING ON US"

The above message was copied in the United States for three nights running, then came a pause of a week and we came on the air with phone, sending the same distress and our location as close as we knew it.

The constructional details of the gymnopush are well worth remembering, just in case you should find yourselves in a similar predicament at some time.

Until the big idea took hold and grew into the finished product we were greatly dejected, as before stated. It was Merle who had the original idea for the transmitter from which our signals emanated. We were lying on the warm sand one evening, discussing our predicament when Merle's face lit up and he said, "Say, I bet we can build the rig with the stuff we saved from the boat and what we can pick up here on the island."

I looked over to him sorrowfully, "Sure you didn't hit your head on the rocks when we hit the island?"

"Nope. Nothing like that. Tomorrow we go to work."

First we lashed the pentode to an improvised socket of volcanic rock. Then, since we had decided to go on forty, we started to tap the coil we had salvaged from the boat for use in a Hartley. But then it dawned upon us that we had better use a crystal because we didn't want to slop over into a commercial band and get mixed up with the FCC. We stopped construction on the set and started up the mountain looking for quartz.

After spending half a day digging around in some caves we discovered, we finally found it. Another argument started as to the cut. Would it be an X cut, a Y or an AT? At last the AT cut won out; they're pretty thin for forty, but we wanted the utmost in stability. It took us two more days to find volcanic ash for the polishing job and another day to powder up enough abrasive to grind the crystal. At last we had it ground.

The next morning we found a wooden case with two empty five-gallon oil cans in it that had been washed up on the beach. From pieces of the can we made by-pass condensers. For tuning the tank we used the cigarette case, opening and closing it to vary the capacity after we had insulated the hinges with rubber from our own rubber trees. At first we used oyster shells filled with sea water for the grid leak and screen resistor. Everything was ready to go at last. The antenna was hanging in the coconut trees and a pile of rocks was handy to throw at the monkeys who thought the antenna was a suspension bridge.

Then it struck us—what were we to use for the power supply? That evening we sat around our little camp fire (which we had started during the day by the aid of our watch crystals filled with water) thinking about our power supply. Merle picked up a coconut he had broken open earlier in the day and drank some of the milk.

"Oh boy! Taste this," he yelled.

I tasted and then drained the shell. It was my turn to become enthusiastic. The milk had fermented. We forgot the power supply for the moment and gathered great piles of the big nuts, broke them open and poured the milk into one of the five-gallon cans. Later that evening, after a few rounds of coconut oil, as we now called it, Merle started thinking aloud.

"Electric eels belong to the Gymnotidae family. When angry one can put out about five hundred volts. There are plenty of them in the stream running down from the mountain. Say, I wonder why they wouldn't work for our power supply."

So, brother hams, we proceeded to gather electric eels for our power supply. But before I go any further I wish to add another rule to the safety campaign: "Never approach an eel without having one hand in your pocket." We soon discovered we couldn't hook brother eel into our circuit in his normal condition, so we proceeded to make him feel right with the world by letting him drink a few shots of coconut oil. When he was out, we hooked him into the circuit, positive to his head, negative to his tail.

To heat the cathode in the pentode we used the rays of the sun through the watch crystals. We mounted the watch crystals on a long stick, anchored it with a homemade hinge at one end, harnessed four teams of snails to the other end and let them pull the crystal along with the sun. This took some fine

[*Continued on Page 78*]

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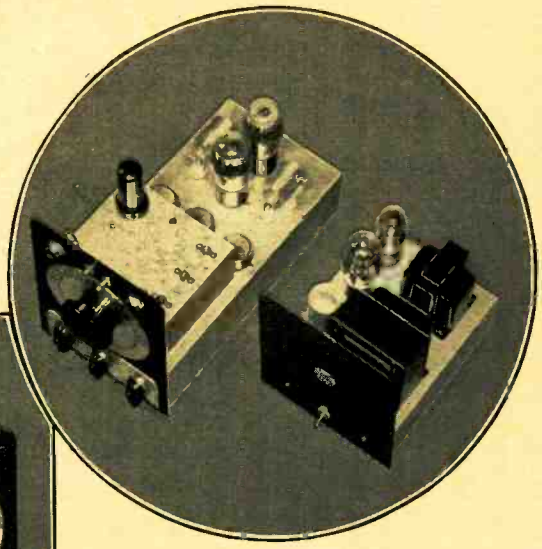
Now It's "X-EC"

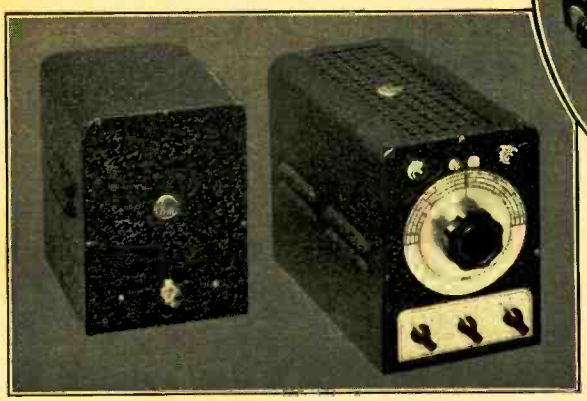
COMBINED "EC" and CRYSTAL OSCILLATOR

(DESCRIBED IN JUNE RADIO)

READ AND COMPARE!

1. POSITIVE "X-EC" STABILITY
2. ISOLATED POWER SUPPLY
3. "EC" AND "XTAL" COMBINED
4. VOLTAGE REGULATION
5. RF ISOLATION
6. NO PLUG-IN COILS
7. VIBRATION-FREE MOUNTING
8. REGULATED BANDSPREAD
9. 40 OR 80 METER OUTPUT
10. CALIBRATED VERNIER DIAL





A "Hughes-Mitchell" Product

"X-EC" HM-103 (LICENSED BY RCA)

$42.50 NET WITH TUBES

INCLUDES POWER SUPPLY WIRED AND TESTED

F.O.B. Los Angeles

● The "X-EC" is not an ordinary electron coupled oscillator for shifting frequency. It is a definite, absolute method of FREQUENCY CONTROL.

● Use the "X-EC" to drive the lowest frequency stage in your transmitter 40 or 80 meters. You may use your present crystals (40 or 80 meter), and have 40 or 80 meter output, either "EC" or "Xtal", by flipping a switch. For working the band edges, spot frequency crystals are suggested, and accommodations for three crystals are provided.

● A stable "ECO" must be vibrationless, humless, and supplied with constant voltage. The voltage regulated power supply for the "X-EC", being isolated, also eliminates heat which would otherwise affect the stability.

● The "X-EC" floats on "shock absorbers" to exclude external jar or vibration. The objectionable features of other electron coupled oscillators are not found in the "X-EC" and its efficiency and stability has been raised to such a high degree that it is the most outstanding, variable frequency control unit thus far presented.

● The two-band output will prove advantageous. No plug-in coils are used, all of them being permanently mounted. You will like the calibrated bandspread dial. This dial incorporates a smooth action reduction drive unit, and it is direct reading for the 10, 20, and 40 meter bands. Band calibration covers approximately the whole of the 180 degree rotation.

● The "X-EC" comes to you COMPLETE . . . . with isolated, voltage regulated, power supply, four feet of shielded connecting cable, and a set of R.C.A. tubes. The richly finished cabinets are only 6½ inches wide, 9"h. and 12"d., and will make a fine appearing unit beside your receiver.

● Remember, the "X-EC" is WIRED and TESTED . . . . ready-to-go . . . . and licensed by R.C.A.

DESCRIPTIVE BULLETIN AVAILABLE

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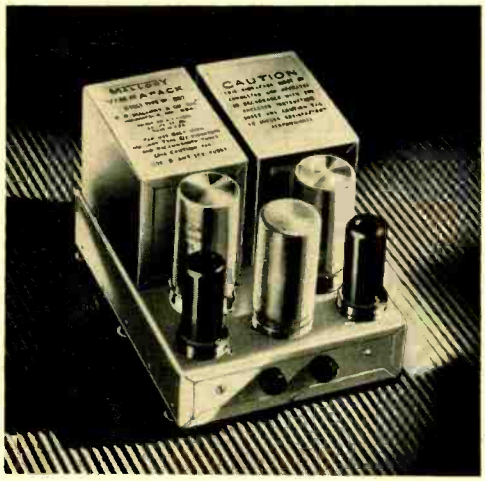
What's New . . . .

IN RADIO

NEW MALLORY HEAVY DUTY VIBRAPACKS



Three new Vibrapack units have just been added to the Mallory line of vibrator power supplies. The new units are:

VP-555—a dual Vibrapack with a rating of 300 volts at 200 ma. load, 6.3 volts input.

VP-557—6.3-volt dual Vibrapack having an output of 400 volts 150 ma.

VP-F558—a 32-volt Vibrapack of the tube rectifier type similar to the VP-554, with a 300-volt 100-ma. nominal output.

A booklet containing complete descriptions of all Mallory Vibrapacks with technical data and instructions is available upon request. Address inquiries to P. R. Mallory & Co., Inc., Indianapolis, Indiana.

FOUR NEW GT-TYPE TUBES

Four new additions to the GT series of octal-based tubes have been announced by RCA; two will be of especial interest to amateurs, the other two will be more suitable for use in a.c.-d.c. broadcast receivers.

The two of greater interest to amateurs are the 6J7-GT and the 6K6-GT; the characteristics of these types correspond exactly to the similar types bearing the same type number without the "GT." In other words, the tubes are short tubular editions of the 6J7 and 6K6. The latter type is also almost identical to the familiar 41 of earlier vintage.

The other two are the 12J7-GT and the 35Z5-GT. The former is a 6J7 with a 12.6-volt heater; the latter is a special rectifier for use with a.c.-d.c. receivers. The 35Z5-GT is a high-vacuum half-wave rectifier with a tap on the heater for operation of the pilot lamp of the receiver. The maximum current rating of the 35Z5-GT is 100 ma. with 125 applied r.m.s. volts.

20-WATT THORDARSON AMPLIFIER

A streamlined 1939 model 20-watt amplifier has just been announced by Thordarson. Contrasting green bands on polished steel with a background of grey wrinkle result in a cabinet of beauty as striking as the solid walnut enclosures introduced by Thordarson last season.

The 20-watt rating is conservative; the frequency response is exceptional—± 1 db from 30 c.p.s. to 15,000 c.p.s. Inputs are provided for two microphones and one phone or r.f. tuner. All may be mixed and controlled independently. The unit would be excellent for use as a speech amplifier in a modern amateur phone station.

Write the Thordarson Electric Mfg. Co., Amplifier Division, 500 W. Huron, Chicago, Illinois, for catalog No. 600-D for complete details.

PERMEABILITY TUNER

A twelve-page construction booklet just released by the Aladdin Radio Industries features the use of the new Aladdin Permeability Tuner. Tuning is accomplished by varying the inductance instead of capacity in the tuned circuits by the insertion of Polyiron cores within the respective fields of the coils. A novel mechanical movement enables the receiver to be tuned in the conventional manner by the rotation of a knob.

According to the manufacturers, the unit permits of simplified wiring, uniform gain and selectivity over the entire 550-kc. to 1500-kc. range, and single-point alignment tracking. A kit has been made available by Aladdin for the construction of a simple b.c. band tuner or receiver with the permeability-tuned unit manufactured by them.

HIGH-POWER BANDSWITCH

Supplying a long-felt need for a practical bandswitch for transmitters up to 1 kw. in power, Heintz & Kaufman have recently placed on the amateur market their Type 892 Switching Unit. Requiring a behind-panel space of only 2⅝" square, they have a depth of 3½" for a single section, with an additional 3" depth requirement for each additional section. Ganging is easily accomplished.

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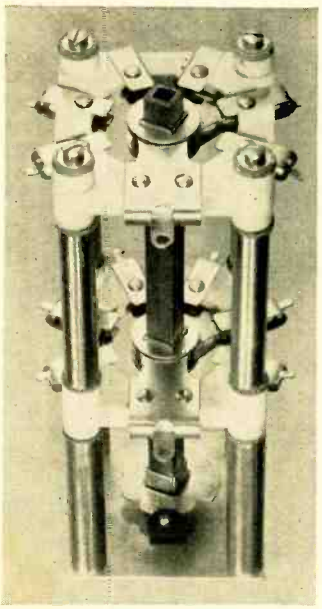
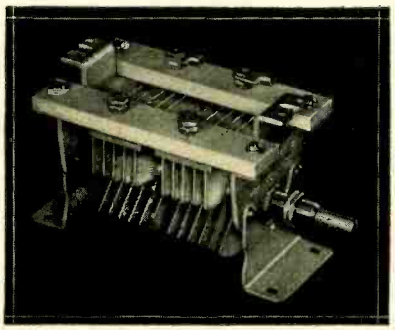


Six positions per section are provided on a ceramic wafer base. The contacts are double for large current capacity, and a wiping action is used to insure positive contact at all times. Each section is rated at 15 amperes at 4000 volts up to 1.5 Mc., and 8 amperes at 4000 volts up to 10 Mc. At 30 Mc. they will withstand 6.5 amperes at 3000 volts. Drive shafting is available in either a bakelite or ceramic material.

NEW CARDWELL U.H.F. CONDENSER



The Allen D. Cardwell Mfg. Corp. is adding to their popular "N" series of ultra-high-frequency capacitors several new items, including the dual 50-$\mu\mu$fd. 3000-volt condenser shown.

The photo also shows the new type "M" Cardwell bracket, which fits both the Cardwell "Midway" as well as the "N" type u.h.f series. Reduced capacity to ground is provided by the inverted mounting shown. The regular mounting feet of the condenser provide a support for standard transmitting inductance coil jack bases.

Monitor's

K-23

A 20-Meter Crystal That Can Take It

Price $10.

MECHANICALLY RUGGED

Will withstand the jar and vibration of severest mobile usage.

ELECTRICALLY RUGGED

As indestructible and active as the best 40-meter crystal.

LOW DRIFT

Coefficient of less than 4 cycles per Mc. per degree C.

Choice of dealers' stock or within 0.1% of specified frequency—14.0-15.0 Mc.—$10.00.

Commercial frequency prices on request.

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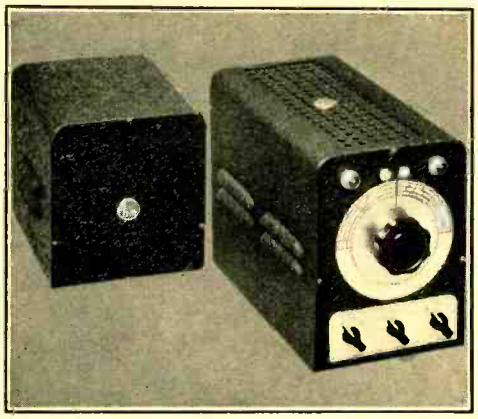
XEC EXCITERS NOW AVAILABLE COMPLETELY WIRED AND TESTED



The XEC combined electron-coupled and crystal oscillator has just been announced by the Radio-Television Supply Company, Los Angeles. This XEC is a "Hughes-Mitchell" product, being fabricated by the manufacturing division of the above company. The stock number of the unit is HM-103.

The XEC incorporates the new design principles brought out in the descriptive article in June RADIO. It has an isolated, voltage-regulated power supply which gives constant voltage to the oscillator. Another feature is the two-band output. The XEC will drive the lowest frequency stage in your transmitter, 40 or 80 meters. You may use your present crystals (40 or 80 meter) and have 40- or 80-meter output, either "EC" or "XTAL," simply by flipping a switch. Accommodations are provided for three crystals.

The HM-103 (XEC) is supplied with the separate power supply, four feet of shielded connecting cable and a set of RCA tubes. It is wired and tested, and licensed by RCA. Descriptive bulletins may be obtained from the Radio-Television Supply Company, 1701 So. Grand Ave., Los Angeles.

NEW MONITOR 20-METER CRYSTAL

Monitor Piezo Products, South Pasadena, California, has announced a new type of high-frequency crystal for use on frequencies in the vicinity of 14 Mc. The complete unit, comprising both a new crystal cut and a new and greatly improved shock-proof mounting, gives greatly improved performance both for fixed-station and mobile use. The particular advantage of the new crystal, however, lies in its unusual suitability to mobile use. The combination of crystal and mounting is very rugged and will easily withstand considerably stronger jars and shocks than will ever be encountered in even the most severe mobile usage. Another advantage of the new crystal, especially for fixed-station use, lies in its ability to withstand a great deal more power than any of the previous types of high-frequency crystals. Extensive tests have shown that the new 20-meter crystal is capable of handling with comparative ease as much power as any of the conventional types of 40-meter crystals.

HEAT RADIATING CONNECTORS

Wunderlich Radio, Inc., San Francisco Airport, South San Francisco, Calif., is now making heat radiating connectors for use in making connection to the grids and plates of tubes such as the 35T, 75T, HK54, HK254, WE304B, to the grids of 100TH's, or to the elements of any other tubes where connection must be made to a tungsten wire of approximately 1/16 inch in diameter. These connectors, aside from giving good electrical contact, have the added virtue of dissipating the heat from the seals of such tubes. The possibility of overheating the seals from excessive plate dissipation is greatly reduced when radiating connectors of this type are employed. A set of these connectors are shown in use on the 75T tubes illustrated in an amplifier elsewhere in this issue. They are quite inexpensive and may, at present, be obtained from the manufacturer.

●

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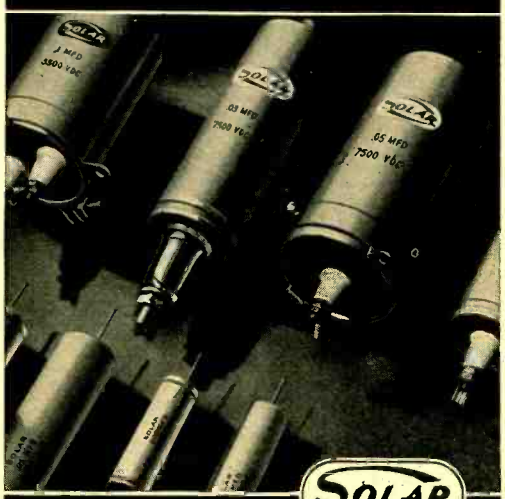

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Postscripts and Announcements

[*Continued from Page 59*]

W4DCZ	2862	W8ACY	1344
W4EQC	2400	W8JAH	1267
W4QN	2214	W9TJ	19,740
W5WG	17,334	W9CWW	7218
W5KC	4020	W9WTW	5992
		VE3KP	1855

Junior Section

W1BFA	356	W7FXF	28
W2ICX	612	W8DAE	280
W3WU	171	W9QMD	12
W5EWZ	1024	VE5ZM	1288
W6QAP	3012	NY1AD	276

Delaware Valley Hamfest

The Delaware Valley Radio Association announces its third annual outing and hamfest which will be held Sunday, August 6 from 10:00 a.m. to 8:00 p.m. (if rain, date will be August 13) at the Trenton State Fair Grounds, Nottingham Way, Trenton, N. J. There is direct bus service from the Pennsylvania Depot to the fair grounds.

Among the many attractions will be a championship baseball game between the second and third call areas. In addition there will be competitive contests of all kinds, two orchestras for dancing, professional entertainment, many prizes for both ladies and gentlemen, and an unlimited supply of tasty food and various beverages.

Tickets—$1.50 per adult, 50c per child at the gate; $1.25 per adult if bought before August 1. Mail all reservations to the General Chairman, Wm. E. Wilbur, W3GNU, Hightstown, N. J.

Alberta Hamfest

The Northern Alberta Radio Club will stage the Alberta Hamfest at the Masonic Temple in Edmonton on Saturday and Sunday, July 22 and 23. Admission is $1.50. Anyone interested is invited.

W6USA Diagram Correction

In the diagram of the W6USA transmitter in the June issue, the final amplifier neutralizing condensers were omitted, though the connecting wires were drawn. The amplifier is cross-neutralized in the usual manner.

• • •

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GAMMATRONS

WILL TAKE HIGH PLATE VOLTAGES

TYPE 24 PRICE $350

This is possible because the GAMMATRON design provides that all internal insulators are eliminated. Elements are supported only from the envelope. Thus, long leakage paths provide almost perfect insulation even at ultra high frequencies. Even the diminutive 24 GAMMATRON will operate at 1500 plate volts at 5 meters. High voltages mean greater efficiency, larger power outputs, and more DX. Write for data on GAMMATRONS.

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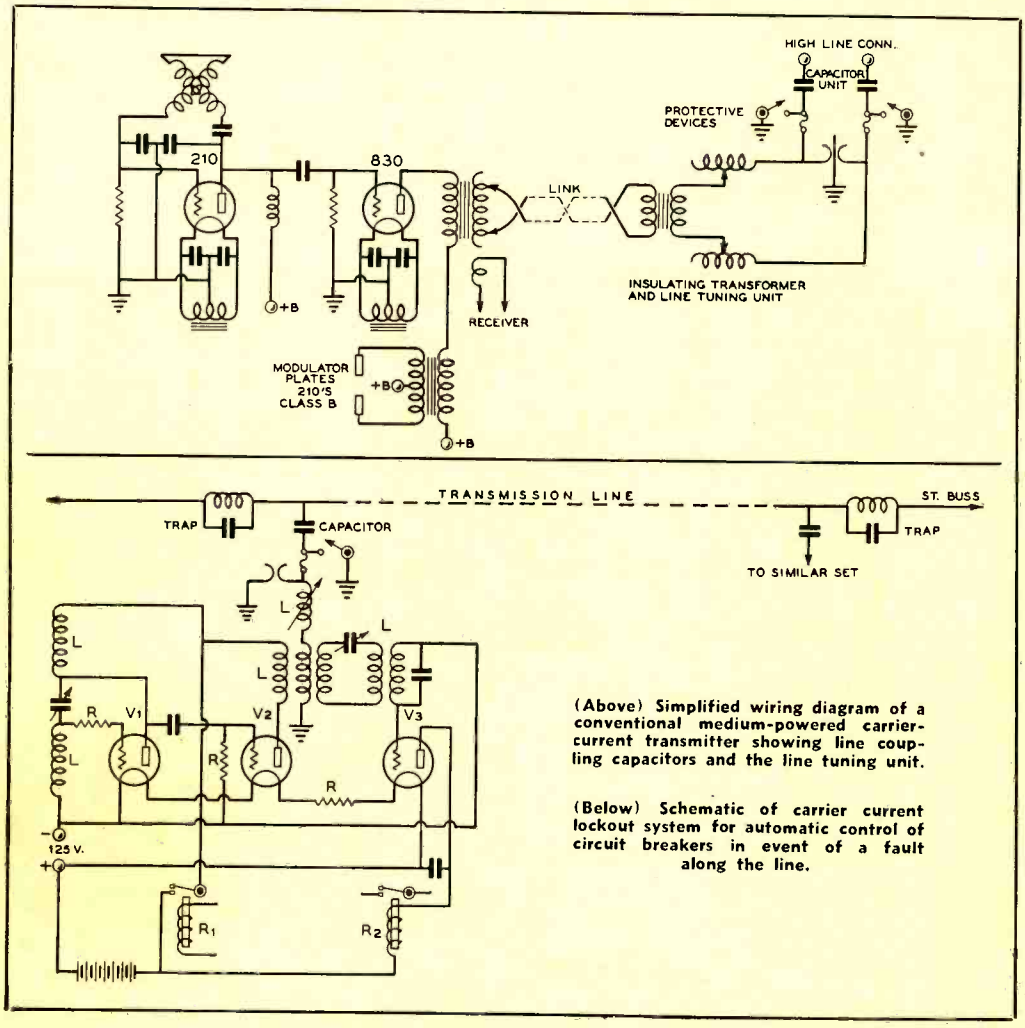
CARRIER CURRENT RADIO

By E. S. Hall*

Although the majority of amateurs know that such a thing as carrier radio exists, few know much of the actual workings of the system and most know only that it has something to do with wired wireless. The principle of operation of such a system is comparatively simple: a low-frequency carrier (between 50 and 100 kilocycles) carrying the desired intelligence (phone or c.w. or controlling impulses) is coupled into the high lines at the transmitting point, is carried along the lines with very little loss due to radiation, and is taken from the lines at the receiving point or points to accomplish the desired object. Such systems are employed by most power companies as a means of communication between various administration offices, generating stations, and the various substations on their high-voltage transmission system.

The transmitters for the most part are of the m.o.p.a. type and have power output ratings of from 0.25 to 100 watts. The communication energy can be coupled into the high-voltage lines by any of a number of different methods, but the most common system is to capacitively couple the energy into the lines by means of very high voltage blocking condensers.

* 222 West 15th St., Wichita, Kans.



(Above) Simplified wiring diagram of a conventional medium-powered carrier-current transmitter showing line coupling capacitors and the line tuning unit.

(Below) Schematic of carrier current lockout system for automatic control of circuit breakers in event of a fault along the line.

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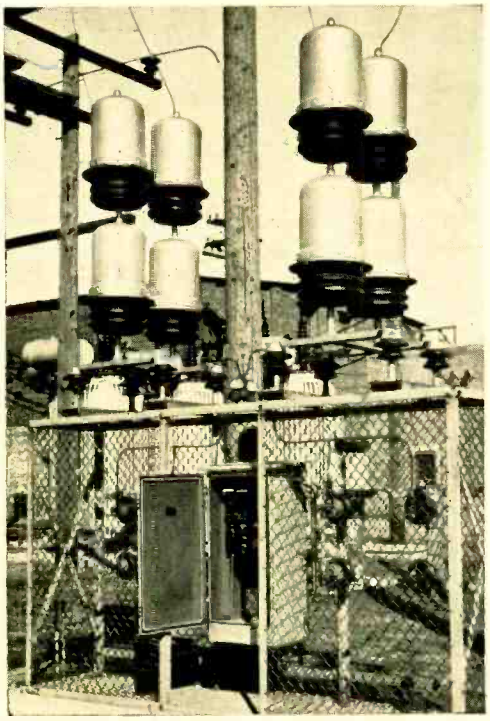
The receivers are of the t.r.f. type and are practically free from any of the ordinary types of atmospheric disturbances. However, the received signal level is somewhat affected by the sleet and ice that sometimes covers the lines and insulators in the winter months.

Sets used for communication between various administration offices have automatic break-in by means of electronic relay systems and are also equipped for selective ringing through the use of a dialing arrangement. The telephone dial keys a tone oscillator which operates selective relays at all stations. However, each station is set up for a different number of tone pulses so that only one station will be called when a certain number of pulses is sent.

Carrier current is also used for relay control of the high-voltage circuit breakers whenever a serious disturbance occurs along the line. When there is a fault somewhere along the transmission line, power may flow from both ends of the line toward this fault. The direction of power flow at each end of a section of the line is determined by reverse power relays which in turn control a carrier-current transmitter. If the relay at each end shows power flowing into the line, which is impossible unless there is serious trouble along this portion, the carrier sets at each end send a certain type of signal which



By-pass arrangement for coupling carrier-current energy around a circuit breaker in the event that it should be opened.

Active

An active crystal is easily excited; it snaps into oscillation rapidly, faithfully follows keying, and has a high Q. All B5 40-meter Crystals have a high relative activity because they are accurately cut, precision lapped, individually finished to rigorous performance standards, and mounted in a correctly designed holder.

Accurate

Each B5 40-meter Unit is calibrated by reference to a primary standard of frequency. The measured value is stamped on the holder nameplate and is guaranteed to be correct within .03% in any standard oscillator circuit. Precise calibration assures frequency accuracy—low drift insures frequency stability.

Dependable

Rigid manufacturing standards and careful inspections are applied during every processing operation. As a final check for perfect crystal quality and the ability to withstand adverse operating conditions, each crystal is subjected to an exacting overload test. Dependable performance is built into B5 40-meter Crystal Units.

Price
40-Meters
± 5 Kc.
$4.80

BLILEY

B5 40-METER CRYSTAL UNIT

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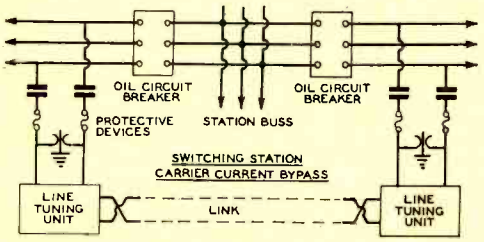
passes through the receivers and through relays actuates the circuit breakers.

If the reverse power relays show power flowing to a fault which is external to this particular portion of the line they send another type of impulse which blocks the breaker tripping relays on this particular portion of the line. The sets used for this type of service are of comparatively low power and are of the unmodulated-carrier type. Traps are used at each end of a section of line to keep the signal isolated from other parts of the transmission system. The sets are also coupled only from one phase of the line to ground so that the other two phases of the conventional three-phase line can be used for communication.



A .001-μfd. 92,000-volt capacitor as installed to couple energy into two phases of a 66,000-volt transmission line.

Separate sets of capacitors are used on each side of a switching station with a link circuit between them so that the r.f. energy will be by-passed when the line switches are open. Carrier current communication is also used in several other applications though to a lesser degree. Some of these applications are: automatic indication of switching operations of a distant substation, remote metering, and supervisory control of outlying stations.

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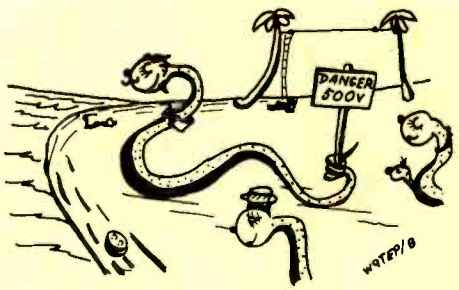
Yarn of the Month

[*Continued from Page 70*]

figure work, but we solved it. In order to keep the team's mind on its job, we planted a lawn in front of it and put a little pool of water in the center of the lawn. This kept them all thinking about the coolness ahead of them and they never shirked their job.

Later we discarded the oyster shell resistors for baby eels as voltage drops. We discovered upon our first attempt to get on the air that we had our big eel hooked up backwards and so we had to get him pickled again to change him around. Thus we were able to hook up the baby eels the right way in the first place for grid bias since there seemed to be no change in polarity with increased age or size.



" — eels were plentiful."

The next big problem was how to break the high voltage power supply. Two eels hooked in parallel would give us 500 volts at 200 ma., too much to break by hand. We brought a mongoose on the job and tied a string around his tail. By bringing him close to the eels our power supply generated full voltage; when we pulled him back the voltage dropped to zero. This worked fine for a few dots and dashes until the string broke. Then we tried another plan. We took turns poking the eels with a stick, sending slow code. This explains the hissing and strange sounds in our signal. It was the eel adding his opinion of such procedure, or would we call it his parasitic oscillations?

Our voltage regulation was rather poor so we tried stringing oyster shells filled with

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salt water across the eel as a bleeder resistor. This gave us a much better note. Still we were not satisfied. We must go on phone and we must build a receiver to enable us to contact the rescue party.

We used medium sized eels for double-cutoff grid bias on the pentode. Then the bottom of one of the five-gallon cans was cut out and hung to a tree limb. A wire ran from the bottom of the square piece of tin and was looped around the center of the eel. When Merle talked against this piece of tin it vibrated and tickled the eel who put out voltage according to the amount of vibration.

This solved we started to work on the receiver. Another piece of tin was hung up in the tree. An eel was fastened inside the tank coil of our transmitter and the wire from the tin fastened to him. The piece of tin would vibrate freely. When a radio signal was tuned in the eel inside the coil would vibrate with the incoming signal. Merle worked this out while I was at the far end of the island replenishing our supply of eels. As a volume control a coconut was fastened on a stick and a piece of bamboo run from the bottom of the nut to the eel's mouth.

" — send eel food."

The nut was filled with coconut oil. When we wished to reduce volume we merely gave the eel a slow or fast flow of oil depending on how much we wanted to tone down the output. [*Continued on Next Page*]

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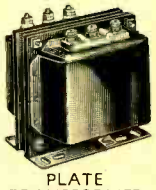

PLATE TRANSFORMER

POLY-PEDANCE DRIVER TRANSFORMERS

Stancor Part No.	Cap. in Watts	Pri. M. A. per Side	RATIO Primary to ½ Secondary	Net Price
A-4761	15	60	1.25:1, 1.4:1, 1.6:1, 1.8:1, 2:1, 2.2:1, 2.4:1	$3.45
A-4762	15	60	2.6:1, 3:1, 3.2:1, 3.4:1, 4:1, 4.5:1, 5:1	$3.30
A-4765	15		1:0.75, 1:0.85, 1:1, 1:1.25, 1:1.45, 1:1.75, 1:2, 1:2.25, 1:2.5, 1:2.75 1:3.15	$3.30

POLY-PEDANCE MODULATION TRANSFORMERS

Stancor Part No.	Cap. in Watts	Pri. M. A. per Side	Secondary Series	M. A. Parallel	Net Price
A-3891	15	45	45	90	$3.00
A-3892	30	80	80	160	3.90
A-3893	60	125	125	250	4.80
A-3894	125	200	150	300	6.30
A-3895	300	260	260	520	18.00
A-3896	600	350	350	700	37.50

PLATE TRANSFORMERS

Primary 115V 50/60 Cycles

Stancor Number	Secondary A.C. Load Volts	D.C. Volts	D.C. M.A.	Net Price
P-6152	1550-0-1550 1350-0-1350	1250 1000	300	$9.60
P-5053	1660-0-1660 1390-0-1390	1500 1250	300	11.10
P-6156	2150-0-2150 1850-0-1850	1750 1500	300	12.00
P-6154	2430-0-2430 2150-0-2150	1750 2000	300	12.90
P-6155	2950-0-2950 2400-0-2400	2500 2000	300	17.70
P-3012	1250-0-1250 950-0-950	1000 750	400	11.40
P-6153	1550-0-1550 1350-0-1350	1250 1000	500	13.80
P-6159	2150-0-2150 1830-0-1830	1750 1500	500	22.50
*P-6163	3000-0-3000 2410-0-2410	2000 2500	500	30.00

*115-230V Pri.

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I'll never forget the day we made contact with San Francisco. Merle shouted at me. "I raised 'em, Hal, and they want to know if we need any supplies?"

"Ask them if they'll send us a crate of assorted eel food; our power supply is running down," I replied, reaching for another half shell of coconut oil, "An' tell 'em to ask the radio magazines to save advertising space for a new type of really streamlined power supply. We'll really upset the market as soon as we get back to the States."

So there we were, the two of us, happy in our solitude and in the pride of our accomplishment, stretched out on our backs watching the monkeys and listening to beautiful music. We were at peace with the world on an island of our own where we could develop other wonders to give to the radio world.

Then, suddenly, something seemed wrong! I was looking up into the face of the family doctor and he was saying to the nurse: "Let me know if he has another relapse. That jolt he got out there in the radio shack last night should teach him not to work on a transmitter when the power is on."

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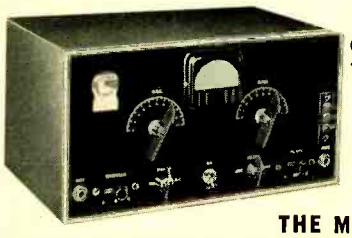

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☐ Enclosed find $29.37 for "5x10" X-mitter Kit.
☐ Please send me Full Details on the above Kit.

Name .....
Address .....

Open Forum

[*Continued from Page 61*]

The question is: why don't the tube manufacturers put a center tap on the filament of transmitting tubes so that a low impedance, direct connection can be made to the exact electrical midpoint of the directly heated cathode? As you know, one of the most common causes of difficult neutralization, as well as hard-to-eliminate parasitics, occurs in the familiar two condenser and center-tapped resistor network at this point. Although a good condenser theoretically presents a very low impedance at the higher frequencies, the necessary lengthening of the leads which are common to both grid and plate is enough to present a serious problem.

I have talked this over with other men who are interested in transmitters, and none of them can give me any reason why the midtap would not work. If feasible, I am sure that it would prove very popular, and would help a lot to make wiring simpler and neater.

GROVER MCMILLEN, W8LNS

Balboa, C. Z.

Sirs:

You are inviting brickbats and bouquets, are you? OK, stand by to dodge one and catch the other.

Fortunately for you, you don't issue RADIO in volumes and consequently you have a good "out" for the January index, but you do put out a cover for the year's issues which leaves you a good "in." Whyinell should we have to dig out the volume for 1939 to get at the index for 1938? Of course we could file the January issue with the 1938's but we are mostly conservative, we hams, as witness the 1915 notes and efficiency of most of us.

The only other brickbat coming in is a complaint regarding the interpretation of the word "portable." One guy describes a rig in RADIO which he very nonchalantly classifies as "portable" as it weighs under 100 pounds. Given the manpower, the RCA A.S.T. 150 would make a dandy too, and according to the account of the "heavy dew" in L.A. (RADIO, April, 1938, page 12) one of the fellows had his "portable" disabled when the power went out. Why don't you get busy and try to educate some of these people as to what portability really means?

The technical articles are really excellent and badly needed. We've had too many articles in the past that told us to put such and such a wire in such and such a place, being very careful to avoid the blooper in passing, etc., without telling us *why*. How about lots more theory?

GEOFF S. HALL

www.americanradiohistory.com

Overgrown Lazy H

[*Continued from Page 25*]

a result of electrostatic and electromagnetic coupling *unless* care is taken in their orientation. This mutual coupling will result in decreased directivity and a slight loss in gain.

To minimize coupling between two horizontally polarized arrays resonant on the same band, they should be oriented so that a line extended through one of them can be made to intersect the center of the other array. This is illustrated in figure 2. To eliminate the necessity for four poles, antenna no. 2 is supported at one end by means of a "V" branching out to both of the other two poles. These two wires should be broken up thoroughly with insulators every few feet as they are right in the field of array or antenna no. 1.

Inductive-Tuned 75T Amplifier

[*Continued from Page 33*]

and with good efficiency at plate voltages of from 1000 to 1500 volts. They can, however, be operated as high as 3000 volts and the maximum plate current rating is 175 ma. per tube at all plate voltages—providing the plate dissipation can be kept within the maximum rating of 75 watts. The amplification factor is 10.6, the grid-to-plate capacity is 2.3 $\mu\mu$fd., the maximum grid current rating is 30 ma. The filament rating is 5 volts at 6.5 amperes. It is recommended that radiator connectors such as those shown in the photograph be used to cool the seals of the tubes when the plate dissipation approaches the maximum rating.

With the amplifier operating on 20 meters the two 3¼" x 4½" pieces of aluminum that comprise the plate lumped-capacity should be separated about as shown in the photograph. For operation on 28 Mc. the plates should be separated about 1½ inches at the far end (toward the tubes) to provide the correct circuit capacity.

With a grid current of only 30 ma. the amplifier took an input of 600 watts on 28 Mc. with comparative ease when operating at 2000 volts. However, for phone operation it would be desirable to have 45 to 60 ma. of grid current to improve the linearity of the stage. The three-turn variable link which is incorporated into each coil makes it possible to have a set amount of antenna coupling for each band. Since the antenna-coupling coil is a part of the plate inductance, no juggling of this control is required when changing the band of operation of the amplifier.

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WIRE BENDING TOOL

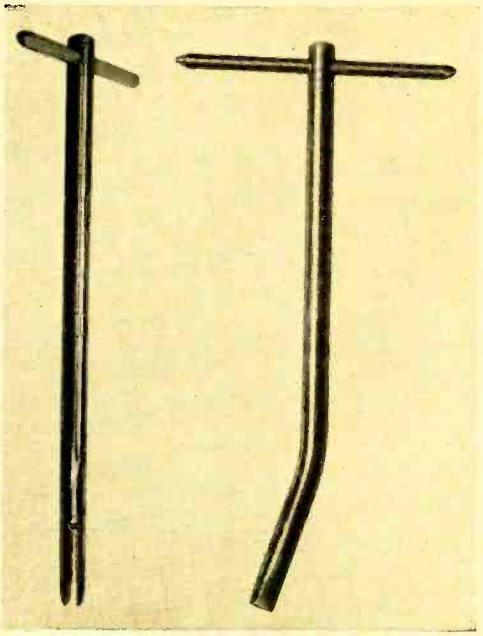
By GUY DICKEY*

Quite often when wiring a transmitter or power supply with bus bar or heavy wire the need for a convenient tool especially made for bending this heavy conductor is felt. Such a special-purpose tool is illustrated and described herein.

This tool is much more efficient than the long-nose pliers with which we are all so familiar as it is made to the correct size, it always fits when picked up and does not have the tendency to slip, as will the pliers. Then when reaching into out of way places the size of the tool makes it so much handier than pliers. Notice the bend in the shaft of the tool. Notice also that it is neither in the same plane as the handle nor the slot. This is important. You will find the tool will lose convenience if made differently.

As to materials, if you are going to use it just for one job, make it of a large spike—a nail could be used for the handle. For a permanent job I recommend the use of a bar of tool steel.

The size of the slot will vary, of course, with the size of wire which you intend to use. A cut made with three hack saw blades is about right for no. 10 or no. 12 wire; two blades make a slot about right for no. 16 wire. The slots will need a little smoothing up with a file after sawing. Make the slot about ¼ inch deep.



The "gadget": an especially-made tool for making neat bends in heavy wire. Notice the relation of the bend, the slot, and the hole for stripping insulation. The overall length of the tool is 5¼ inches.

That small hole between the bend and the slot isn't there by accident. It's very handy to push back the covering on waxed push-back wire—the kind having insulation which sticks so tight. Grasp the wire about ⅜ inch from the end and poke the end into the hole. The covering slides right back, even the stickiest kind, and leaves the end of the wire exposed just the right length for soldering.

The grip referred to in the second paragraph is simply this: if you take up the tool in your hand with the tee end well up in the palm of the hand, you get much better leverage. When holding the tool in this manner the thumb will rest near the bend. The bend will point out away from you but toward your left. Of course this way of holding the tool will not be best when working in corners of chassis and other out of way places.

I make no particular claims as to their originality, but have found that they actually work. A set of them for different sized wire has become practically indispensable. One word of caution—don't leave the tool around with any wire handy; your friends will promptly bend the wire into all sorts of weird shapes as they do with mine.

* 512 East Sixth St., Marysville, Ohio.

REMEMBER!

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The Editors of "Radio" do not publish August and September issues.

•

The next issue of "Radio" will be the October, 1939 issue . . . available about September 25th.

•

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Calls Heard

John G. Kuespert, W9WCW
706 29th St., South Bend, Ind.
(Jan. and Feb., 1939)
(14 Mc. CW)

CE—3CB; 3DG; 4AD; **CM**—2AZ; 2FA; 2SW; 2WD; 6DV; **CN**—8AN; 8MS. CR4HT; **CT**—1JS; 1PX; 2AB; 2BO; **CX**—1CB; 2AJ; **D**—4AFR; 4QET; **EI**—4J; 6G; EL2A; **ES**—1E; 5C; **FS**—AM; FG; IZ; KI; PZ; UE; FA8RY; FY8AA; **G**—2GC; 2JT; 2JU; 2KM; 2LX; 2MI; 2SO; 2XV; 2WD; 3BC; 2BU; 3JR; 2KM; 3QV; 3SD; 3TT; 3XF; 3XP; 3YQ; 5DR; 5DV; 5FN; 5IV; 5LP; 5LY; 5MY; 5NS; 5RV; 5ZT; 6DX; 6MC; 6MK; 6SQ; 6VC; 6VQ; 6WB; 6XP; 6YG; 8AP; 8DL; 8II; 8IX; 8JO; 8NB; 8PX; 8RQ; 8SM; 8US; **GM**—3QG; 3Q■; 3UM; 6XI 8FB; 8MQ; GW3QN; HA2F; HA2N; HC1HM; **HH**—2ES; 2MC; 3L; 4AS; HI2AC; HK2YL; HR2ON; 1IMH; **J**—2JJ; 2KG; 3DF; 5CC; 8CA; **K4**—EYP; EZR; FN■; KD; **K5**—AF; AN; AU; **K6**—AMH; IAE; LCV; LKN; OQV; PPR; PTW; QIU; **K7**—ETS; FLP; HEU; KA1FG; KA1RP; **LA**—1H; 4O; 6U; 7A; 7W; 7Z; **LU**—2EG; 4AG; 6DG; 7AZ; 9AX; 9CK; NY2AB; OA4Q; OA4R; **OH**—1NL; 1NT; 1NV; 5NI; 50A; 50L; 6NG; 6NS; **ON**—4IW; 4NS; 4XA; **OZ**—2X; 7BO; 7CC; 7PD; 7S; 7UU; **PA**—AZ; EP; GN; LB; NN; PK; PN; PO; XG; **PK**—1MF; 1RI; 4FS; 4KO; 4KS; **PY**—1AJ; 1DH; 1DS; 1GJ; 1IM; 1JG; 1MK; 1MP; 2BB; 2BX; 2CD; 2DN; 2EC; 2IH; 2JO; 5QJ; **SM**—3MT; 5KP; 5NK; 5NV; 50S; 5UW; 6NP; 6UA; 6WE. 7UC; SP1NR; SP3AK; **TF**—3C; 5C; 5M; TI2LC; **U**—1AC; 1BC; 3DN; 5KY; **VK**—2AHP; 2AJU; 2DG; 2TI; 3ED; 4SA; 4YL; 5FM; 6KW; 6LJ; 6SA; 7GJ; **VP**—1DM; 1JR; 2AC; 2AD; 4TI; 4TO; 5AD; 5SB; 6MY; 7NT; 9A; VQ8AF; VS6AO; **VU**—2BG; 2LK; **XE**—1AM; 1CM; 2L; XU2AW; XU4XA; XZ2JB; YM4AV; YV5AE; ZC6EC; **ZL**—1LS; 1LZ; 1MB; 1MR; 1NJ; 2FA; 2GW; 2MR; 2VM; 4AO; 4CK; 4GY; ZS6AN; ZS6DM.

(Mar. and Apr., 1939)

CE3—AG; AJ; BF; CB; EE; **CM**—2BC; 2BZ; 2MR; 6DV; 7AC; CN8MS; CR4MM; CR7AF; **CT**—1JS; 1PC; 1ZZ; 2BO; **CX**—1BG; 1BU; 1CB; 1FB; 2AJ; **D**—3BCF; 4DFB; 4QET; 4WER; EI4J; ES1E; **F**—3NG; 8IZ; 8JJ; 8KI; 8PR; 8PZ; FA8BG; FM8AD; **G**—2BK; 2FT; 2IO; 2KM; 2VF; 3JR; 3QV; 3RR; 3SD; 4AR; 5MS; 6MK; 6NF; 6VA; 8CG; 8CL; 8FK; 8FV; 8GI; 8JO; 8LU; 8OA; 8OH; 8PC; 8PI; 8RQ; 8TC; 8UD; HA1R; HA2B; HB9CC; HB9X; **HC**—1HM; 1PZ; 5Q; HH2ES; HH2MC; **HI**—2AC; 6Q; 7GW; HK2BL; HK4DA; HR2ON; HR7WC; J3FP; J3FK; **K4**—ESH; EVD; EYP; FCV; FHR; FYD; **K5**—AA; AC; AE; AF; AG; AN; AQ; **K6**—BUX; LBH; OKN; OQV; PHD; PHK; PTW; PUS; QBI; QIU; KB6OCL; K7ELM; KA1FG; KA1RP; **LA**—4K; 7I; 7R; **LU**—1CA; 1EP; 2EG; 3EV; 4AG; 4DJD; 4DQ; 6DG; 6DJK; 7LC; 8DJ; 8EN; 9BV; NY1AA; OA4D; OA4R; OA4U; OH1NL; OH2NQ; OH5OD; **ON4**—AU; DS; GN; HS; JO; MS; PW; WX; **OZ**—2AU; 4H; 4M; 7CC; 7S; 9Q; **PA0**—AZ; CE; EP; FV; KW; LB; NN; ON; SD; **PY**—1AJ; 1AZ; 1DC; 1DI; 1DW; 1ES; 1FZ; 1GJ; 1IM; 1MH; 1MK; 1MX; 2AC; 2AL; 2BB; 2BY; 2BZ; 2CD; 2DN; 2GJ; 2HQ; 2KT; 2KX; 3BB; 5QB; 5QJ; 7AB; SM5TB; SM6UJ; SM6WE; **SP**—1AO; 1DC; 1KM; 1MX; 1RG; 1YX; 2YL; 3AC; U1AD; U2NE; **VK**—2ACX; 2ADE; 2AEC; 2AFJ;

[*Continued on Next Page*]

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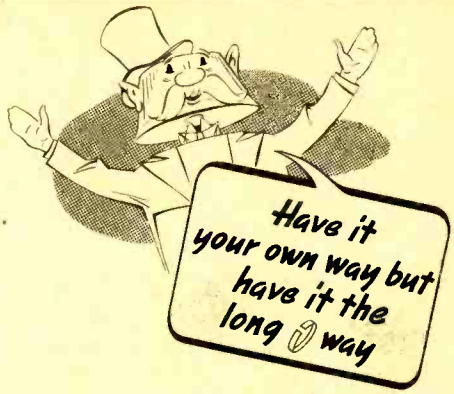

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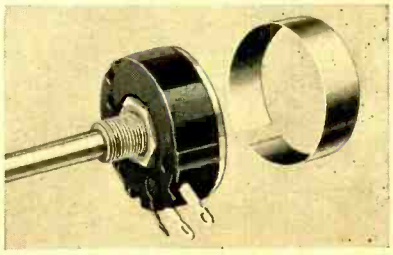

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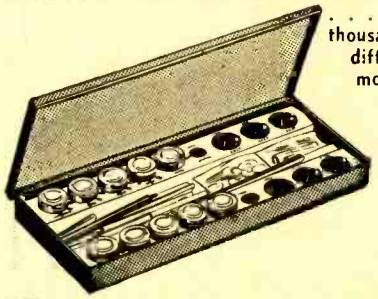

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These seven new "N" types complete a series of 10 models in this efficient line of medium power transmitting condensers for 5 - 10 and 20 meters.

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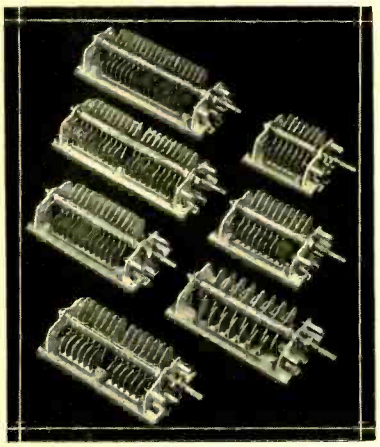

Specifications of "N" TYPE U.H.F. SERIES

FRAME—No frame or tie rods. Aluminum end plates supported directly on heavy lateral ceramic bars which carry stators.

SHAFT—Cadmium plated steel on which rotor assembly is securely locked.

PLATES—Non-corrosive aluminum, grade 3-SH, .040" thick with edges rounded.

BEARINGS—Long N. P. brass shoulder type front bearing, with ball thrust rear bearing. Laminated phosphor bronze rotor contactor.

AIRGAP—.070"—3000 V. peak—(NT)
.084"—4200 V. peak—(NP)
.171"—6000 V. peak—(NG)

INSULATION—Isolantite.

MOUNTING—Single hole, front panel with mounting posts or chassis mounting on feet which form part of end plate. Or use type "M" bracket and mount upside down for lowest capacity to ground.

ULTRA HIGH FREQUENCY SINGLES

Type Number	Cap. Range	Nr. Plates	Airgap	*Dimension "B"	List Price
NP-50-DS	50-9	13	.084"	2¼"	$3.50
NP-75-DS	75-11.0	19	.084"	3 1/16"	4.10
NP-100-DS	100-13	25	.084"	4⅛"	4.70
NP-150-DS	150-19	39	.084"	5⅝"	6.10
NG-35-DS	35-11	15	.171"	4⅛"	5.20

ULTRA HIGH FREQUENCY DUALS

Type Number	Cap. Range	Nr. Plate Per Section	Airgap	*Dimension "B"	List Price
NT-50-GD*	50-7	11	.070"	3 1/16"	$6.00
NP-35-ND†	35-5	9	.084"	3 1/16"	6.00
NP-35-DD	35-5	9	.084"	3 1/16"	5.35
NP-50-DD	50-9	13	.084"	4 1/8"	6.00
NP-75-DD	75-11	19	.084"	5 5/8"	7.20

*Dimension "B" is distance between inside faces of end plates. For overall length back of panel, add 1-3/32" to "B" dimension.
†.040" plates, buffed and polished.
*.025" plates, buffed and polished.

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Alec G. Binnie, ZL-129
Moresby Ave., Waihi, Auckland Province
New Zealand
(March, 1939)

(14-Mc. Phone)

CE—1AH-8; 2BX-7; 4AC-7; **F**—8DC-6; 8PK-7; G6WX-4; HB9DO-7; HC1PZ-8; HC2CC-7; HC3CL; **J**—2CS-8; 2KN-7; 2MI-7; 3CX-7; 3FC-7; **K6**—BNR-9, CMC-7; FAZ-6; MVA-8; NZQ-8; OJI-7; OTH-8; PCF-8; PLZ; **KA1**—ER-8; JM-8; WM-6; LU1HI-7; LU9BV-6; OA4AI; PK6XX-9; PY2JC-9; PY2LD-7; TG9BA-7; XE1LK-7; **W**—1BEQ-4; 2IHS-7; 2IXY-8; 2JWW-8; 2MD-7; 3FAM-7; 4BPG-6; 4XM-6; 5ASG-6 5EEW-7; 6AM-7; 6COF-8; 6FKK-8; 6GLT; 6JK-7; 6JP-7; 6LA-7; 6MZB-8; 7GAE-7; 8CMO-5; 8CUO-9; 8JJM-7; 8JOE-8; 8NOC-8; 8RHP-7; 9BBG-8; 9CNV-7; 9TIZ-9.

(28-Mc. Phone)

K6—PIT-9; PLZ-8; KF6PUL-7; KG6NVJ-8; VE5AEZ; VE5GQ; **W**—2JWW-4; 4EEZ-7; 4EJK; 4FIJ-7; 4FQT-7; 4FRF-6; 4FUM-7; 5BSK-7; 5EB-5; 5EJO; 5FTD-8; 5GYM-6; 5HEG-7; 5HGK-7; 5HMQ-8; 5VQ-8; 6AM-8; 6BBQ-7; 6BCF-6; 6BEI-8; 6BIP-6; 6CGY-7; 6EQW-7; 6FEX-8; 6FT-8; 6GXC-4; 6GRX-6; 6ITH-9; 6JZL-7; 6KSO-7; 5LIP-6; 6LSJ-6; 6MEP-9; 6MGK-6; 6MOU-6; 6MUT-5; 6MUM-7; 6MWD-7; 6MYS-8; 6MZD-7; 6NHK-6; 6NKF-9; 6NLS-7; 6NXQ-7; 6NYQ-7; 6OZH-6; 6PBA-8; 6PBD-9; 6PCV-7; 6PDB-9; 6PMB-7; 6POZ-9; 6PQQ-7; 6PTA-5; 6QGI-7; 6QNW-7; 6QOZ-6; 6QYB-7; 6RK-8; 6RR-7; 6TT-6; 7EFK-6; 7HGK-7; 7KJ-5; 7LSK-6; 7QB-7; 8NFX-7; 9CXE-7; 9KY-4; 9KZB-6; 9PBY-7; 9WAL-8; 9ZNA-7.

(April, 1939)

(14-Mc. Phone)

CE3CH-8; CO2OK-6; F8BF-8; **K6**—BNR-9; MVA-8; NJG-7; OQE-7; OTH-8; PPI-7; PPR-6; W6OMJ/K6-8; KA1FH-8; LA1JM-7; LU1QA-9; LU7BA-6; PK6XX-7; VE3XK-8; **W**—1GR-7; 1AW-7; 1BCX-8; 2ACB-6; 2HS-8; 2IXY-8; 3GHE-9; 3FAY-7; 4GSY-8; 5AXU-9; 5BEK-9; 5CF-5; 5FNY-9; 6ADI-8; 6ERV-8; 6FFN-8; 6GTL-7; 6GY-8; 6IDY-9; 6ITH-9; 6KEI-9; 6LMS-7; 6MCW-8; 6MIK-8; 6MYO-9; 6NAV-9; 6NCW-8; 6OMJ/K6-8; 6QED-8; 6SG-8; 7BVO-9; 8CUO-9; 8EVI-7; 8JOE-7; 9NLP-7; 9ODQ-7; 9OMM-6; 9RLH-6; XE2FC-8.

(28-Mc. Phone)

K6LNT-7; K6PLZ-7; **W**—4EJQ-8; 5BFJ-8; 5FU-8; 5HAJ-8; 6ANU-8; 7ERT-7; 6FZC-8; 6LIP-8; 6NLS-6; 6PBD-9; 6PDB-9; 6PMB-7; 6PME-7; 6POZ-9; 6TNO-8; 6TT-8; 7GYM-6; 9BCX-8; 9CXU-8; 9DRZ-8; 0EAG-7; 9ULJ-8.

Bob Everhard
"Belle Vue," Nelson Park,
St. Margarets-at-Cliffe.
North Dover, Kent, England
(Feb. 10-Mar. 10, 1939)

(1.7 Mc. Phone)

W1—BES; CPI; AAR; DVQ; **W2JHR**; **W3DQ**; **W4BPD**; W4BAH; W4FSS; **W8OLR/3**; **W5BNR**; **HB9BB**;

(3.5 Mc. Phone)

W1—IFD; IWG; AAH; AW; FOF; JXV; DQA; **W2**—FLX; AST; JC; **W3**—AHS; CEI; EOP; EOZ; FTU; FAM; DQ; BIN; BUF; HGR; **W4**—OC; US; JW; BYY; DGO; RS; **W5BB**; **W8BOZ**; **W9**—MN; BBU; RFE; LRJ; **VE1**—CR; GR; GD; CL; LR;

(14 Mc. Phone)

XU7—HV; FN; IC; **KA1**—BI; BH; ME; JB; LB; WM; JM; **VS7GJ**; VS7RA; **VU2**—CA; CQ; FQ; FH; **XZ2**—JB; DY; EZ; PB; **UK3AH**; **PK1RI**; PK1EB; PK2LZ; **VQ**—2FJ; 2PL; 2HC; 4ETJ; **ZS1**—AX; IT; BO; BV;

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Portable Frequency Standard

[*Continued from Page 22*]

kc. points on the receiver dial. If quickly switching the 10-kc. stage on and off causes the multivibrator to jump to a different frequency, the setting of R_{12} should be reduced slightly.

The separate 10-kc. audio output may be utilized by plugging headphones, speaker or amplifier into the two 10-kc. output jacks.

2. The 1-kc. multivibrator is synchronized in a somewhat similar manner:

A. The 100- and 10-kc. stages are switched on with the 1-kc. stage, R_{25} set for full output, and the ungrounded 1-kc. output jack connected *directly* to the antenna post of the receiver. The other coupling lead is transferred from the 100-kc. jack to the 10-kc. output and loosely coupled to the antenna circuit. For this adjustment a selective single-signal receiver must be used with the crystal filter set for *maximum* selectivity.

B. It will be observed that several somewhat weaker signals appear between each two adjacent 10-kc. points as the receiver is tuned through a narrow range. These are harmonics of the 1-kc. multivibrator and will be 9 in number if the multivibrator is synchronized on 1 kc. In the same manner outlined in the directions for adjusting the 10-kc. multivibrator, the setting of R_{20} is varied until exactly 9 points are counted between any two 10-kc. points on the dial. When this condition exists, headphones, speaker or amplifier connected to the 1-kc. output jacks will be supplied with accurate 1000-cycle voltage.

C. In the absence of a sufficiently selective receiver, the 1-kc. stage may be adjusted by means of a dependable beat frequency audio oscillator. Output voltages from the 1-kc. stage and the beat frequency oscillator (set to 1000 cycles per second) are fed into the grid circuit of a suitable mixer tube and R_{20} is adjusted to select the proper synchronization frequency determined by zero beat with the 1-kc. signal from the beat frequency oscillator.

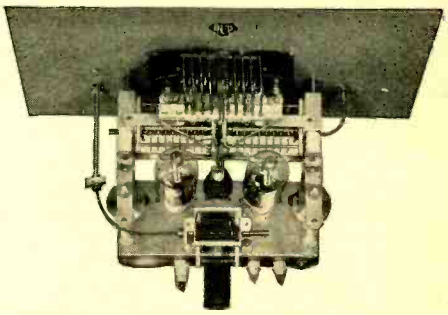
The frequency standard may be used directly for receiver or monitor calibration by coupling the 100-kc. output into the receiver or monitor, as described earlier, switching on both the 100-and 10-kc. stages, and tuning the receiver or monitor to locate a series of calibration points. A curve, showing the relation of dial settings to frequencies can then be prepared from the data obtained.

A frequency meter may be calibrated by coupling its output circuit into a receiver al-

YOU ASKED FOR IT!

The NEW "BPA-500-LF"

RADIO FREQUENCY AMPLIFIER
For 160-80-40-20 meters



NOW . . . . for low frequency operation . . . . a "Semi-Skeleton" Amplifier identical to the one described on Page 40 of March, 1939, issue of "Radio" except that the tuning condensers are of sufficient size to resonate with BUD series of VCL Plate coils and OCL Grid coils on the four low frequency amateur bands.

BPA-500-LF Kit $25.50 Amateur Net
(Complete except tubes, coils, meters)

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A NEW line of handsome cabinets for receivers, instruments, etc. Features include rounded front corners, flush panel, and recessed hinged top. Rear panel stops 2" from bottom eliminating drilling of cabinet to bring out leads. Louvred for ventilation.

Priced from $2.25 to $2.85
Amateur net.

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ready coupled to the frequency standard. In this operation, the receiver is tuned to zero beat with successive 10- or 100-kc. points and the frequency meter adjusted to zero beat with those points. The frequency meter calibration curve would show dial settings (meter) against standard frequencies.

An oscillator, signal generator, or transmitter is set to a desired frequency by coupling its output into a receiver or monitor which is also coupled to the frequency standard. The desired frequency, as generated by the standard, is located on the receiver or monitor dial, and the oscillator or transmitter is adjusted to zero beat with this same point. If the desired frequency is intermediate to any of the standard frequency points, it may be obtained by interpolation on the dial of the receiver or monitor.

If any unknown signal is close enough to a standard signal to create a beat note, the frequency of the note, as measured by a reliable beat frequency oscillator, will be the deviation in cycles from the standard frequency. Drift in self-excited oscillators may be checked in this fashion. The oscillator is first set to zero beat with a standard frequency point and its deviation checked at suitable intervals.

Other uses will become apparent. The frequency standard represents the ultimate in frequency measuring gear and will provide large dividends in the certainty and security that go with knowing exact frequencies. It is an exceedingly useful tool in the station or laboratory, and once used becomes indispensable. Graduate to the frequency standard!

See Buyer's Guide, page 98, for parts list.

●

More F.C.C. Convictions

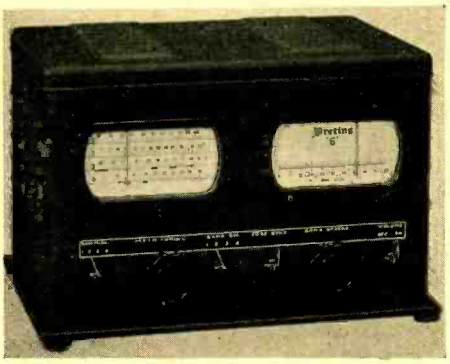
Further evidence that the F.C.C. is actively engaged in putting a stop to amateur regulation violations is shown in the suspension for three months of the class A license of Kenneth A. Olson of Minneapolis, Minnesota. Mr. Olson is alleged to have transmitted false call letters which had not been assigned to the station he operated and, in addition, to have operated his station with A-2 emission in violation of Sections 152.32 and 152.42 of the Amateur Rules and Regulations.

●

We're still waiting to read an article about a transmitter equipped with a mechanical fist on the power supply. Every time J. Q. Ham gets within five feet of it while the power is on, said fist delivers a lusty, though harmless blow to the noggin.

THE SENSATIONAL, NEW BRETING "6"

COMMUNICATIONS RECEIVER



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FEATURING

- **Electrical Band Spread**
- **Iron Core IF**
- **Separate High Q Coils (each band)**
- **Separate BFO Tube**
- **Doublet Input**
- **Built-in Speaker**

Unsurpassed for quality, workmanship, engineering and design, this receiver has a frequency coverage of 550KC to 30 megacycles in four bands. Dimensions are 8 x 8 x 12. For further particulars see your jobber or write.

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RADIO

Asheville Hamfest

The annual Asheville Hamfast, sponsored by the Asheville Amateur Radio Club, will be held this year in conjunction with the North Carolina Floating Club and NCR meetings on July 2nd. Registration will begin at 12 noon at the George Vanderbilt Hotel.

A complete program has been arranged with the principal technical talk to be delivered by Sherwood Githen, Jr., Ph.D., W4EQX, and professor of physics at Wake Forest College. His subject is not known at present, but will probably be in relation to his research work on harmonics. Other speakers will include H. L. Caveness, Director of the Roanoke Division, ARRL, and W. J. Wortman, W4CYB, SCM for N. C. Group meetings covering every phase of amateur activity will be held, chief among these being the NCR meeting, to be conducted by Lieut.-Comm. Isaiah Olch, District Communications Officer of the Sixth Naval District, and Lieut. E. J. Gluck NCR Commander of the Sixth Ward District. The other meetings, DX, Traffic handling, etc., will also be conducted by prominent hams.

The registration fee will be $1.00, covering the business and technical sessions, the banquet, and the South's greatest code contest. This contest, being arranged by Walter H. Candler, will feature the world's best-known code experts—Ted McElroy, the world champion—L. R. McDonald, W8CW, winner of the code contest at the ARRL National Convention, and Jean Hudson, W3BAK. The contests will be held in several classes, starting at 13 w.p.m., followed by 15, 20, 30 w.p.m. and then the high speed contest. Trophies will be awarded for each class.

Display space will be available for distributors and manufacturers and the latest in amateur radio will be shown. For advance registration write to R. M. Gibbs, secretary, The Asheville Amateur Radio Club, Box 128, Asheville, N. C.

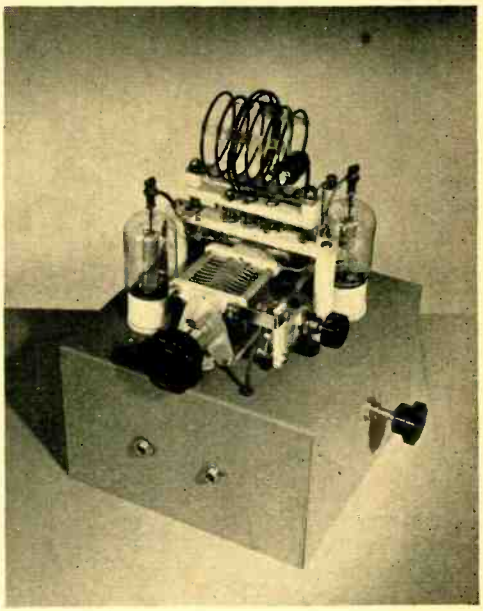
●

"Yarn" Dramatized

QTE*, by Lewis B. Coe, W6CNY, made a swell radio show! So says Howard R. Eckert, W9SRY, who recently dramatized it for his program, The Amateur Radio Club of the Air. This program originates in the studios of WBAA, Purdue University, Lafayette, Ind., every Friday afternoon at 4:30, and should be of interest to all the o.m.'s and y.l.'s within range of the station. It consists of interviews, book and magazine reviews of interest to hams, club news (Purdue's Ham Club, W9YB) and announcements, and general ragchewing by W9SRY, who acts as the M.C.

* Yarn of the Month, RADIO, Mar., 1939.

100 WATT
FINAL AMPLIFIER
KIT



XF-1

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Hams Across the Sea . . . .

OQ5AE

By E. H. Conklin,* W9BNX

Many of our readers will remember the story entitled, "The Congo Calls," in RADIO for May, 1937. It was written by Rev. Carroll Stegall, OQ5AE and formerly ON4CSL. For several months, Carroll has been in this country on one of his infrequent visits home. For the first time, he met John Kraus, W8JK, with whom he has kept schedules on twenty meters for years. We had an opportunity to spend a number of interesting hours with him, too.

Carroll has used a single self-excited 210 with about ten watts input. The power supply for this has been a small gasoline driven generator which is shut off while listening. The gasoline is not only expensive, but it must be hauled by motorcycle or bicycle for hundreds of miles. His total bicycle mileage in the last two years was 4200. The difficulty of getting transmitter power, in addition to the expense, will explain why his transmissions are short and contacts few. His receiver runs from B batteries and a six-volt storage battery. The latter is charged by hand all day every day!

We talked over the possibilities of some other power supply source. There is a little water—fifty gallons a minute over a ten foot drop—but this is hardly sufficient. Another possibility is a wind driven supply, either six or thirty-two volts. The latter would probably give a surplus of power for transmitting and receiving purposes, enabling the elimination of the gasoline problem. It might then be possible to operate a small refrigerator in which serums and perishable foods could be kept. As it is now, when an animal is killed, it is divided up and given away for immediate consumption because it will not keep in the tropical heat of the northern Belgian Congo.

The natives apparently get very little meat. Their diet includes not only rats but bugs as well. The locust is a delicacy, prepared by removing wings and legs, drying them in the sun. When they are to be eaten, they are cooked in an oil. The resulting dish is said to have a nice aroma but Carroll does not claim to have tasted it. He has, however, tried cricket stew.

Vegetables are readily grown but the plants do not go to seed, so new seed is purchased regularly. Canned goods were dispensed with during the last depression, thus reducing a very large item in the household budget.

The import duty and the expensive shipping charges bring the price of most items way out of reach. In fact, one missionary received from a church in this country a barrel of rummage—worn out trousers and the like—on which he had to pay $60.00 duty before he found that the contents of the barrel were practically useless to him. For that reason we are going to be very cautious in sending a box of slightly used resistors and condensers which may come in very handy for repair purposes. The charges involved in getting them delivered in the Congo may be greater than the cost of the necessary parts when they go bad. Sometimes a few months off the air awaiting a 6c repair part may be the best way out!

The 100-watt transmitter shipped to OQ5AE several years ago was packed with a storage battery, and what wasn't ruined by

[*Continued on Page 92*]

* Associate Editor, RADIO.

Your Inquiries Invited:

When you need amateur equipment it is to your advantage to write to me. You get personal attention; terms financed by myself so you buy with less cost and more convenience; fair trade-in value for your equipment; ten day trial of all receivers; and my cooperation in every way to see that you are 100% satisfied. For any equipment, the latest information and technical help, write to W9ARA.

Authorized Factory Distributors for all Amateur Receivers

Model	Cash Price	Down Payment	12 Monthly Payments
SX-23	$115.50	$23.10	$8.16
Skyrider Defiant	69.50	13.90	4.90
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HQ-120X and NC101X	129.00	25.80	9.11
NC100A	120.00	24.00	8.48
NC80X and NC81X	99.00	19.80	6.99
NC-44 and S-20	49.50	9.90	3.49

Similar terms on Hallicrafters, National, Harvey, RCA, RME, Temco transmitters and Thordarson, U.T.C., Utah, National, Stancor, Kits.

HENRY RADIO SHOP

211 North Main Street Butler, Missouri

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Filament Tubes in Mobile Transmitter

[Continued from Page 32]

vibrator power supply, the audio channel and interstage transformer, and the drain of the heaters of the audio tubes. The resulting saving both in dollars and in amperes is well worth taking into consideration.

A small rig of this type would also be quite suitable for use in a marine installation or for use where a.c. power is not available.

See Buyer's Guide, page 98, for parts list.

Hang It All!

[Continued from Page 46]

The stub terminates in a pair of feed-through insulators centered in the bottom spreader, the quarter-inch tubing being rigidly spaced with good quality insulating material, holes being slightly undersized so as to allow a snug fit. Once properly set, this stub will not require readjustment as there can be no slack.

Although the matching stub will be held firmly to the lower spreader additional rigidity is furnished by tying the center of the lowest spacer to the hub of the wheel. The stub will then pivot nicely with the array. The flexible portion of the line running from the anchor of the 600-ohm line to the stub should be well constructed so that the spacing will not vary while the beam passes through its arc. This line is flexible only to the extent that sufficient slack is allowed for a good "follow through."

In spite of low initial cost there is little or no "up-keep" on this type of beam. Occasionally hitching up the main supporting halyard to remove any slack is all that is required, and if feasible, weights can be arranged so as to counterbalance the beam permanently, automatically counteracting the stretching or slack that will appear with humid weather.

To the meek and the lowly in spirit this article is dedicated, with all defiance to mechanical engineers. It *is* possible to build your own beam, hang it all!

●

Elementary??

For those who are chemists as well as radiomen it is interesting to note that the atomic number of tantalum is 73, and that the atomic number of radium is 88. Incidentally, the atomic number of an element denotes the net positive charge on the nucleus, and consequently the total number of orbital electrons revolving around the nucleus.

Could this be the reason that tantalum is so well suited to use in transmitting tubes? Or that radium carries the name it does?

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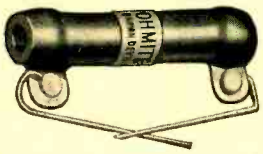

You're *sure* of continuous trouble-free service when you use Ohmite "Brown Devil" Resistors for voltage dropping, bias units, bleeders, etc. Their dependability is proved in countless amateur and commercial installations the world over. "Brown Devils" are built right from the core out—sealed tight and permanently protected by Ohmite Vitreous Enamel. They stay on the job. Popular 10 Watt and 20 Watt sizes, resistances from 1 to 100,000 ohms.

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Here is an adjustable oscillator standard used in circuits described in June, '38, January, '39, and April, '39 QST. Designed for use with 6SK7 oscillator. Provides means for zero beating at 100 and 1000 KC oscillator with WWV. Only $3.45.

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Simplicity in an E.C. Exciter

[*Continued from Page 15*]

⅝-inch sleeves. Placing the panel away from the chassis in this manner allows the "works" of the dial to be kept out of the oscillator compartment, removing a source of vibration from the field of the coil.

Not shown in the photographs is the bottom plate which covers the complete unit. Four sponge-rubber feet of the type used to shock-proof tuning assemblies in b.c. receivers are placed on the bottom plate to separate the entire unit from the effects of operating-table and room vibration.

Operation

No difficulty should be experienced in placing the unit into operation. With the coil and condenser sizes specified, approximately 80 degrees of bandspread will be obtained for the 3500 to 3650 kc. range, and the oscillator and output stage tanks will track perfectly over this range.

With 80-meter crystals, the e.c.o. and crystal outputs are 10 and 12 watts, respectively. With 160-meter crystals, the output measures 10 watts on both the crystal and e.c. positions. These outputs are sufficient to excite either a 40-meter "straight" crystal stage or an 80 to 40 tri-tet or harmonic oscillator in the transmitter. The exciter also could be used to replace the present crystal stage where a straight 80-meter crystal oscillator has been used.

See Buyer's Guide, page 98, for parts list.

●

"No Doubt"

The present carrier power of General Electric's two international goodwill stations, W2XAD and W2XAF, is from 20 to 25 kw. This energy, when fed to a directive array with a power gain of ten db, gives a signal with an effective strength of 200 to 250 kw. in the favored direction. Within a short time a linear will be placed on the end of the present transmitters which will have a power output of 100 kw.; this will give the transmitters an effective signal strength of 1000 kw. —it would take quite a bit to QRM this signal.

"RSD 559, OM"

One of our correspondents suggests that in view of the large number of bad e.c.o. notes heard on the air a new system of tone reporting supplement the regular T system, as some of the notes couldn't even be classified as having "tone." He suggests D1 to D9, the D standing for "diathermy."

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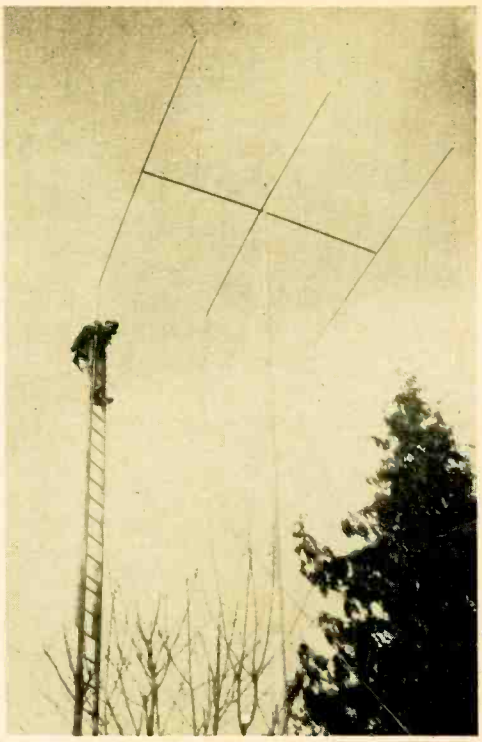
Compacting the 3-Element Rotary

[*Continued from Page 36*]

Tuning

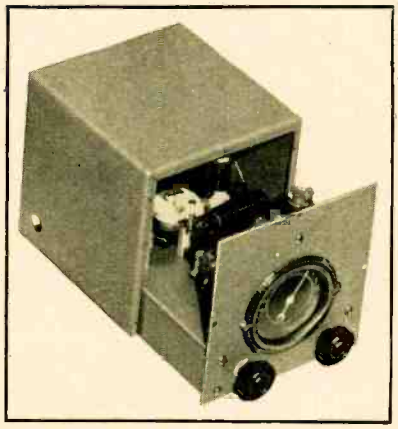
Tuning the beam is comparatively easy. The beam is adjusted to the dimensions given above while it is still on the ground. It is then raised, and the final adjustments are made from a guyed extension ladder. Adjust first the director, then the reflector, for maximum forward gain. Caution must be exercised to keep the opposite ends of each element exactly equal in length, in order to keep the voltage at zero in the centers, where each is welded.



The OM, on the guyed extension ladder, making adjustments to the completed array. ⟹

The Rotating System

The base of the pole has the front axle of a Model A Ford lag-screwed to it through the holes made to hold the brake drum. The casting for the king pin was cut off with a torch. An 8-inch pulley was placed between the axle unit and the pole to turn the beam. The center of the pulley was also "torched"



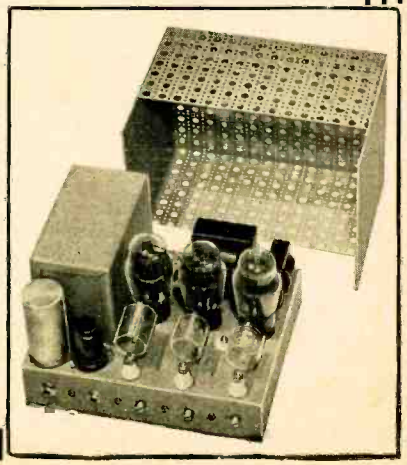
MOBILE 10 METERS

The HM-401 Ten-meter Converter comes to you WIRED and TESTED, complete with R.C.A. tube. Everyone can afford the HM-401 at the extremely low price of $11.50. We most strongly recommend this unit for its efficiency and low current drain. It is compact, 5"x5"x4¾", and can fit into your glove compartment.

HM-401 CONVERTER LICENSED BY R.C.A.

$11.50 NET

F.O.B. LOS ANGELES



The HM-102 Ten-meter Transmitter is supplied WIRED and TESTED, with 4 R.C.A. tubes. This exceptionally low price of $36.00 is within the reach of all. High quality parts are used. The HM-102 is rugged, operates with a good 12 watts input, and has a built-in power pack. Ready-to-go, less (40 meter) crystal and microphone.

HM-102 TRANSMITTER LICENSED BY R.C.A.

$36.00 NET

F.O.B. LOS ANGELES

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out. The wheel bearing was removed and bolted to the 3" x 12" cross member upon which the beam rests.

The turning mechanism is mounted to the underside of the 3" x 12". It uses the belt and worm gear reduction from a washing machine, and is driven by an electric motor. It turns the array at the rate of 1 r.p.m. This system keeps all the moving parts near the ground where they can be easily serviced.

Results

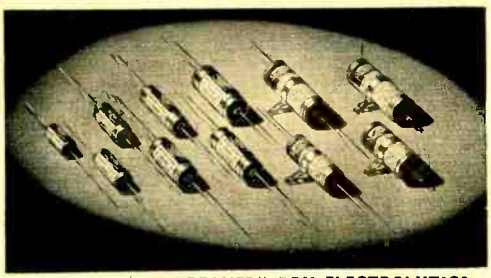
As to results, all continents have been worked with either R9 or R9 plus reports, using phone on all contacts. This was all accomplished in five sessions. It was also possible to work east coast and central state stations until about noon, which has never been possible before at this time of the year from this location.

The beam is also very fine for receiving. When turning the beam, one station will drop out and another from another direction will come in with almost no heterodyning. The position of the array can almost be determined by noting from what direction stations are coming in. It is very difficult to receive stations off the sides or back unless they are very powerful and the skip happens to be just right.

CORNELL-DUBILIER

Starfit ★★★★ OF THE MONTH

TYPE BR



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★ Special C-D Super-Purity Cellulose Separator—Extra long life.
★ Rigid Chemical Purity Control—Uniform performance.
★ Double Ageing—Stable characteristics.
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U.H.F.

[*Continued from Page 66*]

not known here, but using 30 watts. W8QKI, Ashtabula, Ohio, hears him faintly over the 45-mile jump. QKI has a 230-Mc. rig built but waiting for his 35T's and may be on the air before July. He has been silver plating hook-up wire for his receiver and is contemplating silver plating some copper tubing for the transmitter. He believes that a couple of hundred watts with crystal control would produce results that would get the boys enthusiastic about the possibilities of 224 Mc.

And, of course, when this column appears again in the fall issues, Bill Conklin's hand will again be in control.

Hams Across the Sea

[*Continued from Page 88*]

the acid was banged up by the battery which broke loose from its moorings. A new 100-watt phone for both 14 and 28 Mc. has been built up, to be used after June when Carroll goes back again. He has a three-element rotary as well, but may find that his large rhombic will be quite adequate. Also, he has received a gift of sufficient money to buy a small truck, which is being fitted up with portable gear; surplus juice from the car battery may make additional QSO's possible.

Of the many interesting stories Carroll told us, we have selected one to illustrate the type of country and people with which he has to work. He makes regular trips through his territory, visiting the native missionaries whom he has trained and installed in villages. At one town he was approached by natives who wanted him to come to a village of which he had never heard; the natives admitted that it was a "lost" place—for purposes of avoiding government taxes and possible interferences. He accepted the invitation but learned that there was no road or path to it; the natives always used a different route to avoid leaving a trail. Carroll got only a quarter mile in dense jungle with seven more miles to go when he was forced to stop because his clothes were literally torn to shreds. The natives could slip through the brush, not being hampered by clothes. He agreed to try to make the trip again if they would cut a narrow path through the brush. When he came to that part of the country again, the natives brought him through a short bit of jungle to the hidden end of a path good enough for a motorcycle road had the stumps been cleared away. He found a normal village and now has a native assistant there.

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Phone Break-In

[*Continued from Page 42*]

exist leaving V_2 (figure 1B) without bias, whereas it previously had cutoff bias. This allows about a 15-volt drop across its plate resistor, R_4, which also biases V_3 to cutoff. V_3 takes the place of the first audio stage in the receiver (generally in the same envelope with the diode detector). The output of this tube feeds the grid of the receiver's succeeding audio stage (usually a pentode output tube). R_1 is set just above the point where it blocks on the desired station.

V_1 was necessary to the method in which the transmitter blocks the receiver. The high negative blocking voltage applied to the receiver's a.v.c. line would also arrive at the grid of V_2, keeping the audio amplifier functioning despite the distant station's having removed its carrier. With the receiver in the normal unblocked condition, the cathode of V_1 is negative with respect to its plate, permitting unimpaired a.v.c. action. However, when the transmitter is energized by speaking into the microphone the high negative voltage applied to the a.v.c. line disables the receiver, yet will not be conducted by V_1 because the polarity is wrong.

V_4 rectifies some of the audio output of the receiver. The d.c. resulting from this rectification is fed to the control tubes of the peak-limiting speech amplifier. C_6 (shown connected by a dashed line) usually already exists in the amplifier as part of the time-constant filter. The proper point to connect the center-tap of T_1 is directly to the speech amplifier gain-reduction grids in order to make the time constant as short as possible. Observing this detail carefully will sometimes allow the loudspeaker to be placed as close as three or four feet from the microphone. This close spacing is not considered advisable, however, and much better operation will usually be secured if the speaker is 7 to 12 feet away.

As any residual hum remaining in the receiver's output would be rectified by V_4 and applied as blocking bias to the speech amplifier, a small delay bias voltage supplied by the voltage divider, R_{10}-R_{11}, prevents rectification until the audio voltage has exceeded a certain minimum value. R_{11} should be the lowest value permitting satisfactory operation.

This voice-switching system should find its greatest application on the 160-, 75- and 5-meter bands, but there is nothing to prevent its functioning properly on the other bands if the stations worked are not fading too badly.

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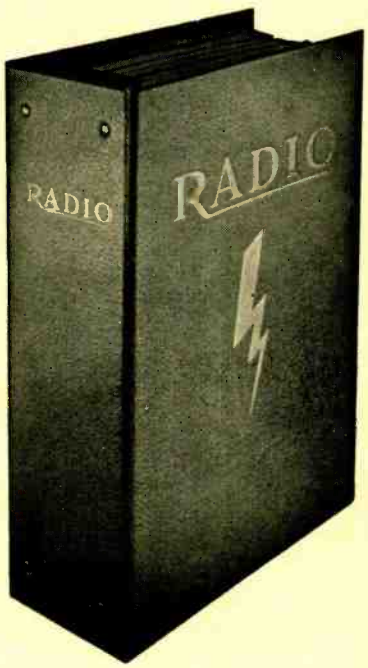

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Optimum Speech Characteristic

[*Continued from Page 45*]

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(2) This characteristic tends to reduce QRM on the bands.

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In closing we must express our appreciation and admiration of the monumental patience and intelligent cooperation shown by the stations who observed. They made this article possible.

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DX

[*Continued from Page 55*]

ON4VU relates that he would be very sad if his call were dropped from the Honor Roll due to inactivity. He therefore sends in new countries and one new zone. ON4VU now has 37 and 99. We learn from ON4HS that he has been doing a lot of operating on 10 and 20 and therefore has boosted his zones to 29 and countries to 78. Henry used to concentrate on 80 but has really been doing fine work on the other bands. ON4HS finds that the 20-meter band has opened up very well for W6 and W7 stations. The frequency he uses the most is around 14,050 kc. The one antenna he uses on all bands is a half-wave 80-meter doublet running north and south and 30 feet high.

This and That

Look at W8BTI for example. He had been brought up a good dx man and what happens. Why, hadn't you heard? He is now on phone, and say, he really has a wonderful voice. I don't know what he was ever doing on c.w. in the first place. Mebbe he doesn't either. W1KHE says that the best way to work LZ1ID is to arrange a sked through HB9CE, who is a very good friend of LZ1ID. KHE also gives the frequency of PJ3MS as 14,400 kc.

K6CGK on 56 Mc.

K6CGK is again on 56 Mc. with 500 watts and would be glad to arrange trans-oceanic skeds with anyone. His probable frequency will be 56,250 kc. He uses an FB7 with homemade coils, a four-section 8JK and a V beam. K6CGK sends word that J3FJ has married, but listening to the 14-Mc. band, you wouldn't think so. Another marriage is J2OZ ex-J6DO, Prince Tanemoto Nijoh, to Princess Kuni. Kay also says that the feud with the G's is over because they work 'em every day now.

From the Australian mag *Amateur Radio* we lift a little item about FK8AA of Noumea, New Caledonia. He is a Frenchman knowing only about a dozen words of English. He uses a 2A5 crystal oscillator, a 6L6G buffer into a pair of 801's in push-pull, with about 70 watts input. The receiver is an O-V-1 57 detector and a 2A5 audio. Antenna is a single-wire-fed Hertz 24.5 metres long and tapped 6.75 metres off center. The bands used are 20 and 40. While we're in the mood of "lifting," here's an item from "Ham" Whyte's column in the *T. & R. Bulletin*: ". . . and the most interesting contact for G3JR was with XU1AG who gave his QRA as Suiyum, Box 56." "Ham" goes on to say that the only place resembling that on the British maps is a province of inner Mongolia, which is in zone 23,

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the same as AC4YN. The spelling on the map of this province is Suiyuan, but that's pretty close. VU2FO reports through G5AN that AC4YN will work his station at 1600 G.m.t. on Wednesdays and Saturdays. After the schedules AC4YN will remain on the band to contact other stations. The frequency is 14,292 kc.

A station signing XUØA has been coming through on phone and c.w. Frequency heard on c.w. was about 14,310. I believe the phone frequency was on the low end of the band. He gives his QTH as "way on the interior of China." Now just how far that is will be difficult to surmise. We are hoping for the best . . . that it might be close enough to 23 for him to move over sometime. C.w. sig is T7.

W6USA, Treasure Island

A little news about W6USA reveals that they have a very high noise level there, especially so until 10 p.m. p.s.t. If any of you fellows happen to call W6USA and they don't come back, please don't feel that they are high hat. A second reason which is mighty important is that they have a great many visitors. When the place fills up with "visiting firemen" all of a sudden, they have to suspend operation through necessity. That has always been one trouble with stations of this type: if you don't treat the visitors kindly, you're a lousy host; and if you don't work everybody that calls you, you're going to be called a stuck up so-and-so. So, fellows, go easy on the boys; after all, they too like to work W9's.

Now then for dx at W6USA we find they have worked over 100 VK's. They really pour in down there. Forty Africans and about 20 Europeans have been logged. Of course, there is the usual line of miscellaneous countries, which all together totals 22 zones on phone. Not bad for the short duration and the handicaps. The rig is more or less a showplace for the general public although a fair amount of traffic is naturally handled. Recently, the commissioner from the Philippines was at W6USA talking to his pals in Manila for two and a half hours. The two ops on duty from 10 a.m. until 10 p.m. are Bob Hansen, W6MPC, and Johnny Woerner, W6ONQ. During the recent directors' meeting in San Francisco, the whole gang visited the station and had quite a time throwing switches, I understand.

A.R.R.L. Directors, etc.

Speaking of directors, etc., after their adjournment a number of them dropped in on Los Angeles, where a special hamfest was staged. Those present were W1EH, W1BVR, W1KH, W9EFC, W4APU, ex-W9ZN, W5SI, W6GG, and of course W1JFN, who is Budlong. I'm glad "Bud" showed up because he is about the only guy from whom I can get the "low down" on W1JPE. Naturally our talk had something to do with dx. W9EFC, Norwine, had something to say at this point, mostly to the effect that he, too, was an 80-meter (dx) man, along with Bud. Do you know, gang, that Bud runs a good 25 watts input . . . and can easily work W9EFC in St. Louis? With the skip just right, he has been able to "skip" across the Atlantic puddle to Europe.

But I still hadn't found out anything about W1JPE. I promptly queried, "Bud, we know that By is a good ex-W6 dx man, but is it true that he soon expects to forsake dx for a yl who has a seven-letter name containing only A's, R's, and B's?"

Whereupon Bud said, "I know not what goes on, 'tis all very mysterious, and taking the mystic's advice, we shall look into the 'magic mirror' for the answer."

We did but we saw nothing. So . . . 'tis still mysterious. Maybe By will stick to dx after all.

The last time Bud was out, he craved oysters on the half shell. We said, "OK, you'll get 'em." We breezed out to the "eat shoppe" and when he was served, he found he had a nice, big,

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hot tamale with nary an oyster. This visit he said he didn't believe we had any oysters in town. This hurt our civic pride so we said, "OK, you'll get 'em." When he was served, he smacked his lips, then uncovered his hot dish . . . and there was a nice, big, hot tamale. I guess he just can't win.

Notes on Japanese Hams

Some interesting information has been given by the second op of J2MI who spent six years in Japan and has now returned to Los Angeles. His name is Leigh Karaki, was born here and will soon be a W6 again. For those who would like to know the time schedule as to when Japanese hams can operate, Leigh gives the following:

0100 to 0300 G.M.T.
0500 to 0600
0700 to 0900
1300 to 1500
1700 to 1900
2100 to 2300

For special occasions such as the International DX Contest, German, VK-ZL, etc., the hams petition the Ministry of Communications for additional hours. The power input (by law) is 20 watts input and 10 watts into the antenna. Hams must pass the international code at 10 words per minute and the Japanese code containing 48 letters at 10 words. The rest of the exam consists of laws and theory. Most of the receivers are of the t.r.f. type and the superhets are very scarce. The antennas are not very good as a rule. Many tests were conducted at J2MI using a vertical, and it seemed to work out very well to all parts of the world but the QRM angle was naturally increased.

Getting back to the license again . . . the application blank consists of 60 sheets and one must list all tubes in use and their inputs. Power supplies must also be described. The location of the station, antennas, etc., must be given together with a map of the ward district in which the ham resides. The average ham in the country runs about 20 watts input but the city fellows know something about high power and several J kw.'s have been seen . . . or should we, as W's say, *heard????* Leigh says that the J hams can use all the old callbooks they can get their hands on. The duty is so high, many of them cannot buy them new, so if any of the W boys could send their *old* callbooks over, they would be greatly appreciated.

Goodbye, for Now!

Well, all you hale and hearty dx men, here's to a good vacation this summer. Don't forget, RADIO will be right back at you the middle of September. For this issue your contributions should be here by August 10th. Just think of the vacation the nines are going to get, too. Ah me!

●

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Buyer's Guide

Where to Buy It

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics usually may be substituted without materially affecting the performance of the unit.

NORTON ELECTRON-COUPLED EXCITER

Page 11

Exciter Proper

C_1—Hammarlund MC-75-S
C_2—Hammarlund MC-20-S
C_3—Centralab Ceramic
C_4, C_{16}—Hammarlund MC-100-S
C_5-C_{15}—Aerovox 1467
R_1, R_2, R_4, R_6—IRC BT-½
R_3, R_9—IRC BT-1
R_5, R_7, R_8, R_{10}—IRC AB
S_1—Centralab 2515
X_1, X_2, X_3—Bliley LD2
Oscillator coil form—Bud 594 with prongs cut off
Tubes—RCA
RFC_1, RFC_3—Hammarlund CHX
RFC_2—Hammarlund CH-8

Power Supply

C_{17}, C_{18}—Aerovox 609
C_{19}—Aerovox PR450
R_{11}—IRC ESA
T_1—Stancor P-3026
T_2—Stancor P-3010
T_3—Stancor P-4019
CH_1, CH_2—Stancor C1421
Tube—RCA

●

TURNER PORTABLE FREQUENCY STANDARD

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L, X—Bliley SOC100 crystal unit
All resistors—I.R.C. insulated BT½-BT1
R_{12}, R_{20}, R_{25}—I.R.C. wirewound potentiometers
All mica and tubular condensers—Aerovox 1467 and 284
C_2—Meissner 21-5214
All Tubes—RCA
Output jacks—General Radio type 274-J
C_{25}, C_{26}—Aerovox "Dandee" 40-μfd. midget electrolytic
C_{19}—Aerovox PR50 10μfd.

●

CONKLIN and RUEBHAUSEN CONVERTER

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C_1, C_2—Rebuilt Cardwell ER-25-AD, see text
C_3, C_9—Cornell-Dubilier 1W-5S1
C_4, C_5—Cornell-Dubilier 5W-5T5
C_6—Hammarlund HF-100
C_7—Hammarlund APC-25
C_8—Hammarlund HF-15
C_{10}—Cornell-Dubilier EDJ-9080
R_1, R_5—I.R.C. BT-½
R_2, R_3, R_4—I.R.C. BT-1
Chassis and Cabinet—Bud 870-A
Tubes—RCA

●

DAWLEY MOBILE TRANSMITTER

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C_1—Hammarlund APC50
C_2—Hammarlund MCD-50-S
C_3—Hammarlund MCD-35-SX
NC—Hammarlund APC-25
C_4, C_5, C_6—Aerovox 1467
C_7, C_8—Aerovox 484
C_9—Aerovox 1467
C_{10}, C_{11}—Aerovox 484
C_{12}, C_{13}—Mallory FPD-410
C_{14}—Mallory CS-131
R_1, R_2, R_3, R_4—Aerovox 1095
R_5—Aerovox 1094
RFC—Hammarlund CH-X
Relay—Guardian
CH_1—Thordarson T-57C54
CH_2—Thordarson T-57C53
Jacks—Carter 2A
Crystal—Bliley B5
Vibrapack—Mallory VP-552
Tubes—RCA
Modulator output transformer—Thordarson T-17M59

●

WILLIAMS PHONE BREAK-IN

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Figure 1

C_1, C_2—Cornell-Dubilier DT-4S1
C_3—Cornell-Dubilier EDJ-3050
C_4—Cornell-Dubilier EDJ-2200
C_5—Cornell-Dubilier EDJ-7080
R_1—Mallory-Yaxley N control
R_2-R_7, R_{11}—IRC BT-½
R_8, R_9—IRC type AB
R_{10}—IRC BT-2
T_1—Stancor A-4713

Second Diagram

T_1, T_2—Stancor A-72

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"Not a Failure in a Million" is the slogan behind these famous tubulars — and it means what it says.

SPRAGUE TRANSMITTING CONDENSERS

SPRAGUE PRODUCTS CO., NORTH ADAMS, MASS.

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Experience!

TEST AND RE-TEST . . . Every RCA Transmitting Tube gets an extreme overload "aging" run prior to the final check-up where it must show normal characteristics.

—the "SECRET" of Choosing the Right ANODE for the Right Job

Built into every RCA Tube is an invisible ingredient that is the most important of all—Experience. This experience extends through every phase of Radio, and every material that goes into radio equipment. Take Anodes as a single instance:

This one subject alone calls for a knowledge of chemistry, metallurgy, and mineralogy, together with expert engineering and invaluable experience—and RCA brings them to you in full measure. A good Anode must dissipate an amazing amount of power. It must not liberate gas. It must have low vapor pressure and it must have suitable mechanical properties.

That's a big order for any one material to fill—and RCA's research has proved there are many materials which must be considered. Among these are carbonized nickel, graphite tantalum, molybdenum, and tungsten. Each is used in one RCA Tube type or another and for one reason only: *It has proved itself best by long and painstaking test for that particular job.*

When you buy an RCA Transmitting Tube you invest in Experience—Experiments. You are assured of ...sive research behind *every* de... That is your guaran... ...t life, lowes... cost. RCA's will not let you down.

Typical! Here are ... examples of the careful selection of the ... Anodes for best results:

RCA-809 CARBONIZED NICKEL
The performance of the famous RCA-809 proves the effectiveness of this Anode material in an inexpensive tube where operating temperatures are relatively low.
RCA-809 . . 55 Watts* . . $2.50

RCA-...
Special process... assures maximum thermal emissivity and a minimum of gas in the Graphite Anodes of many RCA Tubes such as this popular high perveance triode.
RCA-810 . . 375 Watts* . . $13.50

RCA-... TANTALUM
A totally enclosed Tantalum Anode provides the utmost in efficiency and performance, especially on the higher-frequency bands.
RCA-806 . . 450 Watts* . . $22.00

*Power output ratings for Class C Telegraphy

Visit RCA Television Exhibits at Golden Gate International Exposition and New York World's Fair.

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