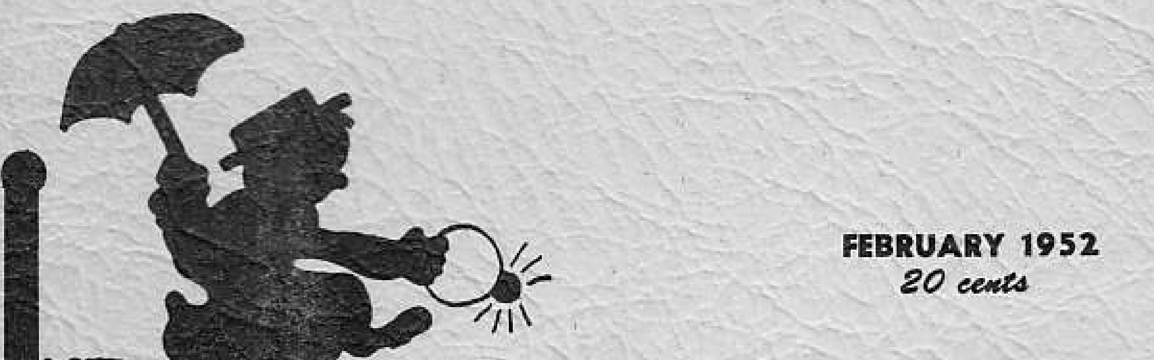
# SKYWIRE

## THE CANADIAN RADIO AMATEURS' JOURNAL



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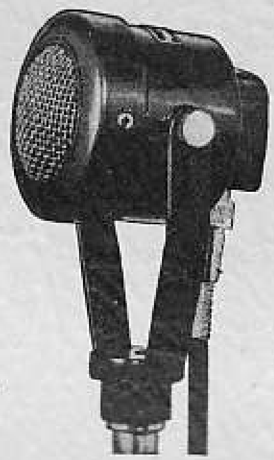

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# SKYWIRE

Vol. 5 No. 2

*Published monthly as*

THE CANADIAN RADIO AMATEURS' JOURNAL

*Editor - Fenwick Job, VE3WO*

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# FEBRUARY, 1952

SKYWIRE BUSINESS AND EDITORIAL ADDRESS

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# SIDEBANDS

The field of electronics has undergone some tremendous changes in the past few years. And to some extent, amateur radio technique and equipment has been changed to keep pace with new developments. But not completely, for there have been some rather needless limitations imposed on the amateur fraternity as a whole by a few who are in a position to more or less control what regulations are to be in effect in this hemisphere.

Unfortunately, although amateur equipment has been modernized as quickly as new ways of doing things became known, our regulations in many ways have not kept pace with technical know how. The rules were written in many cases, back in the earliest days of our hobby, and they have been altered little, if at all.

For instance, to become a radio amateur in this country, a code test is still a necessity, and this fact has kept a lot of top brains out of the field. Perhaps it has also kept down QRM, but the fact remains that we could use in our ranks many of those now excluded because of this outmoded regulation.

Tradition is a wonderful thing, and CW is as traditional as rice at a wedding. But sometimes tradition has to go out the window in favor of something new, and it is your writers opinion that now would be a good time to clean house. A lot of new ideas have come along, and are in need of a better break in the radio spectrum. And at the moment, efforts being made to bring about similar changes in the U.S. are being fought tooth and nail.

What brought this column to a head was a recent visit to the hamshack of one of the locals - Vic Hastings, VE3ATP. Vic is one of our more astute technical minds, and has gone in for everything that can be built, up to and including radio teletype. An evening spent talking on a teletype keyboard, controlling a 2 meter rig transmitting to VE3TC who was watching the printed words roll off the machine - and who was transmitting on a similar rig, would convince anyone that teletype needs a small part of some of the longer haul bands such as 80 and 40 and 20 where its many advantages could be realized. But such a change proposed by one representative group, NARC, has met with no success so far - and a lot of opposition. Teletype isn't the only mode of communication demanding a change in regulations. A preponderently large portion of each of our better bands is still devoted exclusively to code transmission, in spite of the fact that new methods of reception in recent years now have made such an unfair division of the bands completely unnecessary.

Single Sideband, mobile phone rigs too should be given some kind of a break. A Single Sideband rig bothers AM fone ham operators and vice versa. And yet SSB stations can be less than one kc apart and still give rise to none of the horrible squawks and heterodynes of AM.

Mobile, because of its power limitations could well be given a narrow slice of some of the bands, so that they could make better use of what in time of stress will become our emergency communication of most use to the authorities.

Rebellious thinking? Perhaps! And tradition would suffer, but few hams would. Let's get the job done now and encourage greater use of newer techniques as they are developed. There's room for all. And it's time all are given the same chance. P.S. See you on SSB on 20 and 75 now !

de VE3WO

# THE ZL SPECIAL

## High-Gain Two-Element Beam for Ten or Twenty

*By* F. C. JUDD (G2BCX)

*Though it does not offer any theoretical proofs for the results claimed, this article describes an aerial array well worth trying by those interested either in indoor fixed beams or working in one or two main directions only. The design suggested can also be applied to a rotary beam on the same principle.—Editor.*

DATA on the aerial to be described came to the writer from New Zealand, hence the name "ZL Special." Little is known of its origin save that it was designed in the U.S.A., just prior to the late war, for commercial purposes. Since the war it has been modified and developed for amateur use by W5LHI, WØGZR and ZL3MH. Further tests and measurements made by the writer may be of interest.

### Performances Claimed

**Forward Gain : 7 dB (over a dipole).**

**Back-to-front Ratio : 40 dB down.**

**Broad Band Characteristic : Variation of only 6 mA at 600 watts when tuning from 14 to 14·4 mc.**

This was actually the information received from a ZL correspondent, but the following figures have been obtained from models made to operate on 144 and 288 mc and from full-size versions on 10 and 20 metres. At a height of half-a-wavelength a scaled-down model working on 288 mc and cut from the formulæ given showed a forward gain of 7 dB as claimed (equivalent to a four-element parasitic beam), and a forward vertical radiation angle of 15 to 20 degrees. These measurements were taken over a perfect earth, *i.e.* a metal sheet ground. The aerial radiates in one direction only as a normal two-element beam, and has a horizontal radiation pattern as shown in Fig. 1. It is compact and easy to construct either as a fixed beam indoors or outside, or as a rotating array on a suitable tower. It can be cut to operate over a wide frequency band from the formulæ and measurements given, without the tedious tuning procedure normally required to obtain peak performances from the parasitic type of beam.

### Constructional Features

The elements can be made of either self-supporting tube, open wires or 300-ohm twin transmission line. Tubing up to 1½ in. in dia. can be used without changing the dimensions. The elements are parallel to each other and on a plane horizontal to the ground, the general construction being similar to the W8JK beams (*see* Fig. 2). Apart from rotating, the directivity can be reversed by "flopping the aerial

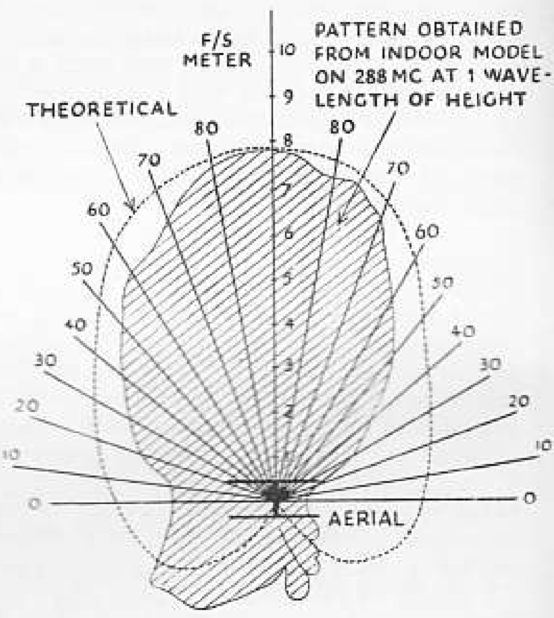



**Fig. 1. Horizontal radiation pattern, compared with the theoretical polar diagram, as obtained by G2BCX with a scaled-down model of the "ZL Special."**

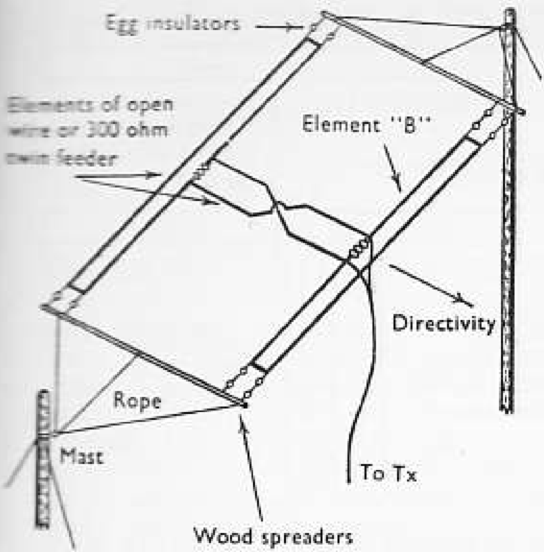



**Fig. 2. Construction of the "ZL Special," points regarding which are discussed in the text.**

over." A model constructed to operate on 288 mc was made with open-wire lines supported on a wood frame-work, and for 10-metre operation a similar arrangement would no doubt afford a compact and useful rotating beam (see Fig. 3).

### Electrical Characteristics

The aerial consists simply of two folded dipoles fed approximately 135 deg. out of phase, the impedance at the point of feed being 70-75 ohms, so that a standard 72-ohm twin line can be used for feeding (any length)

**FORMULÆ**

*For Diagram of Layout see Fig. 4.*

A. 492/F.mc × 0·95
B. 492/F.mc × 0·9
C. 984/F.mc × 0·1
D. 123/F.mc
E. 246/F.mc × 0·77 (*Matching stub for 300-ohm line*).
F. 123/F.mc × 0·9 (*Phasing line*).

**DIMENSIONS**

| | 10 metres | | 20 metres |
|---|---|---|---|
| A. | 16 ft. 3 in. | A. | 32 ft. 6 in. |
| B. | 15 ft. 5 in. | B. | 30 ft. 10 in. |
| C. | 3 ft. 6 in. | C. | 7 ft. 0 in. |
| D. | 4 ft. 3½ in. | D. | 8 ft. 7 in. |
| E. | 6 ft. 7 in. | E. | 13 ft. 3 in. |
| F. | 3 ft. 10 in. | F. | 7 ft. 9 in. |

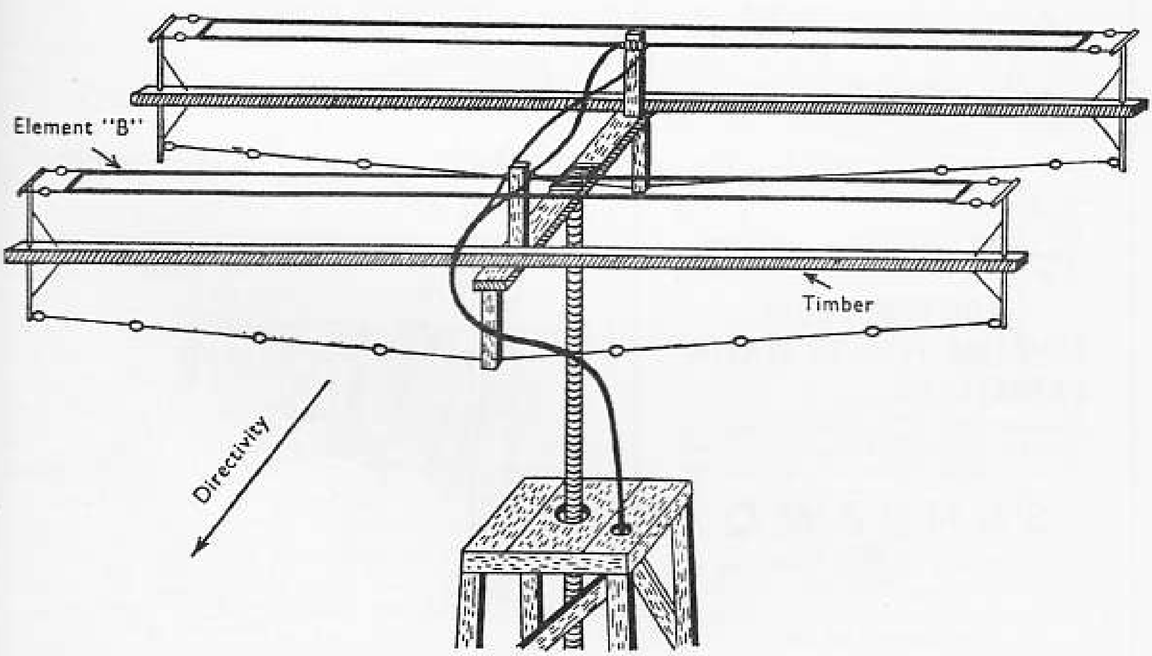



**Fig. 3. For a rotating version of the "ZL Special" described by G2BCX, thisi s a suitable arrangement.**

from the transmitter. Alternatively, a 300-ohm line plus a Q-matching stub of 150 ohms impedance may be used (see dimension E in formula). Both systems have been used on models and each has worked to satisfaction.

The phasing line (F) can be made of 300-ohm ribbon feeder with the cross-over at the centre, or from open-wire line made of 14 SWG wire spaced 2 in. If open-wire line is used the length of the phasing link should be reduced to 7 ft. 6 in. for 20 metres and 3 ft. 9½ in. on 10 metres.

Contacts made by ZL3MH with VK's resulted in S9 plus signals with the aerial only 10 ft. off the ground. He comments also on very good reports from the W's and on the exceptionally good receiving properties of this aerial. G3YF (Chingford, London) has been operating with the same design on 20 metres and has obtained reports of S9 plus phone from VE5 and VE7 with 100 watts input, and from W's and other VE's at strengths varying from S6 to S9 under adverse conditions.

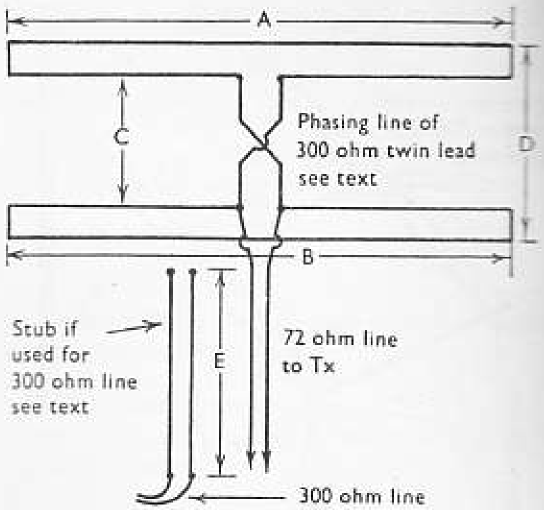



**Fig. 4. Electrical layout sketch of the "ZL Special"; it is clear tha t the directivity of a fixed version could be changed simply by throwing the aerial over. (*See Fig 2*)**

10-metre phone. The performances obtained from the scaled-down models support the claims made for operation on the normal wavebands of 10 and 20 metres.




**. . . That's all it ever says. Last time I'll buy surplus equipment. . . .**

# Flexible Crystal-VF Oscillator

## Describing a New Driver Circuit

By F. BUTLER, B.Sc., M.I.E.E.

> The quest for new types of high-stability driver unit, capable of accurate calibration, goes on unendingly. Here are the details of an original arrangement, devised by the author, the application of which is of particular interest in the field of Amateur Radio.—Ed.

IN transmitter design, it is customary to employ quartz-crystal or variable-frequency oscillators as alternatives for the purpose of primary drive and frequency control. There are both technical and operational reasons for this functional separation, though in certain classes of equipment it is of advantage to be able to combine the two. It has been found possible to do this, using a circuit developed by the writer, a theoretical account of which has already been published. ("Series Resonant Crystal Oscillator," *Wireless Engineer*, June, 1946.)

It is the purpose of this article to give a simplified description of the new arrangement with sufficient practical detail to induce experimenters to give it a trial in comparison with more conventional circuits. The distinguishing feature of the new crystal oscillator is that it uses the series-resonant mode of vibration of the quartz plate, as against the more usual parallel-resonant mode. Before going into an explanation of the action of the oscillator, it is essential to understand the difference between these two modes.

It is possible to resolve into an equivalent electrical circuit and so to calculate the performance of most electro-mechanical apparatus, including telephones, loudspeakers, microphones, gramophone pick-ups, sound-boxes and piezo-electric and magneto-striction devices. The vibration modes of a quartz plate are particularly simple to determine by this technique, and without going into unnecessary detail, it turns out that there are two principal modes, the characteristics of which are simulated respectively by the series and parallel resonances of a coil and condenser circuit of extremely high "Q." It transpires that the two oscillation modes occur at slightly different frequencies, the series resonance being a few parts in a thousand lower in frequency than the parallel mode. A further point emerges, in that the series-resonant frequency is not greatly affected by changes in the parallel capacity shunting the crystal, whereas, in the parallel case, there is an appreciable variation. For this reason, the series mode is almost always chosen for employment in oscillators of the highest precision. It is more usual for crystals to be operated in circuits of the Pierce or Miller type, or in some variation of them, so that crystals

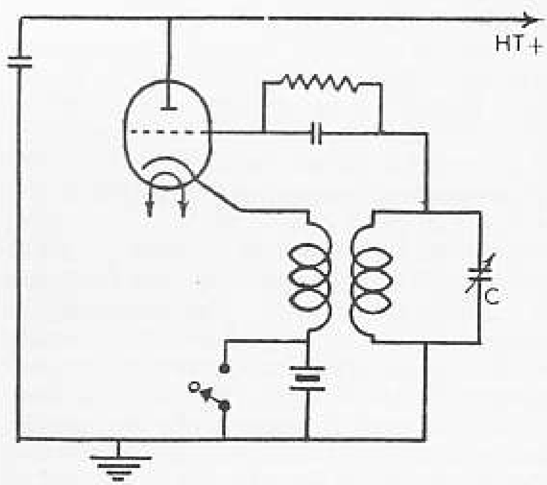



Fig. 1. Basic series-resonant crystal oscillator circuit as designed by the author.

are calibrated for the parallel-resonance operation which these employ. Though higher in absolute stability, the series-resonant crystals will operate at lower values than the frequencies marked on the holders and they must be measured or recalibrated in the alternative circuits to be described. This operation is easily performed, using a heterodyne frequency meter.

### Series-Resonant Oscillator Circuit

One of the commonest drive-circuits used in amateur practice is the electron-coupled oscillator. This is a version of the Hartley circuit in which the anode of the oscillator valve is earthed at RF, and the cathode is taken to a coupling coil or to a tap on the tuning coil, one end of which is earthed and the other taken to the valve grid, through a grid-leak and condenser auto-bias circuit. The tuning capacity normally shunts the whole of the main tuning coil. If a pentode or tetrode valve is used, a further parallel-tuned circuit may be connected in the anode circuit (the screen being earthed at RF) and used to select the fundamental or, more usually, some harmonic frequency. This circuit forms the variable-frequency oscillator to be described, and it is the basis of the series-resonant quartz oscillator, the circuit of which is given in Fig. 1.

It will be seen that this is a conventional cathode-coupled oscillator, with a quartz plate joined in series with the coupling coil. At series resonance, the impedance of a tuned LC circuit degenerates to a very low resistance, being practically that of the coil alone. The quartz plate, at its series resonance frequency, is almost a short circuit and so permits sufficient feedback to sustain oscillation. The frequency is selected by the setting of the main tuning condenser C. Off resonance, the quartz plate simulates a high reactance, the feed-back is altered in magnitude and phase, and oscillations stop. A milliammeter in the anode circuit shows a dip in current at the true resonant point, the rise on either side being almost symmetrical in form and

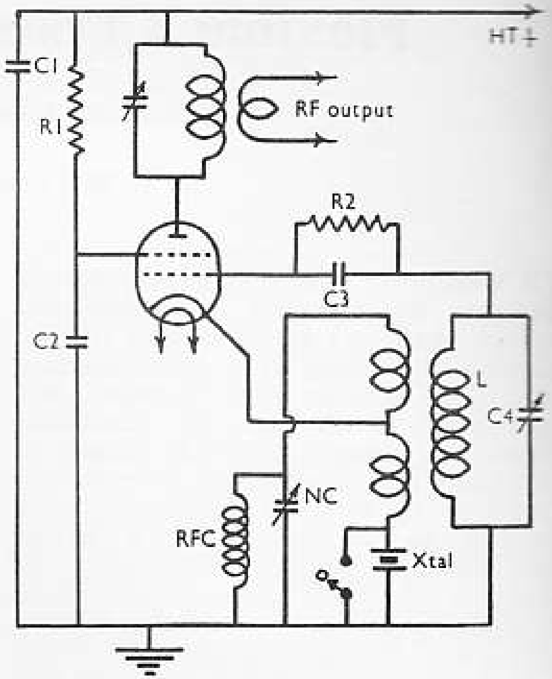



**Fig. 2.. Practical circuit derived from the original Butler oscillator, giving crystal or VFO operation at will.**

**Table of Values**

**Fig. 2. The Butler Oscillator**

| | | |
|---|---|---|
| C1 | = | ·002 μF |
| C2 | = | ·01 μF |
| C3 | = | 100 μμF |
| C4 | = | 500 μμF |
| R1 | = | 50,000 ohms |
| R2 | = | 30,000 ohms |

quite different from the readings observed in the case of a Pierce or Miller circuit, where a markedly unsymmetrical characteristic is encountered. This tuning property is one very useful feature of the new circuit, and makes it extremely easy to set up on frequency.

To operate the system as a VFO it is sufficient to join a short-circuiting switch across the crystal.

The elementary arrangement in Fig. 1 suffers from one obvious and one more obscure disadvantage. In the first place, quartz is an insulator, and so the flow of anode current is prohibited. To avoid this an RF choke is connected across the crystal. The value of this choke is not at all critical.

There is another objection to the circuit as it stands. This is due to the capacity of the quartz holder, which may permit sufficient feed-back, at frequencies remote from the crystal resonance, to start self-oscillation. This defect is avoided by the use of a neutralising circuit, shown in Fig. 2. In this, the main tuned circuit LC is the same as in Fig. 1, the values being selected to cover the desired range of frequency. The coupling coil is centre-tapped, and a neutralising condenser, equal in maximum capacity to that of the crystal holder, is joined between one free end and earth. The other end of the coupling coil is connected to the quartz crystal. As before, the RF choke serves merely as a DC path for the valve anode current. A tetrode is shown, in the anode circuit of which is a second tuned circuit set to the fundamental, or preferably to some harmonic frequency.

In setting up an oscillator of this type, the first step is to choose a coil which will tune, with the main variable condenser, over the desired range. Each half of the coupled winding should include about one-fifth of the number of turns used on the main coil and should be well insulated from it. The neutralising condenser should normally be an air trimmer covering say 3-30 $\mu\mu$F.

To adjust the oscillator, first short-circuit the anode coil, and with a meter in the HT lead, set the neutralising condenser about half-scale and tune the main variable condenser slowly through its range. A pronounced dip will be observed when the setting is correct. Note this reading, then search for spurious responses at other settings. These can be eliminated by trial adjustments of the neutralising condenser. If the tuned circuit covers an exceptionally wide range, it is possible that a harmonic response of the crystal ill be excited. This must not be confused with some undesired feed-back instability. Having adjusted the crystal circuit, remove the short-circuit on the anode coil and tune this circuit to resonance. Practically any tetrode valve and any type of crystal from 50 kc to 10 mc can be used in the circuit. With reasonable HT voltages, crystal current is low and the output and efficiency are both high. Grid leak and condenser values are normal, *e.g.*, 30,000 ohms and 100 $\mu\mu$F.

**Multi-Crystal Operation**

A remarkable property of the circuit is that a number of crystals can be employed simultaneously, all joined in parallel, without any form of switching. The desired frequency is selected merely by tuning the main condenser and watching for the separate dips in anode current. Naturally, the anode circuit will need re-tuning to each new frequency. Multi-crystal operation requires only an increase in the setting of the neutralising condenser to allow for the increased total holder capacity. The crystal frequencies must not be very closely adjacent, or there will be some interaction. In any of the circuits described, VFO operation is secured by connecting a short-circuiting switch across the crystal, or bank of crystals. It is well to remember that VF oscillators of high stability should be operated with a large fixed padding capacity and a variable portion just large enough to sweep over the desired frequency range.

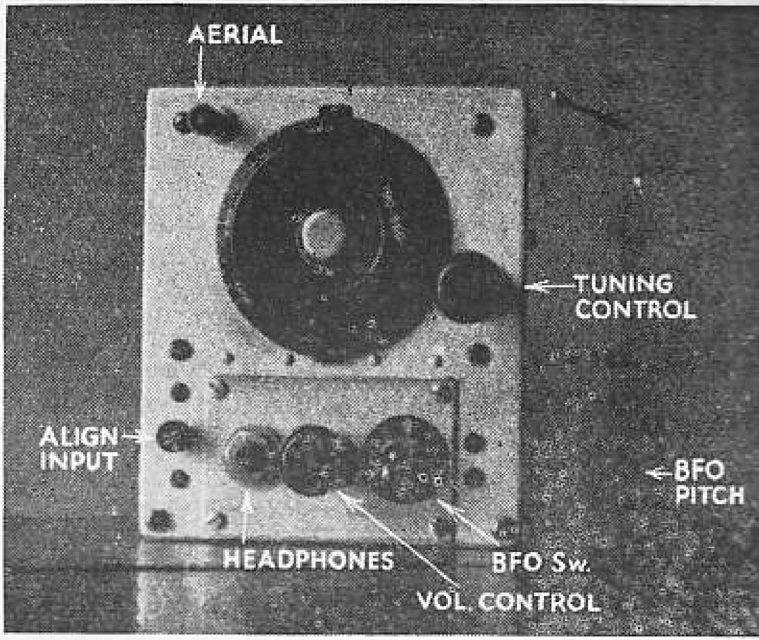
As a refinement, voltage-stabilised supplies can be used, but this is not normally required.

The form of oscillator described has its principal use as a driving source for an RF amplifier. In addition, it can be used in a signal generator or in a heterodyne frequency meter. For these applications, the tuned harmonic selection feature is not required, and a simple triode oscillator can be used. The possibility of working on one of a number of spot frequencies, with an easy change to variable-frequency control by the use of a single switch, makes the circuit extremely convenient in operation.

*By* F. E. WINGFIELD

# BC-453 for Better Selectivity

## The "Q5'er" Idea in Detail



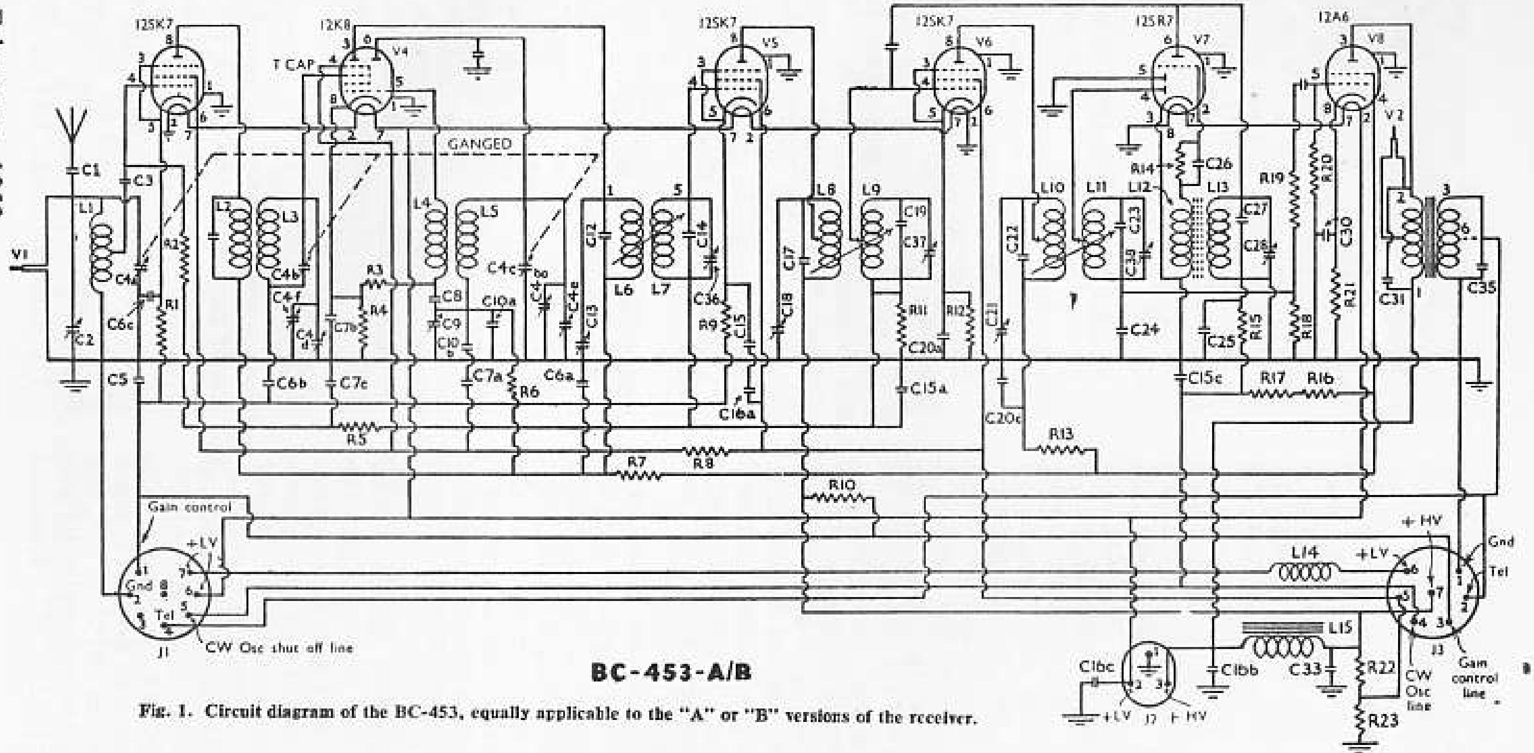

IT is intended in this article to describe the BC-453 in detail and to provide the necessary information for its conversion to the "Q5'er." This was described very briefly in *QST* for January, 1948, under the title "The Lazy Man's Q5'er", but as the equipment is quite well known in America, no very full details of the BC-453 were given.

This receiver is part of a multi-band service installation and covers the frequency range 190-550 kc. It is a 6-valve superhet having a 12SK7 RF amplifier, 12K8 mixer and oscillator, 12SK7 1st IF amplifier, 12SK7 2nd IF amplifier, 12SR7 2nd detector and BFO, and 12A6 audio amplifier. The intermediate frequency is 85 kc and the HF oscillator coil

### Table of Values

**Fig. 1. Essential Details of the BC-453**

| | |
|---|---|
| C1 = | 11μμF mica |
| C2 = | 15μμF variable |
| C3 = | 100μμF ceramic |
| C4 (A-G) = | 4-gang 346 μμF |
| C5 = | 3 μF elect; 300v. |
| C6, 7, 15 (A, B, C,) = | 3 x ·05 μF, paper 300v. |
| C8, 24, 26 = | 200 μμF ceramic |
| C9 = | 40 μμF variable |
| C10 (A, B) = | 690 μμF total, mica |
| C11, 33 = | 3 μμF ceramic |
| C16 = | 3 x ·22 μF, 300v. paper |
| C20 (A, B, C) = | ·05 + ·01 + ·05 μF, 300v. paper |
| C27 — | 345 μμF mica, 400v. |
| C29 — | ·006 μF mica, 400v. |
| C30 = | 15μF elect; 35v. |
| C31 = | ·001 μF, mica, 400v. |
| C32 = | 5 μF elect; 300v. |
| C35 = | 720 μμF mica, 400 v. |
| C39 = | 120 μμF ceramic |
| C12, 13, 14, 36 = | Part of 1st IF |
| C17, 18, 19, 37 = | Part of 2nd IF |
| C21, 22, 23, 38 = | Part of 3rd IF |
| C25, 27, 28 = | Part of BFO assembly |
| L1 = | Input |
| L2, 3 = | Mixer |
| L4, 5 = | RF Osc |
| L6, 7 = | 1st IF 85 kc |
| L8, 9 = | 2nd IF 85 kc |
| L10, 11 = | 3rd IF 85 kc |
| L12, 13 = | BFO 85 kc |
| R1, 4, 9 = | 620 ohms ½ watt |
| R2, 20 = | 2 megohm ½-watt |
| R3, 14 = | 51,000 ohms ½-watt |
| R5 = | 150,000 ohms ½-watt |
| R6, 18 = | 510,000 ohms ½-watt |
| R7, 8, 13 = | 200 ohms ½-watt |
| R10 = | 360,000 ohms ½-watt |
| R11, 19 = | 100,000 ohms ½-watt |
| R12 = | 510 ohms ½-watt |
| R15 = | 20,000 ohms ½-watt |
| R16, 17 = | 150,000 ohms ½-watt |
| R21 = | 1,500 ohms ½-watt |
| R22, 23 = | 7,000 ohms 7 watt |




**BC-453-A/B**

Fig. 1. Circuit diagram of the BC-453, equally applicable to the "A" or "B" versions of the receiver.

| | VT131 12SK7 | VT132 12K8 | VT133 12SR7 | VT134 12A6 |
|---|---|---|---|---|
| Pin 1 | Shell | Shell | Shell | Shell |
| Pin 2 | Heater | Heater | Triode Grid | Heater |
| Pin 3 | Grid 3 | Hexode Plate | Cathode | Plate |
| Pin 4 | Grid 1 | Hexode Grid 2 | 2nd Diode plate | Grid 2 |
| Pin 5 | Cathode | Osc: Grid | 1st Diode plate | Grid 1 |
| Pin 6 | Grid 2 | Osc: Plate | Triode plate | Not used |
| Pin 7 | Heater | Heater | Heater | Heater |
| Pin 8 | Plate | Cathode | Heater | Cathode |
| Top Cap | — | Hexode Grid 1 | — | — |

L5 has a lower inductance than L3 and therefore tunes to a frequency equal to Fs + Fi.

So as to obtain a reasonably uniform sensitivity over the tuning range, C39 across L2 serves to tune L2 to a frequency lower than 190 kc and by so doing, increases the amplification at the low frequency end of the band covered.

The intermediate frequency consists of six tuned circuits and two valves ; L6 and L7, 12SK7, L8 and L9, 12SK7 and L10 and L11. In this receiver the magnetic coupling between coils in each IF transformer is variable between an over-coupled value (bakelite rod, protruding through the top of the IF transformer, "down") or an under-coupled value (bakelite rod "up"). When the receiver is purchased it will have the rods in the following positions: 1st and 3rd IF transformers, rods down ; 2nd IF transformer, rod up. During alignment all of these rods should be *up*. This will be described later. Care should be taken to use a screwdriver with an insulated shank when adjusting these transformers, as the rotors of trimmers C36, C37 and C38 are not earthed.

The second detector is one diode of a 12SR7 ; resistance coupling is used to the input of the 12A6 audio amplifier, which has a 2·2 : 1 step-down output transformer in its anode. The triode portion of the 12SR7 is used as a BFO and is composed of L12 and L13, the grid and plate coils of a tuned anode oscillator. C27 and trimmer C28 are tuning capacities ; C33 is connected between the anode of the 12SR7 and the grid of the 2nd IF amplifier. The junction of R15 and R17 goes to a contact on a switch in the control unit (not shown on the circuit diagram, but called Adaptor FT-260-A and it replaces Adaptor FT-230-A which will be found in the front of the receiver). The other side of the switch is connected to ground. This switch works in reverse to normal ; when the switch is *closed* the BFO is off, the junction between R15 and R17 having been grounded and the HT removed from the 12SR7 anode ; therefore, for CW reception, the switch is opened. The 2nd diode of the 12SR7 is grounded.

The gain control is a 50,000-ohm variable resistor ; again, this is not shown on the circuit diagram as it is located in unit FT-260-A. The cathode circuits of the RF and 1st IF amplifiers are completed to ground through this resistor ; as it is increased in value the cathode/ground voltage increases and therefore the gain is reduced.

V1 and V2 are small neon lamps acting to protect the receiver when exceptionally strong signals are received ; they strike at about 80 volts and any increase in voltage increases the current.

The difference between (A) and (B) type receivers is a very minor one. In model B, the secondary winding of T1 has a tap for use if low impedance headphones are employed ; normally, the set is received with two wires on terminal 3 of T1, for 8000 ohm impedance headphones. To convert to 600 ohms, remove these two wires and connect them to terminal 6.

The full circuit diagram is shown in the drawing.

**Conversion to Q5'er**

When received, this set will be wired for 25 volts, *i.e.*, the six twelve-volt valves are wired in series/parallel. As it is much easier to find 12 volts than 25 volts, the heaters were all wired in parallel. There are a few components and some wiring which are not required ; while a potentiometer, switch and jack for volume control, BFO On/Off and headphones, not incorporated in the set, are necessary additions.

Turn the receiver upside down and remove the baseplate by means of 14 bolts round the sides. Now, with the set placed so that the front is towards the left, the following operations are carried out. (The photographs and drawings will assist in the location of the components mentioned).

(1). Remove choke L14 by undoing two

screws at sides, replace screws to hold two soldering tags in place, remove white leads from choke ; one goes to pin 6 on J3 at the rear of the chassis, the other to pin 7 on J1 at the front end.

(2) ***Conversion of filament wiring to 12 volts.*** Now that L14 has been removed, the 3-pin power plug to the dynamotor is visible ; in the writer's case this was left as a 12-volt dynamotor was available. Black lead on pin 1 is negative, white lead from pin 2 is positive filament, going to pin 2 of V8 *via* condenser C16C. Remove white lead from pin 7 of V8 and earth this pin, replace white lead on pin 2 of V8, thereby joining positive filament to pin 7 on V7, earth pin 2 of V7. On V5 remove white lead from pin 2 and join to pin 7, earth pin 2. Remove white lead from pin 7 which goes to pin 6 on J1. On V4 remove bare wire from pin 2, cover with sleeving and join to pin 7, earth pin 2.

(3) J1 complete with can is now removed to make room for BFO switch, volume control and headphone jack, which will all need to be small components to fit in. The leads which are needed are : Black lead from pin 4 ; red lead from pin 5 ; green lead from pin 1 ; and a ground in place of pin 2. The leads from pin 6 and 7 have already been removed.

(4) The construction of the panel for the extra controls is best seen from the photographs. It utilises the small front panel of FT-230 A. The circuit of Fig. 3 is drawn round J1 for clarity.

Now replace the baseplate and turn set up correct way.

(5) Normally, the dial is driven by means of a cable from the remote control unit, or by a local control unit MC-237-A, either of which may be found on the surplus market. If not, an adaptor can be made by getting a piece of ¼-in. copper tube, cutting four slots 90 deg. apart in one end and forcing this over the toothed drive visible in the hole to the right of the dial. A small ¼-in. spindle knob is put on the other end. This modification is only necessary if the set is required as a separate receiver.

(6) Remove cover to give access to valves and IF transformers. Now, as has been stated before, the IF transformers have provision for two settings of coupling, the

| *C.W.* | | *'PHONE* |
|---|---|---|
| 7100 kc. (day) | **NATIONAL** | 3875 kc. |
| 3550 kc. (night) | **CALLING** | 14,225 kc. |
| 14,050 kc. | **AND** | 29,640 kc. |
| 28,100 kc | **EMERGENCY FREQUENCIES** | |

During periods of communications emergency these channels will be monitored by stations of the National Emergency Net for personal-inquiry traffic. At other times, these frequencies can be used as general calling frequencies to expedite general traffic movement between amateur stations. Emergency traffic has precedence. After contact has been made the frequency should be *vacated immediately* to accommodate other callers.

The following are the National Calling and Emergency Frequencies for Canada: *c.w.* — 3535, 7050, 14,060; *'phone* — 3815, 14,160 kc., 28,250 kc.

idea being that normally the set is aligned with loose coupling and then the coupling is increased to give a broader band. Unscrew the caps from the top of each IF can and beneath will be found the bakelite rod mentioned earlier. Carefully pull these out about a ¼ in., their maximum travel. The centre transformer is already set in this way and does not have to be touched.

**Receiver Coupling**

Coupling the BC-453 to the normal station receiver depends on whether it has

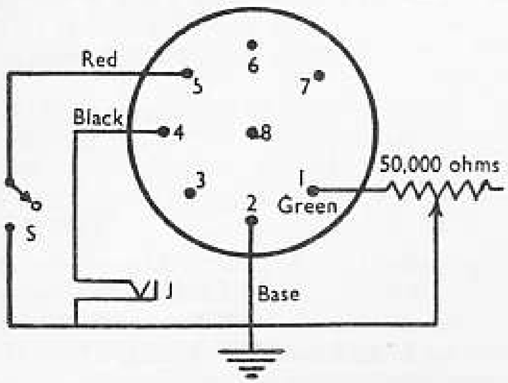



**Fig. 3. Circuit diagram of the gain and BFO control.**

double- or single-ended valves. If they are double-ended, twist an insulated wire round the grid lead to the last IF valve (HRO, etc.). If it uses single-ended valves the same is done to the detector diode plate pin. This lead should then be screened (to stop break-through from ships) and taken to the aerial te minal on the BC-453. Use very loose coupling, otherwise the BC-453 will overload.

Now connect, through J2, a power supply delivering 12 volts AC at 0·9a, and 200-250 volts DC at 40 mA ; connections are shown in Fig. 4.

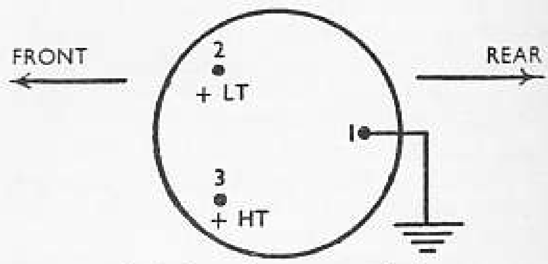
There is a choice, on CW reception, of using either the BFO in the station receiver or that in the BC-453. It has been found that for optimum selectivity it is best to use the one in the normal receiver. At the same time, the AVC can be left on if the BFO in the BC-453 is used, and the S-meter also becomes operative.

Actually, to get the best from the AVC, the line voltage should be taken from the 12SR7 in the BC-453, but without this modification the gain is exceptional. To obtain AVC control is simple, as there is a spare diode on the 12SR7.

**Operation of the Unit**

Tune a signal in on the station receiver using the S-meter, then carefully tune the BC-453 to the IF of the receiver (crystal in "sharp" position) ; it will be found that with an S9 signal real single-signal reception is possible, there being *no signal* on the other side of zero after setting the "rejection notch" of the crystal to take out the remains of the signal.

It is possible to obtain a form of *selectable* single-sideband reception with this set. By detuning a telephony signal one kc from the centre position *towards* the *unwanted* signal, the wanted signal is

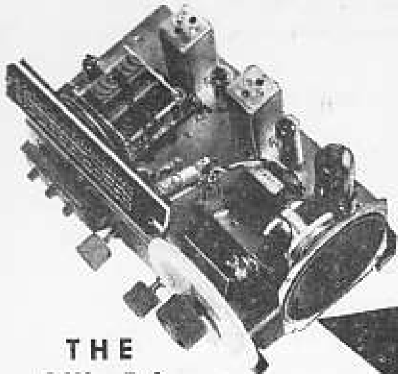



J2 Looking down on top of set

attenuated by 5dB, but the unwanted signal is attenuated by 30dB. An audio filter in the headphone lead is used.

It is proposed at the writer's station to replace J3 with an octal socket and feed the power in there. Modifications in wiring necessitated are as follows : Same pin numbering used as on J3. Take lead from pin 3 of J2 and join to pin 6 of (octal) J3—this is positive HT. Remove red lead from pin 7 which goes to one end of L15 ; remove red lead from pin 5 to joint at top terminals of R22, R23 ; remove both red leads from pin 4—that the one which goes to C15C is cut out, the one going to the front panel BFO switch is joined to C15C in place of the one taken off.

IT'S **NEW!** IT'S A **NATIONAL!** THE SW-54




THE
SW-54

## *Sleek, Low-Priced Beauty is Most Compact General Coverage Receiver Ever Built!*

**SIZE:** 11″ wide 7″ high, 7″ deep.

**USES MINIATURE TUBES AND UNIQUE BANDSPREAD DIAL**

New miniature tubes make possible new sensitivity and performance. Unique plastic bandspread dial is adjustable to assure complete logging accuracy.

**TUBE COMPLEMENT:** 12BE6, converter; 12BA6, CW osc.—IF amp.; 12AV6, 2nd det.-1st aud.—A. V. C.; 50C5, audio output; 35Z5, rectifier.

SW 54

Here is National's latest engineering triumph! A complete superheterodyne receiver covering all major broadcast and shortwave bands that is smaller than the average table radio! New design makes possible a standard of performance never before achieved in so compact a receiver!

**COVERAGE:** Entire frequency range from 540 kc. to 30 mc. Voice, music or code.

**FEATURES:** Sensitive and selective superhet circuit. Slide rule general coverage dial with police, foreign, amateur and ship bands clearly marked. Separate bandspread logging scale usable over entire range. Built-in speaker.

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**CANADIAN MARCONI COMPANY**

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VANCOUVER WINNIPEG MONTREAL HALIFAX ST. JOHN'S NFLD.

# DX PREDICTIONS

Prepared by C.B. McKee, Engineering Division, CBC International Service

## PREDICTIONS FOR MONTH OF MARCH, 1952.

Skywire frequency predictions are for amateur communications on various circuits to almost any part of the world. These tables are for five major areas in Canada, and amateurs who are operating reasonably close to the cities indicated will find these predictions quite adequate.

Figures shown are in megacycles and indicate the band to be used. They are for normal F layer transmission and don't consider Sporadic E which may provide unusual DX openings!

| Toronto to: EST | 00 | 02 | 04 | 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 14 | 7 | 14 | 7 |
| Africa | 7 | - | - | - | - | - | - | - | 14 | 7 | 7 | 7 |
| Caribbean | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| S. America | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 28 | 14 | 14 | 14 |
| Australia | 14 | 14 | 14 | 14 | - | - | - | - | - | - | - | 14 |
| U.S. - West | 14 | 14 | 14 | 7 | 14 | 14 | 28 | 28 | 28 | 28 | 14 | 14 |
| U.S. - Central | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - South | 14 | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 14 | 14 | 14 | 14 |
| Vancouver | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 14 | 14 | 14 |
| Watrous | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Montreal | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Sackville | 7 | 7 | 4 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 7 | 7 |

| Sackville to: AST | 01 | 03 | 05 | 07 | 09 | 11 | 13 | 15 | 17 | 19 | 21 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 7 | 7 | 7 |
| Africa | 7 | - | - | - | - | - | - | - | 14 | 7 | 7 | 7 |
| Caribbean | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| S. America | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Australia | 14 | 7 | 7 | 7 | - | - | - | - | - | - | - | 14 |
| U.S. - West | 14 | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| U.S. - Central | 14 | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| U.S. - South | 14 | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| Vancouver | 14 | 7 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 28 | 14 | 14 |
| Watrous | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Toronto | 7 | 7 | 4 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 7 | 7 |
| Montreal | 7 | 7 | 4 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 7 | 7 |

| Watrous to: MST | 22 | 00 | 02 | 04 | 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Africa | 14 | 7 | 7 | 7 | 14 | 14 | 28 | 28 | 14 | 14 | 14 | 14 |
| Caribbean | 14 | 14 | 14 | 7 | 14 | 28 | 28 | 28 | 28 | 28 | 14 | 14 |
| S. America | 14 | 14 | 14 | 14 | 14 | 28 | 28 | 28 | 28 | 28 | 28 | 14 |
| Australia | 14 | 14 | 14 | 14 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 28 |
| U.S. - West | 14 | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - Central | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - South | 14 | 14 | 14 | 14 | 14 | 28 | 28 | 28 | 28 | 28 | 28 | 14 |
| Vancouver | 14 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Toronto | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Montreal | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Sackville | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |

| Montreal to: EST | 00 | 02 | 04 | 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 7 | 7 | 7 |
| Africa | 7 | - | - | - | - | - | - | - | 14 | 7 | 7 | 7 |
| Caribbean | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| S. America | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Australia | 14 | 14 | 14 | 14 | - | - | - | - | - | - | - | 14 |
| U.S. - West | 14 | 14 | 14 | 7 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| U.S. - Central | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - South | 14 | 14 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 14 | 14 | 14 |
| Vancouver | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 28 | 14 |
| Watrous | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Toronto | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Sackville | 7 | 7 | 4 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 7 | 7 |

| Vancouver to: PST | 21 | 23 | 01 | 03 | 05 | 07 | 09 | 11 | 13 | 15 | 17 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Europe | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 7 | 7 | 7 |
| Africa | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 14 | 14 |
| Caribbean | 14 | 14 | 14 | 77 | 14 | 28 | 28 | 28 | 28 | 14 | 14 | 14 |
| S. America | 14 | 14 | 14 | 14 | 14 | 28 | 28 | 28 | 28 | 28 | 14 | 14 |
| Australia | 14 | 14 | 7 | 7 | 7 | 7 | 7 | 14 | 28 | 28 | 28 | 14 |
| U.S. - West | 7 | 7 | 7 | 4 | 4 | 7 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - Central | 14 | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| U.S. - South | 14 | 14 | 14 | 7 | 14 | 28 | 28 | 28 | 28 | 28 | 28 | 14 |
| Watrous | 14 | 7 | 7 | 7 | 7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| Toronto | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 14 | 14 |
| Montreal | 14 | 7 | 7 | 7 | 14 | 14 | 14 | 28 | 28 | 28 | 28 | 14 |
| Sackville | 14 | 7 | 7 | 7 | 14 | 14 | 28 | 28 | 28 | 28 | 14 | 14 |


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# HAMADS

Skywire Hamads must pertain to amateur radio. Rates are 20 cents per word, per insertion for commercial advertisements for profit, and 4 cents per word for all non commercial, non-profit advertisements by experimenters or licensed radio amateurs. Full remittance MUST accompany copy. Print plainly and count address in the total. Do NOT send personal checks unless exchange is included. Mail to Skywire, Toronto.

HALLICRAFTERS SX-42 25 cycle receiver, complete with speaker, $325.00. 150 watt PP807 final 6AG7 oscillator, 807 buffer, antenna tuner, all bands with plug in coils. This is all contained in Hammond 6 foot cabinet with 100 watt 807 modulator and speech amplifier. The best offer over $200.00 takes this. Also have Collins 32-V transmitter, 60 cycle, VHF-152A, deluxe TBS-50D and PE-103 dynamotor with control box and cables. What offers ??? Write, T.W. Clemence, 2278 King Street East, Hamilton, or contact VE3KM. Be generous - these are being sold to close hams' estates.

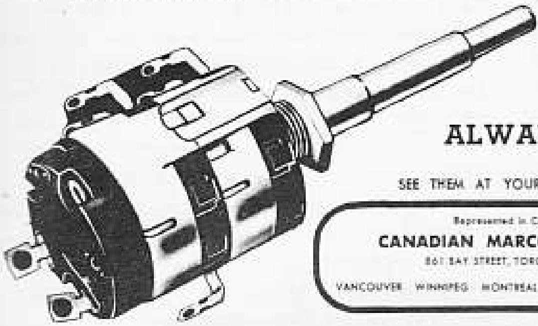


RECEIVER, 1155-A, with power supply and speaker for sale, $80.00. This is fully converted and ready to put on the air. Excellent condition. Arn. Castrucci, R.R. #3, Niagara On The Lake, Ontario.

FOR SALE, like new, National HRO, complete with coils, speaker, rack. Price $225.00. Fred Ledger, 78 Alexander St., Sherbrooke, Quebec.

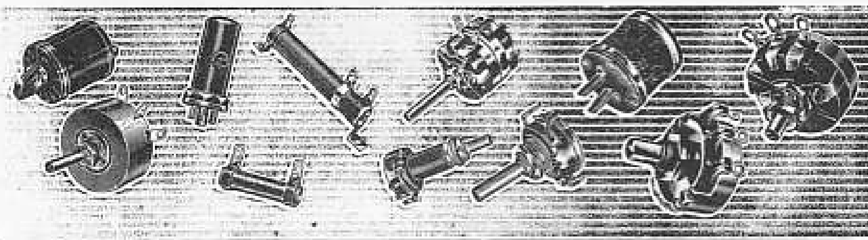
FOR SALE, like new, No. 19 Army transmitter-receiver, 807 final, 2 to 8 mcs. 12 volt DC or 60 cycle operation, complete with power supplies, headphones, mike, key, connectors, aerials etc. Make offer. VE3BYD, Box 268, Mattawa, Ontario.

A QSO Contest, open to all Ontario amateurs, sponsored by the Ontario Phone Club will be held on Sundays March 9th and 16th, 1952, from 10 a.m. to 10 p.m. Purpose of the contest is to enable CW phone operators to become more familiar with both types of operating. Two awards will be made. The CW trophy will be known as the Sparton Radio Trophy, and and phone award as the Columbia Record Trophy. Both donated by Sparton of Canada will be suitably engraved with winners call and year of presentation. Three wins give permanent possession. From 3500 to 3725 is for CW, 3725 to 3800 kc for the mobile phones running 100 watts and less. 3725 to 3800 kc is also for phones of 30 watts up. No multipliers - one point for each contact, phone to phone, phone CW, and vice versa when contacts are made in designated parts of band. Judges, CW, VE 3DU,HP, phone, 3YJ,FQ. Logs to be sent to E. Kimble, Sparton of Canada Ltd., London up to midnight, March 31st, 1952.











# HOW'S UR OBS IQ?

Official Bulletin Nr 330, Jan 17, 1952. ARRL announces the availability of a Reference Guide for Code Trainees. The guide contains a bibliography of articles on code training, a schedule of W1AW practice transmissions, code charts and helpful suggestions. Copies will be sent gratis, to those learning the code, to individual amateurs or club groups engaged in assisting prospective amateurs to learn the Continental code. Address requests to Communications Dept. ARRL, W. Hartford, Conn.

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Official Bulletin Nr 331, Jan 24, 1952. Additional stations are needed in the current ARRL program of on the air code practice for persons wishing to learn Continental code. Schedules may be arranged to suit the convenience of cooperating amateurs and will be published in QST. A combination of voice and code transmissions is considered to be most effective. Suggestions for conducting code lessons over the air are now available from ARRL. If you are willing to assist in this program, send a postal or radiogram to ARRL CD indicating so and you will be furnished with complete details.

---

Official Bulletin Nr 332, Jan 31, 1952. ARRL invites applications for its Official Observer appointment. League members residing in any US or Canadian section are eligible. The various classes of Observer appointment include categories for fone and CW checking which require only receiving equipment and individual skill. All amateurs interested are requested to write ARRL HQ for application blanks, a sample OO Bulletin and full information on how to qualify.

---

Official Bulletin Nr 333, Feb 7, 1952. All amateurs are urged to consider the advisability of participating in their local civil defense program in preparation for for implementation of the proposed Radio Amateur Civil Emergency Service. Your local EC will be glad to sign you up in the AREC with this in mind. If no local EC, give your recommendation of a qualified amateur for the post to your SCM.

---

Official Bulletin Nr 334, Feb 14, 1952. Canadian Headquarters of the Boy Scouts Association is encouraging Scout Leaders and Senior Boy Members to take part in and learn amateur radio. It is hoped that adult leader and boy will be introduced to our hobby and that they may thereby further their emergency service training. Through Canadian national magazines, Scout leaders and scouts have been asked to contact radio amateurs in their community if interested. Canadian amateurs are urged to give members of the Boy Scouts Association whatever assistance and direction they may need. Check with your local Scouting groups, if possible.

## ERRATA

DESCRIPTION OF JACKSON MODEL 652 IN JANUARY SKYWIRE SHOULD HAVE BEEN AS FOLLOWS

| | |
|---|---|
| LINE VOLTAGE | 105 - 120 Volts, 50 - 60 Cycles |
| INPUT WATTS | 50 Watts |
| FREQUENCY RANGE | 20 to 20,000 Cycles |
| ACCURACY | 3% or 1 cycle |
| CALIBRATION CURVE | Logarithmic |
| SCALE LENGTH | 25" |
| OUTPUT IMPEDANCE | 10, 250, 500, 5000 Ohms and High |
| OUTPUT POWER | 500 Milliwatts |
| OUTPUT CONTROL | Continuously Variable |
| WAVEFORM | Less than 5% Distortion at all frequencies |
| FREQUENCY CHARACTERISTIC | Plus or Minus 1 DB 30 - 15,000 cycles |
| HUM LEVEL | Down more than 60 DB of maximum output |
| TUBES | 1-80, 1-6SJ7, 2-6F6 furnished installed |
| DIMENSIONS | 13" Wide, 9½ High, 9½" Deep |
| WEIGHT | 26 Lbs. |

THE RADIO CENTRE 72 CRAIG ST. W., MONTREAL

## DX QTH's

| | |
|---|---|
| EA6AF | Bartolomé Pina, Casa de Espana 2, Palma, Majorca. |
| EA6IM | Box 324, Palma, Majorca. |
| EA8HS | Box 16, Tenerife, Canary Is. |
| EA8RK | Box 215, Tenerife, Canary Is. |
| FF8JC | Box 209, Dakar, French West Africa. |
| FM7WE | Box 281, Fort de France, Martinique, F.W.I. |
| HC7KD | Box 340, Quito, Ecuador. |
| HS1SS | King, c/o American Embassy, Bangkok, Siam. |
| MP4BAO | Box 333, Awali, Bahrein Island, Persian Gulf. |
| SP1KM | Box 320, Poznan, Poland. |
| ST2SP | Posts and Tels. Dept., Ma'akal, Upper Nile, Sudan. |
| SV5UN | Radio SV5UN, United Nations, Rhodes, Greece. |
| TI2SA | Box 1266, San Jose, Costa Rica. |
| VP6RJ | Box 92, Barbados, B.W.I. |
| VU2BK | H.Q. Eastern Command, Karachi. |
| YU3FMG, YU1AA | Box 48, Belgrade, Yugo-Slavia. |
| ZB1IH | Cdr. (L) G. C. Turner, R.N. (G5IH), Metropole Hotel, Sliema, Malta, G.C. |
| ZD1KO | Sierra Leona Signal Squadron, Freetown. |
| ZD4AC | Box 933, Accra, Gold Coast. |
| ZD4AV | Capt. H. M. R. Mallock, Gold Coast Signal Squadron, Giffard Camp, Accra. |
| ZD6HJ | H. H. Jones, P.O. Dowa, Nyasaland. |
| ZE3JF | Box 596, Salisbury, Southern Rhodesia. |

# TELEVISION IN 1955

Prospects of Video Industry Outlined by NBC President in Year-end Statement which also Analyzes Trends of Viewing Audience, Theatre Television and Sponsor Participation

By Joseph H. McConnell

A TELEVISION viewing audience of 84,000,000 people, more than half the total national population is envisaged for 1955 in a year-end statement by Joseph H. McConnell, President, National Broadcasting Company. "By that time," he said, "we will think of television as we think of radio today; not in regional terms but as an instrument of mass communications for all of America."

Mr. McConnell expressed his opinion that theatre television will keep abreast of home viewing. "I anticipate that 4,100 theatres will be television equipped on our target date (1955). Each will accommodate an average audience of 1,000 bringing the theatre total to 4,100,000 viewers.

"The economic graph for television will climb with all the speed of audience growth," he continued. "We now count television billings in the tens of millions; but 1955 should put us in figures several times as great.

"Total national expenditures for advertising in 1951 were $1,775,000,000. With an expanding economy, with television vaulting toward maturity, with growing business awareness of the importance of all advertising media, I anticipate that the total annual income from all advertising sources in 1955 will reach $8,000,000,000.

"Considering the present leaping demand for television network time, it is probable that television in 1955 will achieve billings of $1,000,000,000; or one out of every eight dollars spent by American advertisers *in all media.*

"At first glance, this sounds fantastic: one communications medium, in three additional years, to achieve a gross income that represents more than 50 per cent of today's total advertising budget. But that is typical of television's history. A billion dollar industry has been created almost overnight. Hundreds of millions are being spent on new equipment, on scientific research, on programming and talent and on network expansion.

"Despite the vast increases in revenue, the major networks will not record large profits. Income will be plowed into growth. It is possible, even probable, that networks will continue to show losses in this period of feverish expansion.

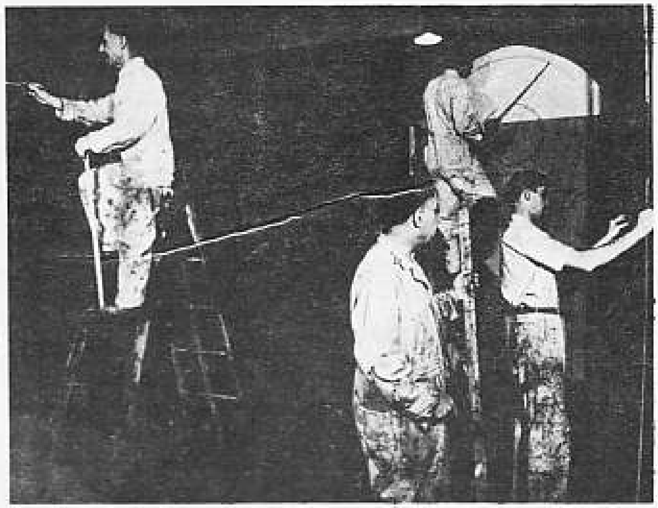
"We who are custodians of the airwaves have an obligation to the American people to use this new medium for the benefit of all. We intend to fulfill it. By 1955, I expect to see television well entrenched as our foremost cultural instrument. Not since the printing press has any invention offered such opportunities for the enlightenment of everyone."

## World's Loftiest TV Station Is Planned by Mexican Firm

The loftiest TV station in the world, and Mexico's latest addition to its telecasting facilities, will be located at Cortes Pass, 12,500 feet above sea level.

The new station will be operated by Televisión de Mexico S. A., an enterprise of Romulo O'Farrill, Sr., who also owns television station XHTV, radio station XEX, and publishes the newspaper "Novedades."

The 2,500-watt transmitter, purchased from the RCA International Division, will be operated as a satellite of station XHTV Mexico City, to cover the Valley of Mexico, the Valley of Puebla, and other areas where reception from XHTV is blocked by mountains. Cortes Pass is located about 65 miles from Mexico City and 40 miles from Pueblo, between Mexico's two famous volcanos, Popocatepetl and Ixtlacihuatl.



# Diary of a TV Set Designer

By Tom Jewett

A SET DESIGNER for an hour-long weekly television program such as NBC's "Television Playhouse" has everything at his command except a 14-day week. Tools are there in abundance, talent is always available but time is a relentless taskmaster. This unusual situation is created by the fact that while the designer is creating 15 or 20 sets for one show he is currently planning a similar volume of scenery for the program that is scheduled a week later.

For purposes of illustration let us use the December 23 production of the Vogeler story "I Was Stalin's Prisoner". In diary form, this is the procedure that was followed by the writer during the seven days preceding the actual broadcast.

*Monday:* Worked all morning on paint shop elevation and detailed plans which included specifications of colors to be used in all sets. In the afternoon, accompanied a camera crew to a rural area near New York to film outdoor scenes which would be inserted in the program.

*Tuesday:* After a production meeting in the morning hours were devoted to the selection of furniture, pictures and lamps for the indoor sets. Came evening, and a conference called by the producer to make last minute changes in settings.

*Wednesday:* This was the day set aside for the designer's weekly visit to the property shop in the basement of NBC's huge storage warehouse and production plant on West 56th Street. Stored there are more than 1250 pieces of furniture and miscellaneous "props" that may number 2,500 or more. To sort over and inspect this mass of material takes time. Some of the items sought may come from shelves of imitation breakfast foods or from the stalls where old taxicabs and horse-drawn shays are stored. Whatever is chosen, it must be in precise keeping with the period and locale of the drama. Errors here are quickly detected by astute viewers. On Wednesday afternoon plans were begun at a production meeting for the program of December 30. At this conference, the designer was expected to come through with a rough floor-plan of the stage settings. This he did, and then returned to the warehouse to continue his selection of props for the show of the 23rd.

*Thursday:* Morning hours devoted to the making of drawings for the second production after which attention was turned again to supervising the construction and painting of the scenery for the Vogeler story, then only three days away. In the construction shop, the designer showed his blue print specifications to the foreman and then selected additional pieces of stock scenery from a photographic catalogue. The twelve experienced stage carpenters employed here can build almost any object from a "flat" to a castle. The many out-of-the-ordinary requirements placed upon these artisans have taught them that nothing is impossible to simulate. In the past they have reproduced rocks, a Gothic cornice and a Victorian gingerbread porch.

It is in this stage of set production that ingenuity comes to the fore. Both time and money must be saved, wherever possible. One way of doing this is to design sets that are flexible. It is not unusual to make two stage settings do the work of four or five. The dressing can be altered, tapestries can be rolled down like maps, pictures shifted and furniture changed.

There are numerous other money saving "kinks." A cellar window can be produced by turning a fireplace wing upside down and topping it off with an inexpensive mullion. Doors and windows are constructed so that they may be used front and back, and even an elaborate cave can be built out of heavy wrapping paper, staples and paint.

*Friday:* Now with only two days to go, the tempo increased. First came a rehearsal of the Vogeler drama, then more time across town in the paint shop. Dinner over, back to NBC studio 8G in Radio City to supervise the erection of "flats." Flats are the vertical surfaces which comprise the walls of a set. After being completed at the production shop these flats, together with furniture, draperies, etc., had been trucked to a receiving platform 34 feet under ground below the RCA building and brought to studio level on a freight elevator.

*Saturday:* Beginning at 8 a.m., the set designer, together with the "dressing crew", went to work in 8G putting drapes and furniture in their prescribed places and touching up paint jobs where necessary. Then back to the designer's drawing board for more work on the following show which already was creeping up.

*Sunday:* The Day! The set designer moved back and forth between the studio stages and the control room. At a time like this, it is always amazing what the camera will reveal. For instance, at one point the producer decided on a higher camera shot than had been specified originally. The producer was satisfied by having one flat mounted above the other, bolted on and then painted to correspond with the color already applied. A chair which, on the monitor screen, didn't seem quite authentic enough was removed and a replacement located by making a fast taxi tour of theatrical rental firms and antique shops. Of course, the correct chair was found eventually, and placed on the stage. But just as the designer was about to put his O.K. on the setting, he realized that one picture was so brilliant that its reflection blackened the face of an actor standing beside it. A spray gun solved this problem, but immediately the control room reported that a coffee pot was casting a bad reflection. This time a coating of wax deadened the glare.

And so it went on, right up to the minute when the little buttons on the front of the television cameras glowed red to warn the performers that they were "on the air." Then and only then could the set designer sit back and relax. There was nothing more that could be done for the Vogeler story, but, facing him like another necessary spectre was the show of the 30th. On Monday, the hectic pace would be picked up again.

Truly, fourteen days in a week would be a solution—after a fashion.

Dress rehearsals give the set designer his final chance to make the changes in scenery and "props" that will add reality to the drama.

# RADIO AND ELECTRONICS
# Their Status and Promise

By Dr. E. W. Engstrom

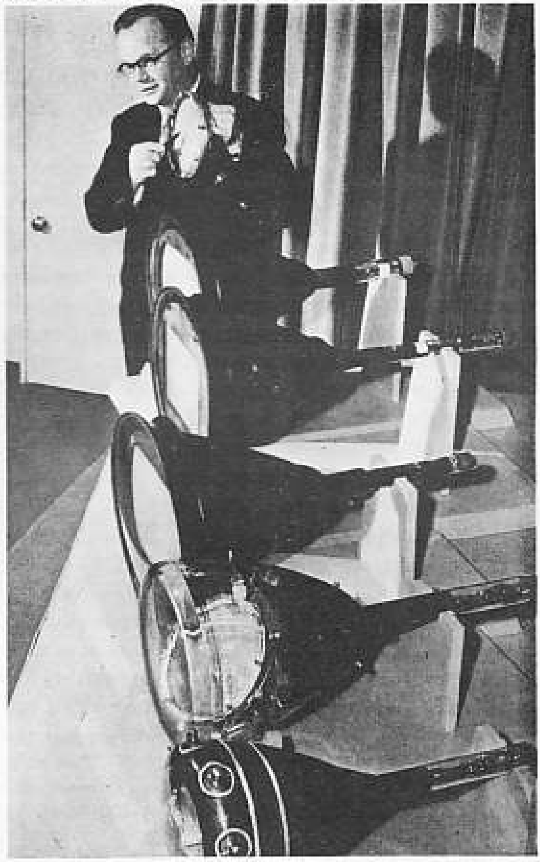
*Vice President in Charge,*
*RCA Laboratories Division*

*An address delivered at the 60th Anniversary Convocation of Drexel Institute of Technology in Philadelphia on October 31, 1951*

IT IS particularly appropriate on this occasion to speak about radio and electronics as a science and as an industry. It is appropriate because radio, followed by electronics, had its beginning at about the same time this Institute was founded. We may but think of Hertz's experiments in electromagnetic radiation. We may consider Branly and his coherer for detecting radio frequencies in the early 1890's. Again we may think of Marconi and his experiments of the 1890's, culminating in his historic transmission of the letter "S" across the Atlantic in 1901. These were the beginnings and I have called attention to but a few of the pioneers. They were followed by a host of others until today the technical workers are counted by the tens of thousands and those who serve in the industry, by the hundreds of thousands or millions.

In the years that followed the first practical radio transmissions, the service grew rapidly in both its continent-to-continent and ship-to-shore branches. During those early years the use of radio was confined to code communications. While some experimental work on radio telephones was done, the idea of broadcasting had not yet been proposed. The period of World War I and the years just following saw the development and initial use of the "vacuum tube." It is this electronic tube which today is at the base of the huge radio-electronics industry. I shall say more about this later.

While radio communications grew rapidly, it even now is small in terms of plant and equipment and in operating revenue when compared to the services to which it and the electron tube gave birth. I refer, of course, to radio broadcasting — sound and television — and to the many applications of electronics. Before leaving the subject of radio telegraph communications, it may be of interest to note that during the past several years the radio message traffic handled by private companies in the United States has run from one-half to three-quarters of a billion words each year.



The author points to one type of tri-color television picture tubes developed by RCA.

With the advent of radio broadcasting in the 1920's, radio really began reaching its seven league stride. This new service, the outgrowth of radio communication, soon outdistanced its parent. As an example of the magnitude of this now mature service, 12 million sound receivers were produced last year in the United States. These had a retail value of 650 million dollars. In that same year some 380 million electron tubes were produced at a value of approximately 500 million dollars. Radio billings for network broadcasting totaled some 200 million dollars. As of the start of this year, 96 million radio receivers were in use in 45 million homes of our country — or 95 percent of the population.

This, then, is the measure of the service which has extended man's power to hear — to listen at a distance. For as long as man has had the concept and the vision to do so, he has likewise dreamed of sight at a distance. It is significant that as the pioneers were first experimenting with and conceiving uses for radio transmission, other pioneers were carving out the beginnings of television. Here, however, real progress in the art had to await the development of refined instrumentalities of electronics.

Television of a practical and commercial nature began as World War II developed. Once started, the service marked time until the cessation of hostilities. Since then, the growth has been phenomenal — beyond the estimates of the most optimistic. Last year in this country some 7½ million television receivers were produced, representing a retail value of approximately 2 billion dollars. Today, more than 14 million television receivers are in operation.

109 television broadcasting stations serve more than 60 important areas representing roughly 60 percent of the nation's population. The number of stations would be much larger except for the "freeze" on new stations which has been in effect since 1948. The majority of the 109 stations are now served by network programs. This network facility has just recently become transcontinental. Currently, billings for television network broadcasting are approximately the same as that of sound broadcasting. Soon it is expected that new station authorizations will be given, both through the lifting of the freeze and the establishment of service in the ultra-high radio frequencies.

### *What Electronics has Accomplished*

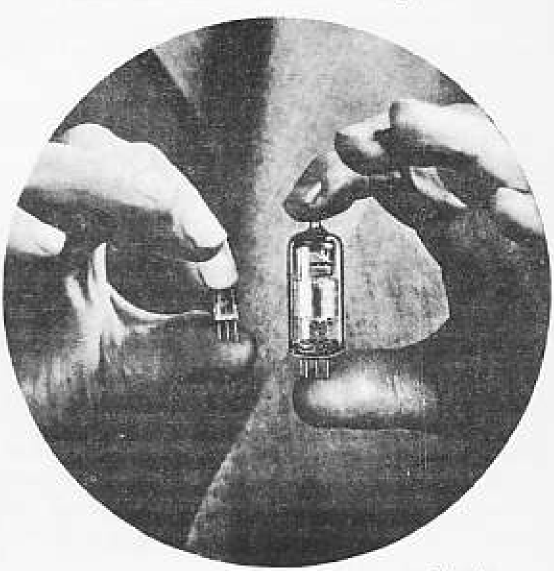
We have examined three of the stepping stones leading to the present. There are others. Electronics gave the silent films a voice. Electronics gave the speaker, the singer, and the performer an enlarged voice for large audiences. Radio and electronics gave the public, industry, and individuals means to communicate and means to control at a distance. Electronics means control and safety on land, on sea, and in the air. Now industrial forms of television permit sight at a distance in places where it is difficult or dangerous for man to view. Other forms of industrial television permit teaching in new and improved ways. Electronics abounds in control processes for machinery in factories. Now electronics is doing our counting, our computing at lightning speed. There are facets so numerous that I can but mention these few examples.

Radio provided its first major test as a military tool during World War I. By World War II, radio and electronics were integral parts of the military machine. Superiority in radio, radar, and electronics had much to do with the outcome of the conflict. One used to say that an army marched on its stomach. Now one may say that military might on land, on sea, and in the air, lives, moves, shoots, and conquers on its electronics. Radio and electronics are the "brains" on which all military movements and actions depend.

### *New Materials Enter Scene*

Radio equipment of the early days made use of essentially the same materials as its older brother, the electrical industry. I mean the use of conductors — materials permitting the ready movement of electrons when under the proper influence; insulators — materials where the electrons are bound; and magnetic materials. From almost the beginning, however, a new class of materials entered the radio scene. These were neither conductors nor insulators in the usual sense and they did not obey Ohm's law. I refer to the loosely packed particles of the coherer and the crystal with its point contacts. These were the detectors of radio waves. While the performance of such units could be measured, the basis of the performance was little understood. Except for such specialty applications these semi-conductors were the discards of the electric and radio arts. They served well

The tiny transistor (left) is compared here with a miniature vacuum tube which it may eventually replace in radio sets and other electronic apparatus.



during the early radio days but passed from the scene when the electron tube emerged. Like actors in a play, a place was reserved for them in a later scene. We shall come to that soon but first, we need to examine the electron tube.

The electron tube is the lever-arm of radio and electronics. It is the foundation stone or the keystone of all apparatus and techniques upon which the present ever-expanding industry depends.

### *Industry Built on Electron Tube*

In its simple form, an electron tube is a device — a vessel devoid of air — in which electrons are boiled out from a metal or cathode material. When freed in the vacuum space, they are subjected to the desired action by a control influence. Through the effect of a small control influence, a larger output effect is produced on the electrons. This output effect is transformed in a work circuit so as to do what the designer seeks to achieve. From this simple form we have progressed to a myriad of electron tube types. We have transducers of voltage, current, light, and other manifestations of energy. Upon this versatile instrument we have built an industry of first magnitude. It is truly a modern version of Aladdin's Lamp.

While we have progressed far, and while we are still expanding the versatility and usefulness of electron tubes, attention again has been directed to the discard materials, the semi-conductors. As is so often the case, we find in the discard, the real gem itself. But this time the approach was not through empirical experimentation but by painstaking research with understanding of each step. Also it was not a single approach but one which has taken many routes with many evidences of current and potential results. This has been termed the electronics of the solid state. The electron tube might be similarly termed electronics in vacuum.

The first broad uses of these new materials came from their non-linear and unilateral properties which were those of importance for radio-frequency detectors of the early days. Then we moved into small power applications as well. As understanding grew, we learned that conductivity could be influenced by radiant energy (photoconductivity), by electron bombardment (bombardment induced conductivity), and by applied voltage (transistors), just as is the case for the electron tube. Here, however, we are working with the controlled action of electrons in solid materials.

Why is this important? It is important because we have a new tool, a new instrumentality. It promises to augment and to supplement the electron tube. It means new freedoms in the future in the designs of equipment. It means wider and added services and uses. It provides a new dimension.

In radio and electronics we view the scene on an approximate sixtieth anniversary and we see a vast panorama of what has been created. These are the creations of scientific and applied research with the dress of ingenious engineering. We see a view which has radiated outward in an ever-expanding fashion. Now as we move to the present and look to the future, we do so with new instrumentalities in hand. We do so with a sound established framework of research and engineering. We see service for which our measuring tapes are too short. The horizon is boundless.

## NEW TUBE FOR UHF

A new tube in the "pencil-type" series which is capable of producing an output of 1,000 watts in certain types of specialized service, at frequencies up to 3,300 megacycles, has been announced by the RCA Tube Department.

The tube, a triode, is distinguished by its small size, light weight and stability. It was specifically designed for service in transponders, navigation beams, telemeters and pulse altimeters, and for use in signal generators and mobile transmitters operating in the UHF region. All metal parts of the tube's envelope, with one exception, are made of silver-plated steel.

# ASTATIC PICKUPS

## TRANSCRIPTION PICKUPS FOR SLOW-SPEED AND STANDARD 78 RPM LATERAL TRANSCRIPTIONS

### 6D

• Switches from 33-1/3 or 45 RPM records to standard 78 with turnover knob at front. Plays both types of records at only eight-gram needle pressure, thus has no extra mechanism to change pressure when knob is turned, eliminating a potential source of trouble and varying reproduction quality. Employs LQD-1 Double-Needle Cartridge. Mounts seven inches from turntable center, die-cast curved arm finished in dark brown Hammerlin.

### FLT-33

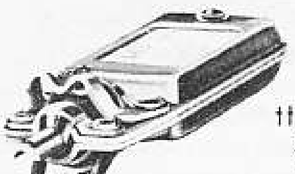
• Never before, a pickup of such professional instrument quality and precision. Like the FL-33, this sleek transcription model employs the U-J Crystal Cartridge with one-mil tip-radius needle, instantly replaceable with the U-78-J for playing 78 RPM records. In addition, the U-TR Cartridge with 2.5-mil tip-radius may be inserted to play standard lateral broadcast transcriptions. Special ball-bearing, anti-resonance base is adjustable to desired height, as is the unique arm-rest. Feather-touch needle pressure of five grams is accomplished by a revolutionary hinged division of the arm, which also contributes to perfect tracking and elimination of surface noise. Die-cast arm and base look their fine instrument part, with finish in telephone black. All three "U" Series Cartridges are available with diamond stylus tips instead of the regular sapphire.

††"U" Series

††"U" Series

### 400-D

• Turnover type transcription pickup adapted from famous Astatic Studio Master "400" conventional transcription arm. Plays 33-1/3, 45 or standard 78 RPM recordings at eight-gram needle pressure. Employs LQD-1 Double-Needle Crystal Cartridge. Notable excellence of frequency response, particularly at low frequencies. Gracefully curved, die-cast arm in light brown Hammerlin finish.



††"LQD" Series
Double-Needle
Turnover Type

### MODEL 8-D TURNOVER ASSEMBLY AND DOUBLE-NEEDLE CARTRIDGE, MOUNTED IN WEBSTER-CHICAGO TONE-ARM

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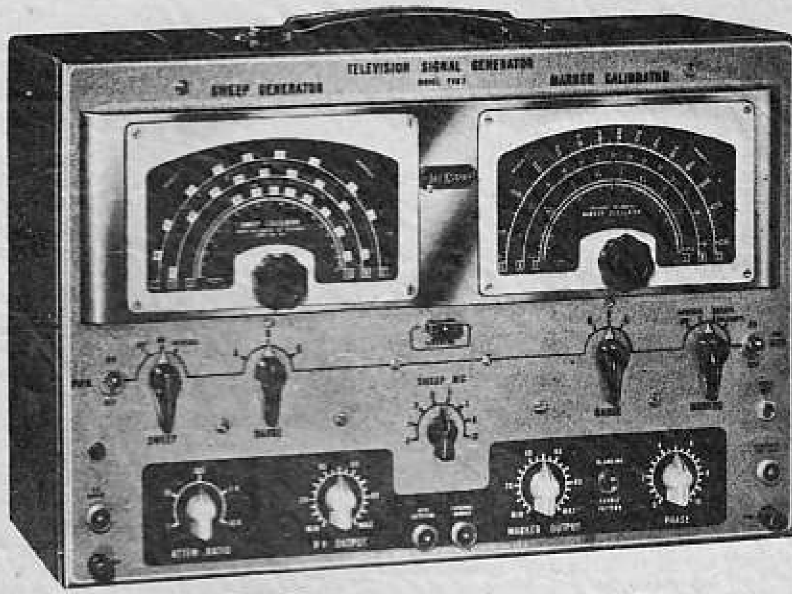


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