

SKYWIRE

THE CANADIAN RADIO AMATEURS' JOURNAL



April, 1951
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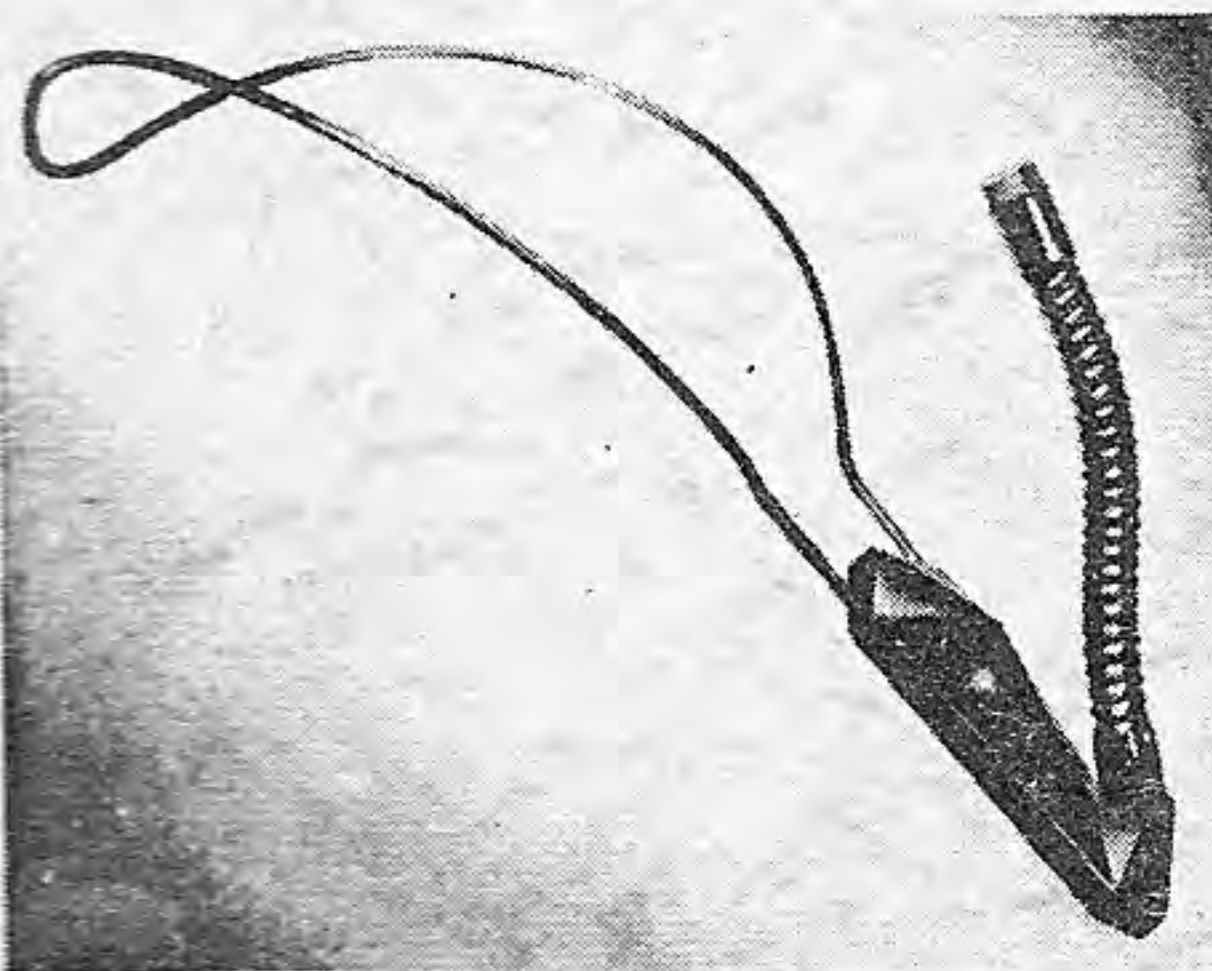
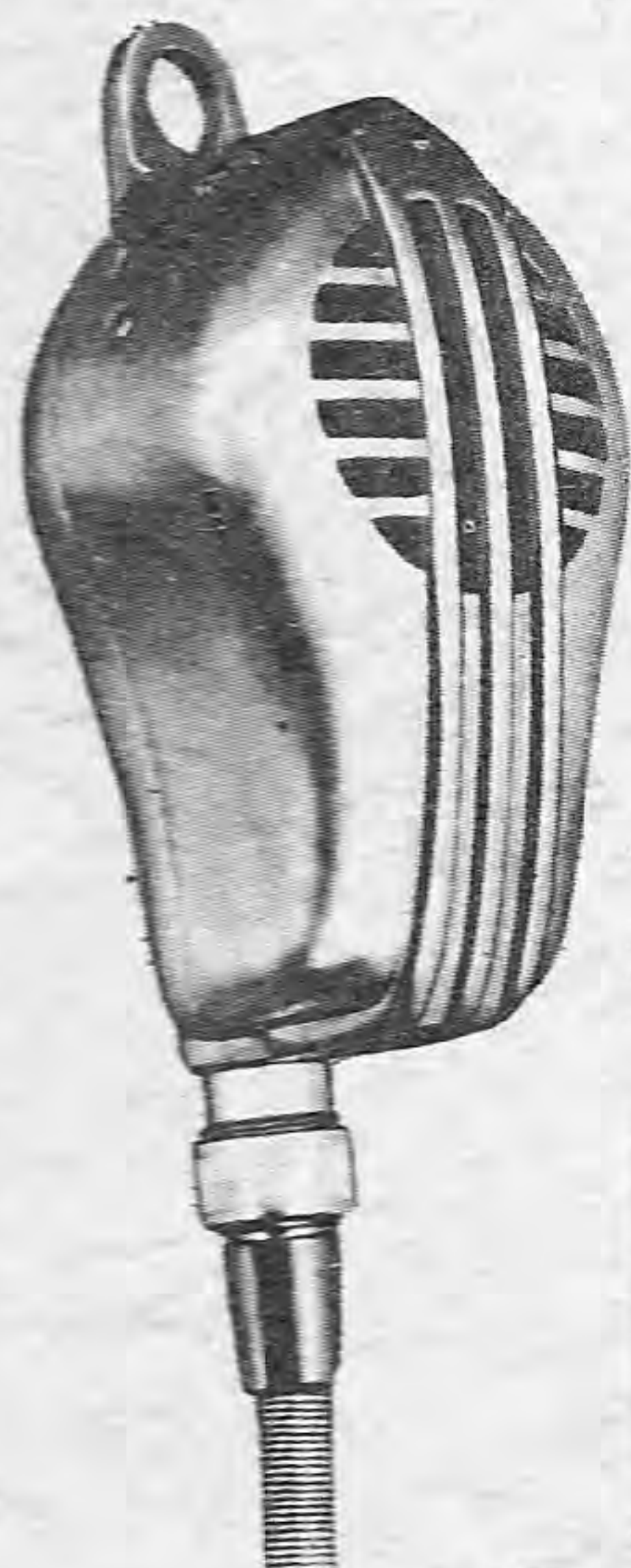
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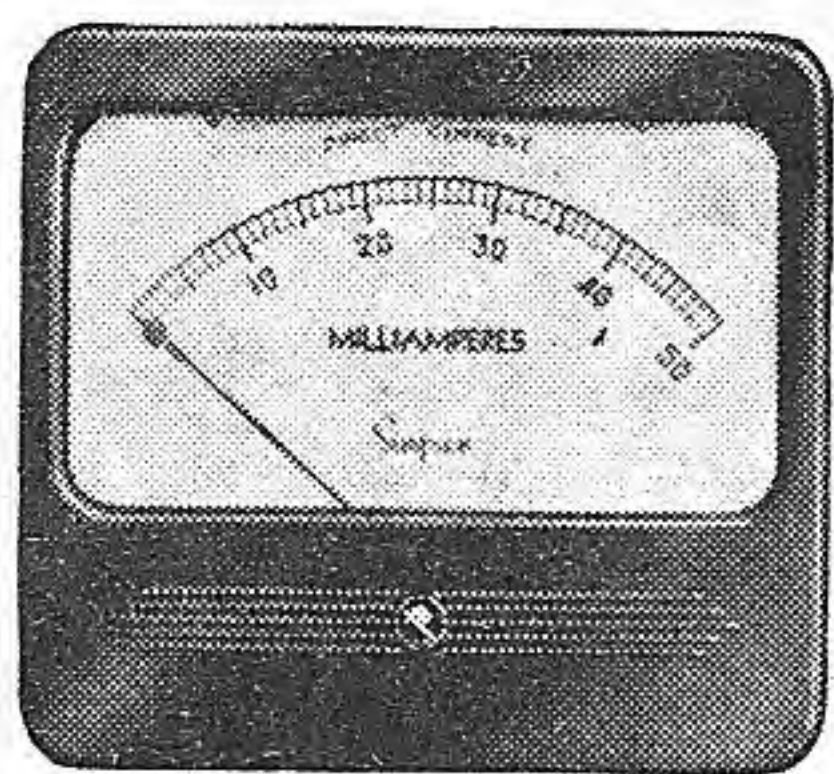
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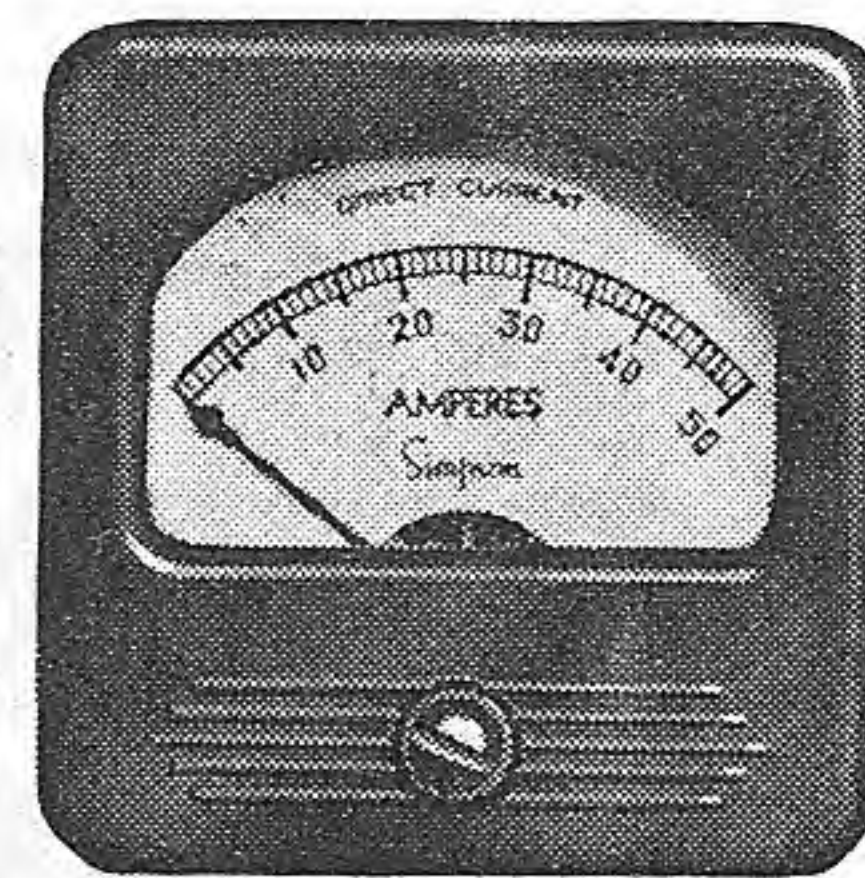
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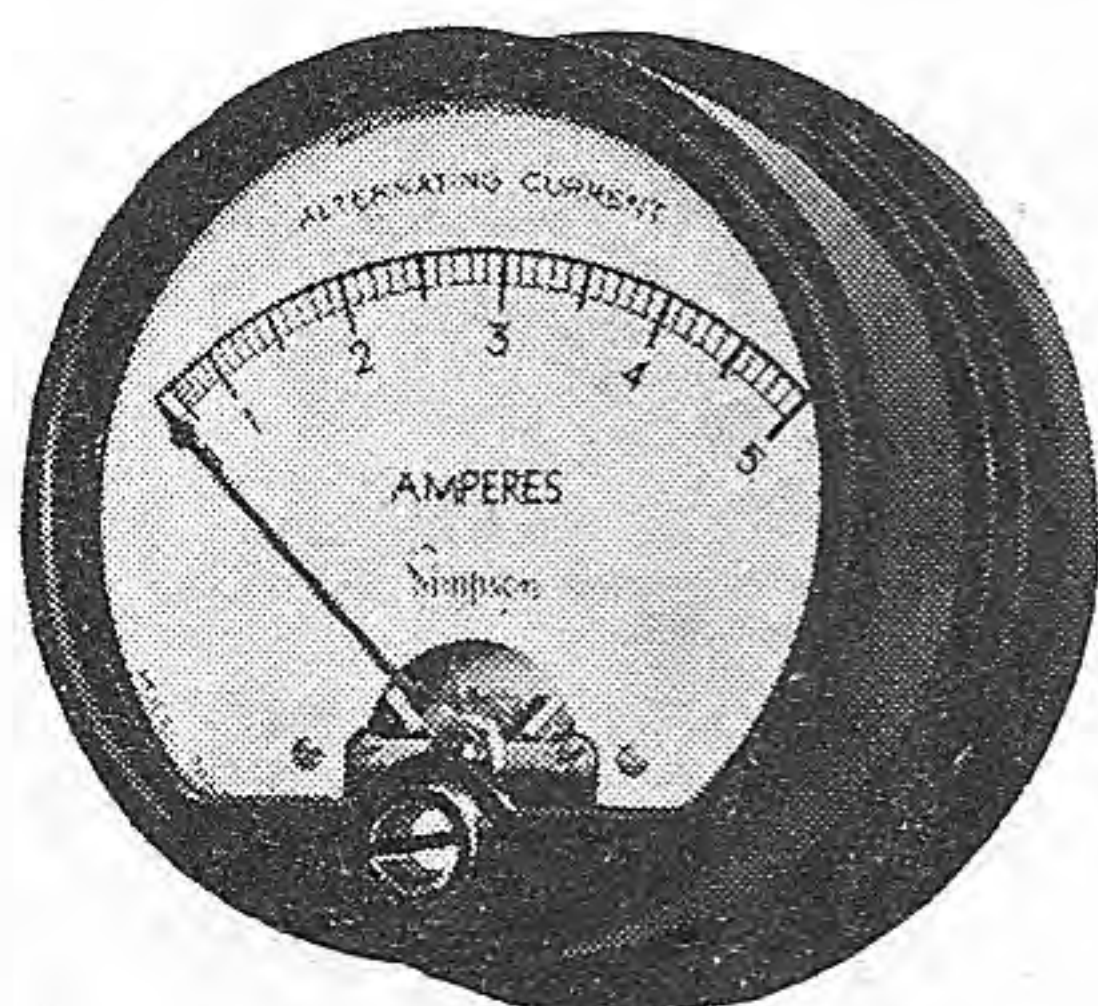


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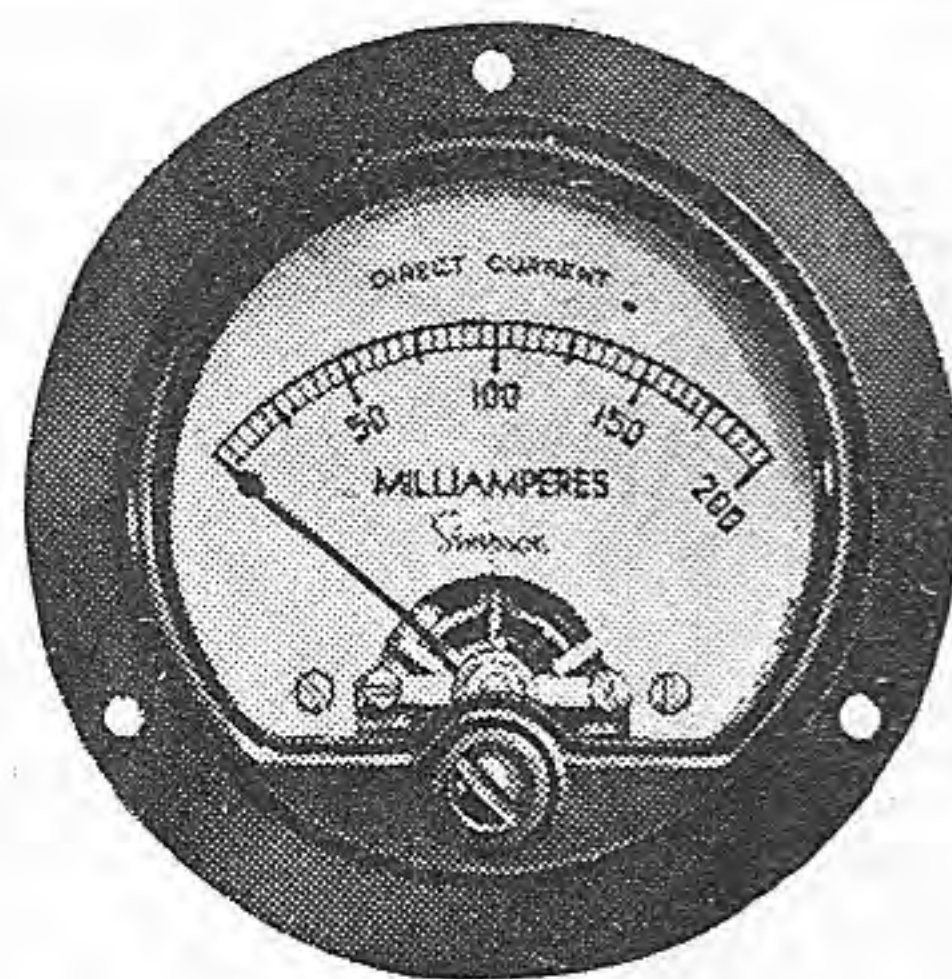
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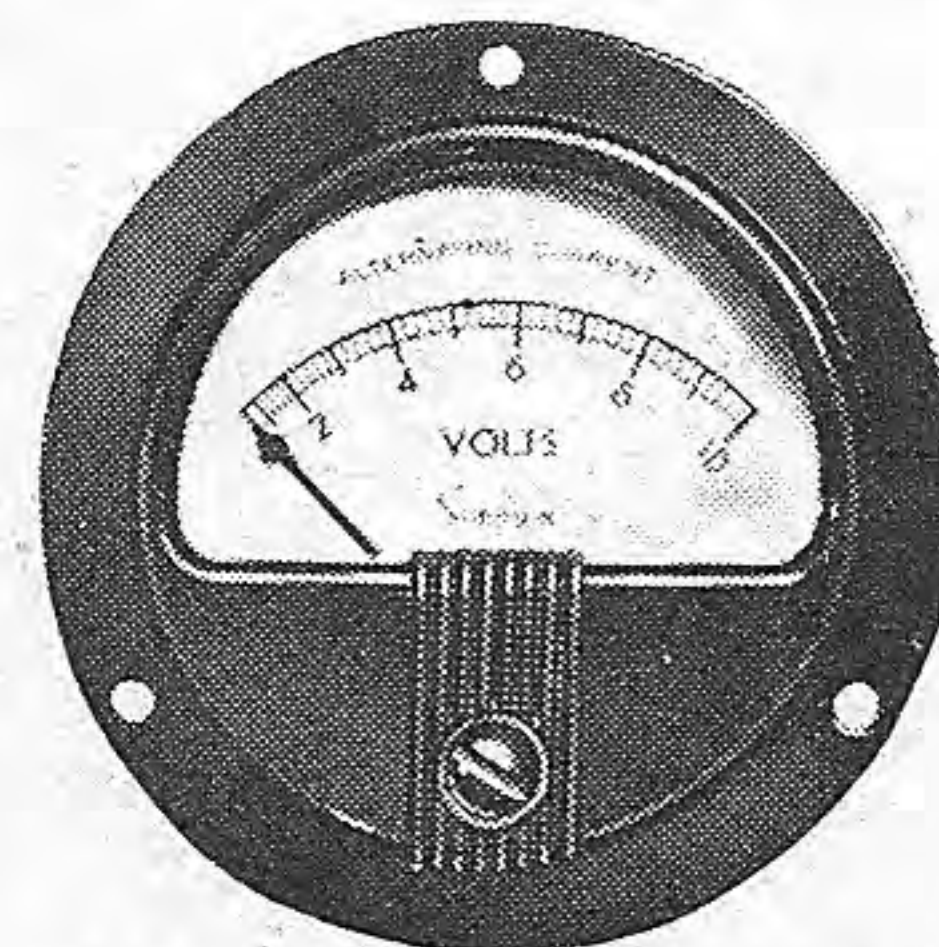
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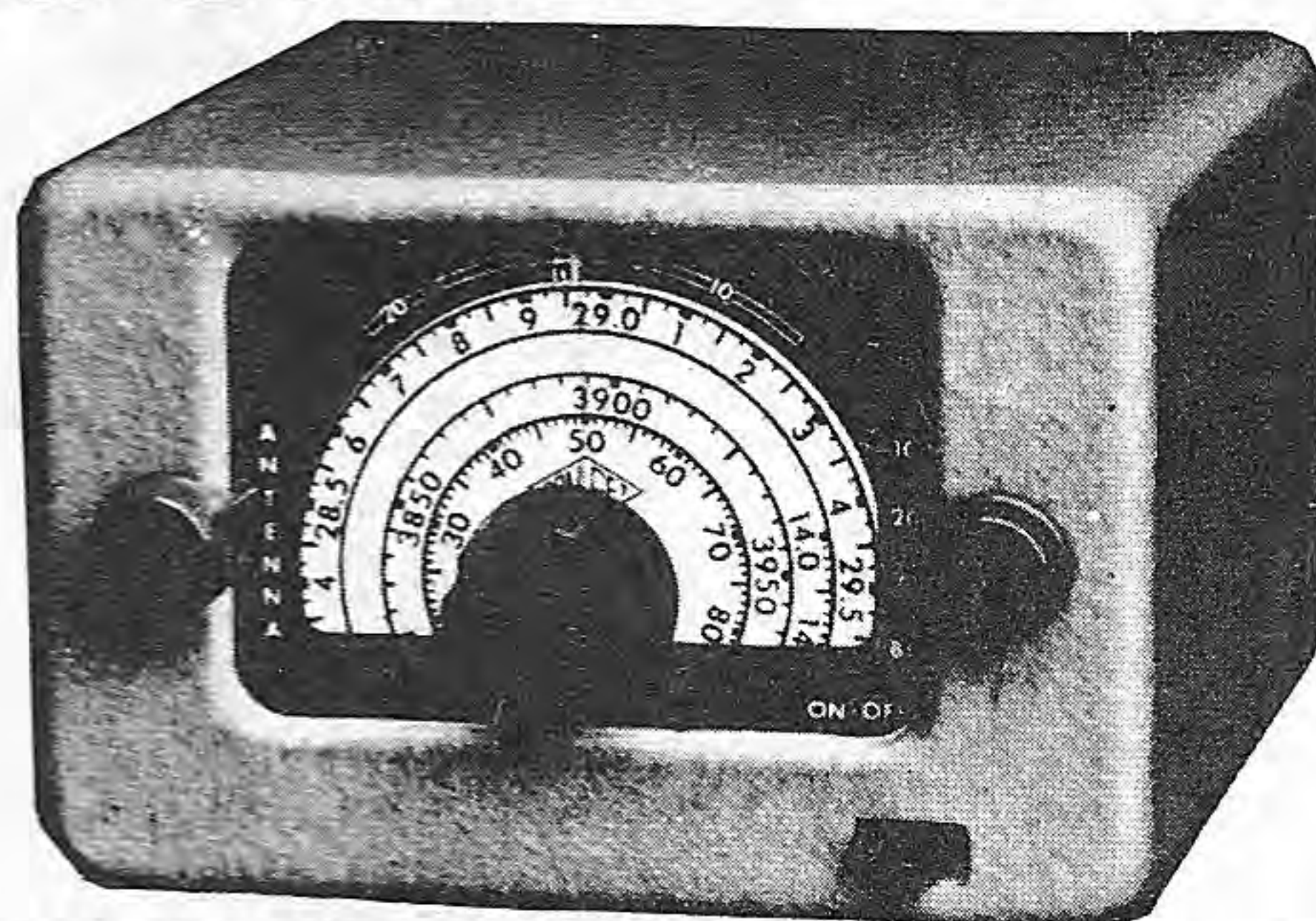
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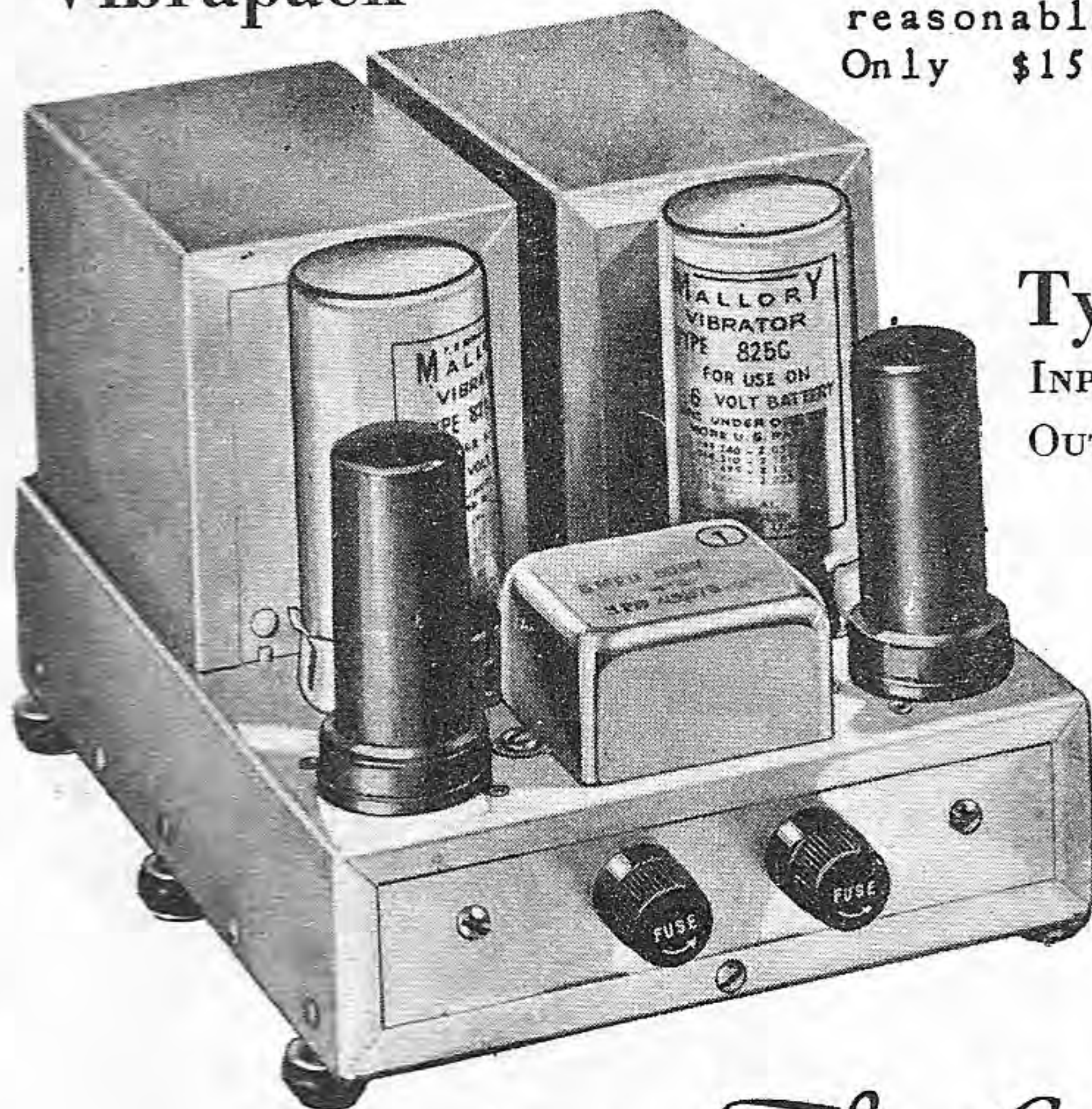
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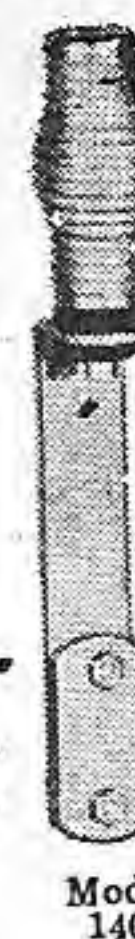
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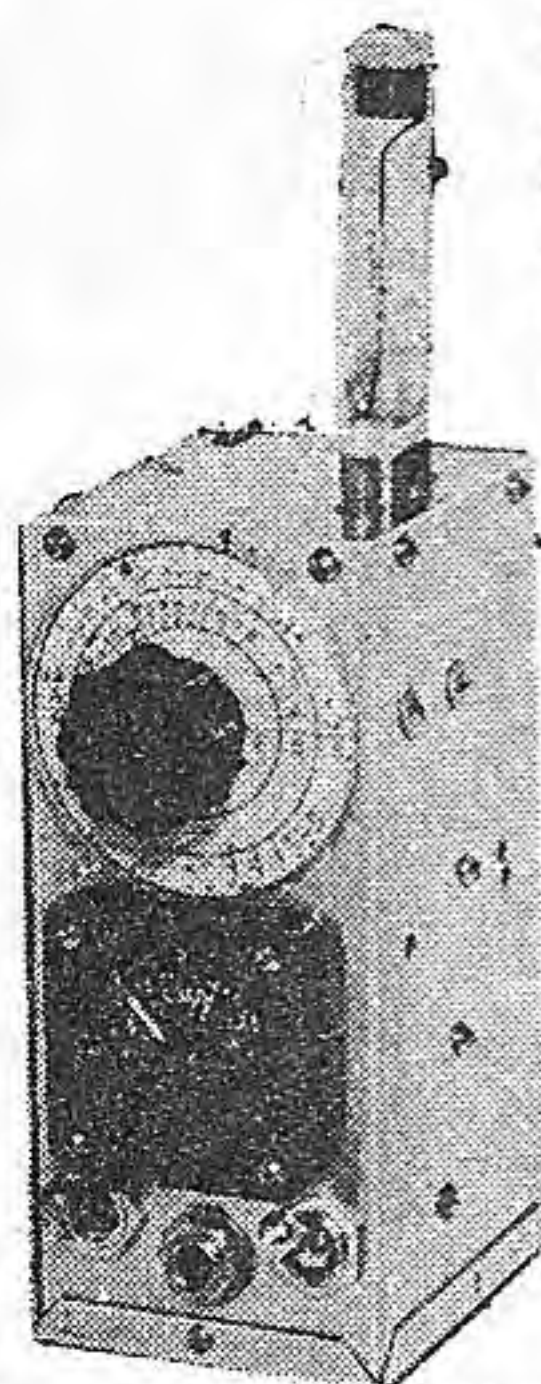


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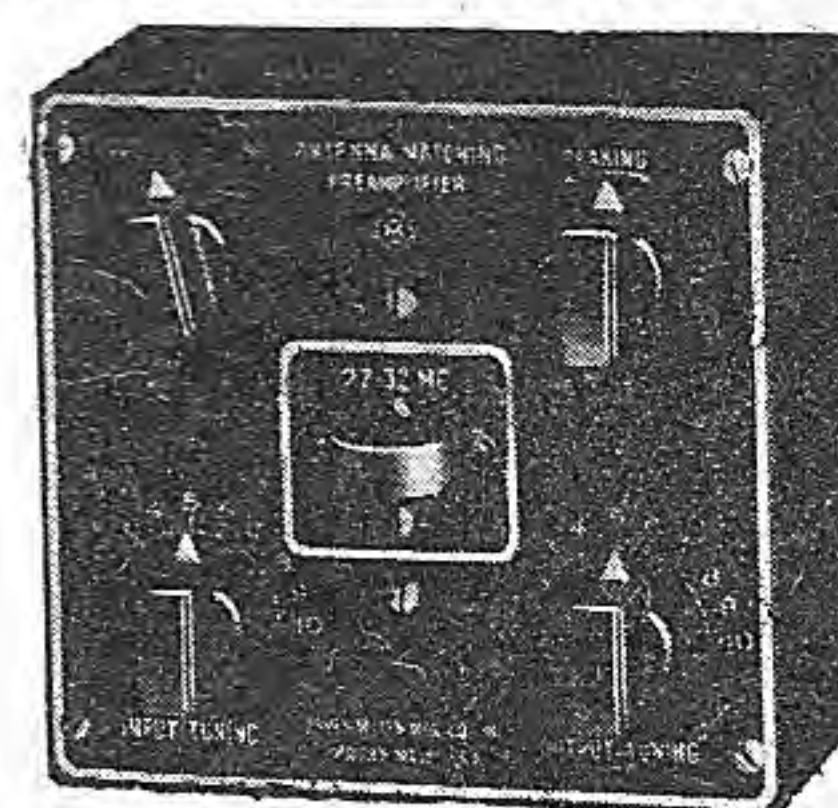
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Vol. 4

No. 4

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Editor - Fenwick Job, VE3WO

Table Of Contents

Sidebands	Fenwick Job, VE3WO	5
Technical Technique		
Short Wave Magazine		
Practical Single Sideband	J. Wood	6
New Approach To S-Meters	H.C. Woodhead	11
How's Ur OBS IQ?	A.R.R.L.	15
Skywire Hamads		16
DX Predictions	C.B. McKee	21
Lighthouse Larry	G.E. Monogram	22
DX QTH's		29
Television	Sylvania News	31

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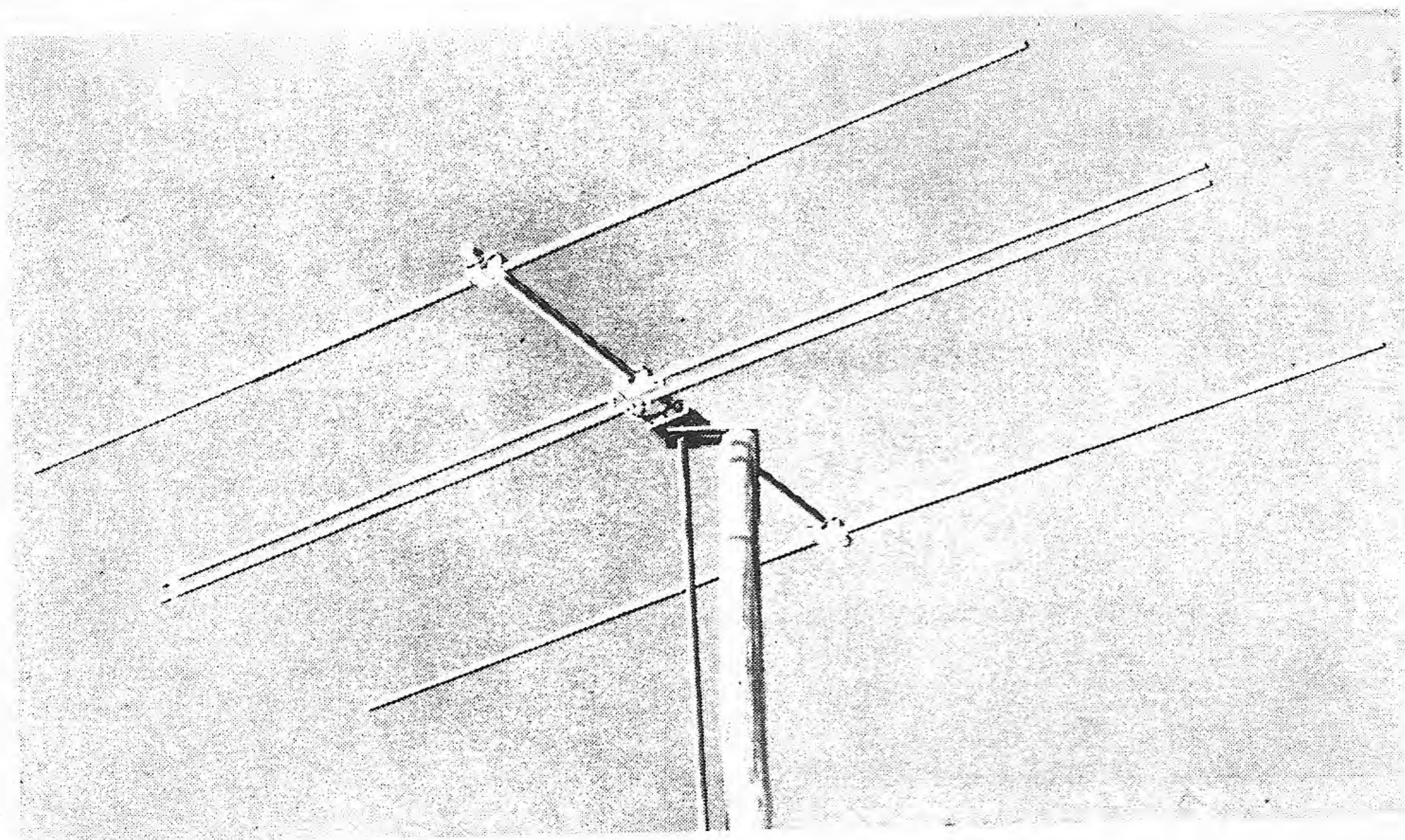
April, 1951

SKYWIRE BUSINESS AND EDITORIAL ADDRESS

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SIDEBANDS

Listening to 20 meters a few nights ago, something was brought forcibly home to me. And this was that the high cost of living is making itself felt in diverse ways. One of these was a thoughtlessly voiced complaint about the high cost of imported amateur equipment, here in the Dominion.

The plaintiff - a VE1 whose call is not nearly as important as his allegations, was moaning at great length and in some detail about how unfair these prices were. The unit in question - a fairly high priced piece of American gear - was naturally considerably higher in price in this country. All this ham could see was the U.S. price tag, and was unable to justify in his own mind, the disparity between this, and our own net. He even went so far as to state that he felt the jobbers were taking an unfair advantage of the Canadian amateur.

Nothing could be farther from the truth! And because this VE1 is not entirely alone in his thinking - others have said much the same thing - we would like the VE amateur to consider carefully the facts as they stand.

I don't intend going into a complete breakdown of how every cent of a price is arrived at by the Canadian jobber. There are, however, certain basic rules which everyone can comprehend and which, if you think it all over, make sense.

First of all, the Canadian jobber is in most cases, either ham-owned, or ham-staffed. As such, the company realizes just how much some of these prices of today can hurt. And they are constantly looking for some means of reducing them. Unfortunately, many of the heavy taxes remain unchangeable, and unless, as is sometimes the case, it is possible to change the tax category of the merchan-

dise to save a few percent, these taxes account for the greatest part of the price differential.

Don't forget, in the case of U.S. equipment, that the U.S. dollar is worth more than our own. At exchanges of five to ten percent, this means several dollars in every hundred that must be added. The cost of these dollars, when buying in the United States, must be added to the cost you pay for the equipment here. Unfair? You can't honestly say so, but that's one aspect you overlook.

Another is that all this material has to be cleared through Customs. Most jobbers can't spend long hours at Customs Warehouses, clearing shipments, so brokers who specialize in this work are employed to do it. They also have to eat, and a very small cost is added for this operation. And let's not overlook the Express costs for shipping goods from the manufacturer to the importer. Most small goods, and many large items are Expressed in to save the tremendous loss of time in freighting the same goods the same distance. If you weren't impatient - if you didn't expect your jobber to have exactly what you want the moment you want it, he might be able to save a bit on these charges too.

Perhaps you haven't realized that the manufacturers are faced with gray or black markets in components, and that prices must rise accordingly, whether they like it or not. Frequently those prices rise faster than advertising can advise you of the change, and jobbers take a smaller margin to hold the line.

No - the jobber here is frequently taking less than the justifiable profit in order to hold prices down. I KNOW the job he has done is remarkably good. He's making a living - not a million!!

Practical Single-Sideband Working

Application of S.S.S.C. Technique in Amateur Radio

By J. WOOD

THIS article is intended to amplify, from the point of view of amateur operation, the first notes on the subject by the writer in the June issue of the *Short Wave Magazine*.

The design of the drive unit to generate the system is of first importance in amateur suppressed carrier working. With the usual D.S.B. suppressed carrier system, no filters are necessary. The only requirement extra to a normal amateur system is a balanced modulator. A suitable design for amateur requirements is shown in Fig. 1.

In order to keep distortion to a minimum, the audio input to the grids of the balanced modulator should only be about a quarter of the carrier input, thus giving a lower modulation depth which considerably reduces distortion level. A high modulation depth is in any case not necessary because the carrier is ultimately cancelled out.

Suitable values of AF and RF drive to the balanced modulator valves are about $\frac{1}{2}$ -1 volt of audio and 2-4 volts of RF at the grids of the pentodes. Higher levels would result in slightly more drive with a higher distortion level.

The stage is balanced by means of adjustments to C1 and R1. To do this, RF only is applied to the balanced modulator and adjustments made until zero output is obtained in L1. If a complete balance is not possible, a fresh pair of valves should be substituted.

The output from the balanced modulator will not be sufficient to drive the transmitter, and a pair of 6V6's in push-pull can be employed as an amplifier. Little need be said about this as it is a conventional RF amplifier, and the output from the balanced modulator can be coupled to it

This article, following on our contributor's discussion of S.S.S.C. technique in the June issue, outlines single-sideband operation strictly from the point of view of its amateur application. It is the first such article to be published in this country, and will be the basis on which British amateur S.S.S.C. working will develop.—Ed.

by any usual method. It will be necessary to operate this further stage as a linear amplifier. Being a low-level stage, it can be operated in Class-A, which will ensure good linearity; the loss in efficiency is of little consequence. The level of the output need not be greater than 1 watt, this being sufficient to provide drive to the linear final amplifier.

Rather better operation will be obtained by the use of triodes for this B/M amplifier, particularly if careful attention is paid to neutralising. In any case, no grid current should be allowed to flow in this particular stage, and its anode circuit should be loaded as heavily as possible consistent with adequate output level. In the physical layout of the units of the whole SSSC transmitter, the aerial feeder must be kept well away from the early stages in order to eliminate the effects of "throw-in" and coupling back between output and input ends.

The Linear Output Stage

Almost any amateur transmitter could very quickly be converted to a linear amplifier and made to give results. However, in order to add success to the system it is desirable to redesign and partially rebuild the existing transmitter in order to accomplish good linearity with low distortion.

The design of a linear transmitter is
Skywire

dependent upon several factors acting together :

- (1) Choice of valves.
- (2) Correct bias.
- (3) Driving power.
- (4) Anode loads.
- (5) Interstage coupling.
- (6) Output coupling to aerial.

Triodes should always be employed wherever possible. The linear operation of tetrodes and pentodes is generally unsatisfactory—especially in drive stages where, owing to grid current in the succeeding stage, the triode or pentode, being a high impedance type, is presented with a varying anode load.

Bias

The linear stages are normally biased to "projected cut-off", *i.e.*, a figure slightly less than cut-off, or Class-B.

However, in practice, a figure can usually be found which gives better linearity than this. Distortion should be checked at both high and low level of speech input, since a low bias gives good distortion at low levels and bad distortion at high levels, and *vice versa*.

The grid-cathode resistance of the stages should be kept low and the bias voltage should not change by more than about 10 per cent. when the grid current varies from zero to maximum.

Driving Power

In order to preserve the linearity on peaks of modulation it is usual to provide about 50 per cent. more driving power than is normal for the stage. Resistors are fitted across the grids or anodes in order to help stabilise the grid impedance as a result of varying drive. These resistors dissipate about 25-50 per cent. of the driving power, and must be the non-inductive (carbon) type.

Anode Loads

The anode load of the drive stage is chosen to give the greatest linearity. Its value depends upon (a) valve impedance,

(b) drive level, and (c) step-down ratio of coupling.

A suitable value of anode load can often be determined from inspection of the valve characteristics, bearing in mind the available drive to the stage, the allowable anode dissipation and the drive required to the stage following.

Inter-stage Coupling

Inter-stage coupling is rather critical in linear RF amplifiers, owing to the need to minimise the effect of the grid current in the succeeding stage on the anode of the drive stage. To effect this it is usual to employ a type of coupling giving a step down in voltage. Three methods are shown in Fig. 2.

Method "A" is inductive coupling and the degree of step-down voltage is determined by the tapping points on the tank inductance of the driver stage. "B" is capacity coupling and the degree of step-down is governed by the reactance of C1 and C2. "C" is link coupling. This method will probably be preferred by most amateurs. The dimensions for, say, 7 mc could be two turns on the driver end and four turns on the grid inductance of the driven stage.

Aerial Coupling

It will be found in practice that best results—that is, lowest distortion compatible with good efficiency—are obtained when the coupling is adjusted rather more tightly than is required for best efficiency. The average efficiency of the final stage is not likely to be greater than 50 per cent. with a tone modulation with good distortion characteristics.

Measuring Distortion

Linearity is obtained when the amplitude of the modulated output wave is proportional to the grid drive. There are several methods of observing this :

- (1) By the use of an oscilloscope, observing the actual modulated wave-form.
- (2) Valve voltmeter, measuring peak

RF volts output as a function of grid volts drive. (It must be remembered that peak RF volts can be as high as 1.8 times the applied plate volts in a push-pull stage.)

An alternative method would be to make all the adjustments to the transmitter—drive, coupling, and so on, with modulation applied and monitor the signal simultaneously.

As the anode feed to each stage is a

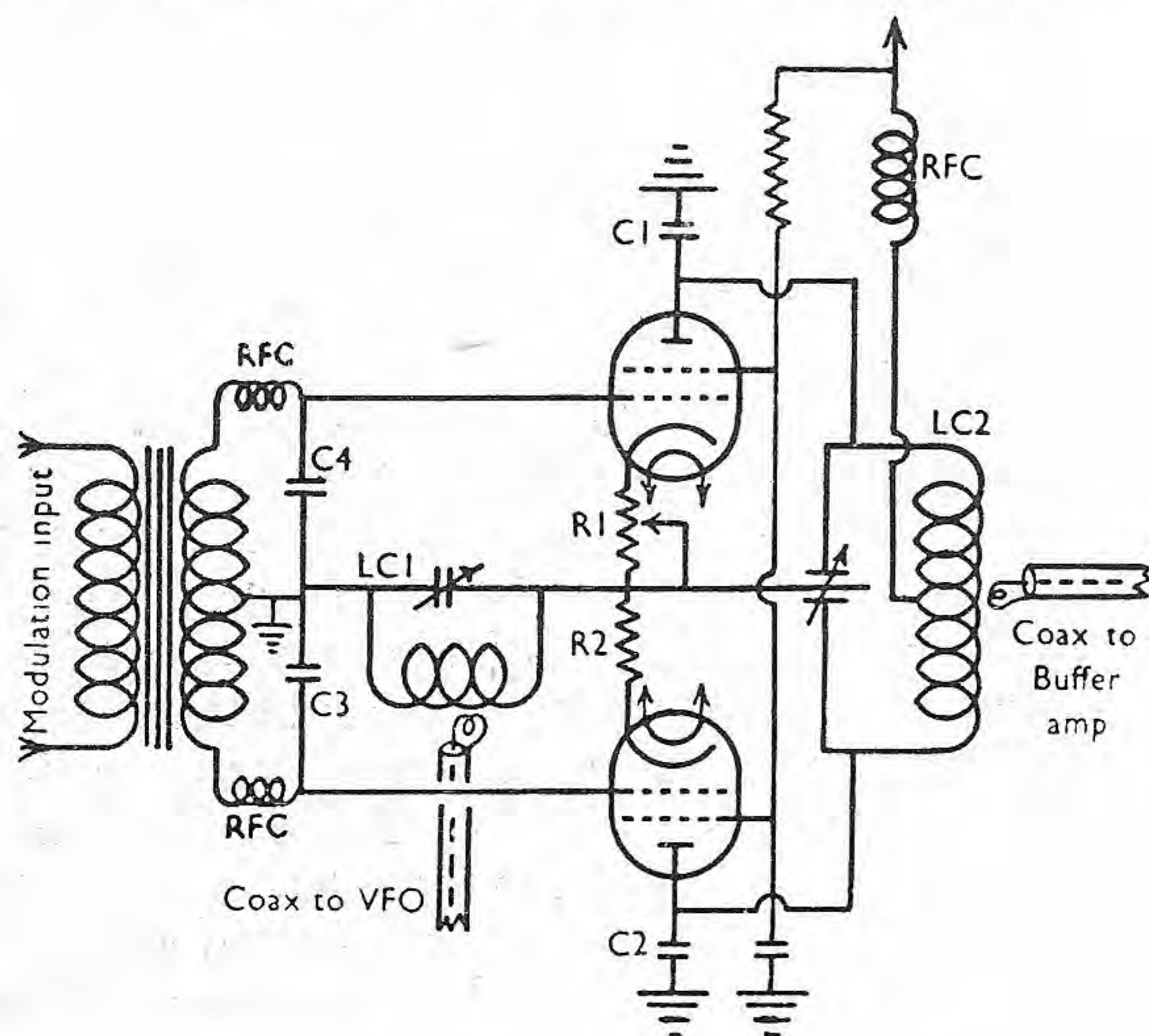


Fig. 1. Circuit of the Balanced Modulator—values as in in the table below. (*C1 above should be shown variable.*)

Table of Values

Fig. 1. Balanced Modulator Unit

C1	= 30 $\mu\mu\text{F}$
C2	= 15 $\mu\mu\text{F}$
C3, C4	= .01 μF mica, non-inductive
LC1	= Tuned to carrier frequency
LC2	= Tuned to carrier frequency
R2	= Determined by experiment

function of the modulation level, it is necessary to ensure that the HT supply regulation is good. The use of mercury-vapour rectifiers, with choke input filters having the lowest possible inductance consistent with adequate smoothing will be found the most effective.

Adjustment for Operation

Lining up a Suppressed Carrier Transmitter can be rather complex, but if it is done in the following order it will reduce possible snags to a minimum.

After the balanced modulator has been tested it should be connected to the linear amplifier by means of coaxial cable. HT can be applied to the balanced modulator and transmitter stages. The steps are :

- (1) Modulation input to the balanced modulator is switched off and the only drive into the balanced modulator is the carrier RF from the VFO. The balanced modulator stage is then thrown into a state of *unbalance* by altering the balancing condenser and bias resistor tapping. This allows the carrier to appear in the output of the balanced modulator, thus providing drive to the transmitter. The transmitter stages can then be lined up on this.
- (2) Now re-set the balanced modulator stage by restoring the correct settings of C and R. These can be found by repeated adjustments until no carrier output appears.
- (3) Apply modulation input to the balanced modulator. It is preferable to use a tone signal from an AF oscillator for initial line-up. Adjust the level of the audio input to the balanced modulator until the transmitter is driven to the proper output.
- (4) Check distortion on transmitter monitoring continuously and make repeated adjustments to drive level, bias, inter-stage coupling and aerial output coupling for lowest distortion.
- (5) Take tone modulation off and apply speech input to balanced modulator.

Care must be taken to ensure that the speech level on peaks does not exceed the level predetermined by the tone input tests, otherwise the transmitter will be over-driven and high plate current and distortion will result.

A recommended method is to utilise the VFO driving the S.C. transmitter. The VFO can be loosely coupled to the receiver by means of a single-turn loop and coaxial, or by mounting a short rod aerial upon the VFO. In practice the amount of pick-up necessary for carrier re-insertion can be ascertained by experiment for average value and the loop coupling or rod aerial fixed at that.

It must be remembered that the success obtained in suppressed carrier working depends entirely on the frequency of the re-inserted carrier respective to that of the original (See note) and a VFO of good frequency stability is essential. The Frequency Meter BC-221, which is used by a good many amateurs, would be excellent. It provides a high degree of stability correct to ± 0.05 per cent., and is temperature compensated. There is also a short rod aerial mounting.

This instrument may not give sufficient output to drive into the balanced modulator of the transmitter, but a small amplifier stage could always be added to it.

Practical SSSC Operation

The question which will obviously arise is "How can suppressed carrier working ever be successfully applied to amateur operation since one has to re-insert the carrier at the correct frequency to make the signal intelligible?"

A block diagram of a suggested operating system under amateur conditions is shown in Fig. 3. It will be noted that a common oscillator for carrier suppression and re-insertion is employed. The following notes, with the aid of Fig. 3, explain the working.

Assume station "A" is calling CQ on, say, 7100 kc. Station "B" looking round the band hears the unintelligible signal of "A" and moves his VFO up to the frequency indicated on his receiver, *i.e.*, 7100 kc. This VFO then provides the re-inserted carrier and the signal is demodulated normally.

On station "A" going over, "B" calls

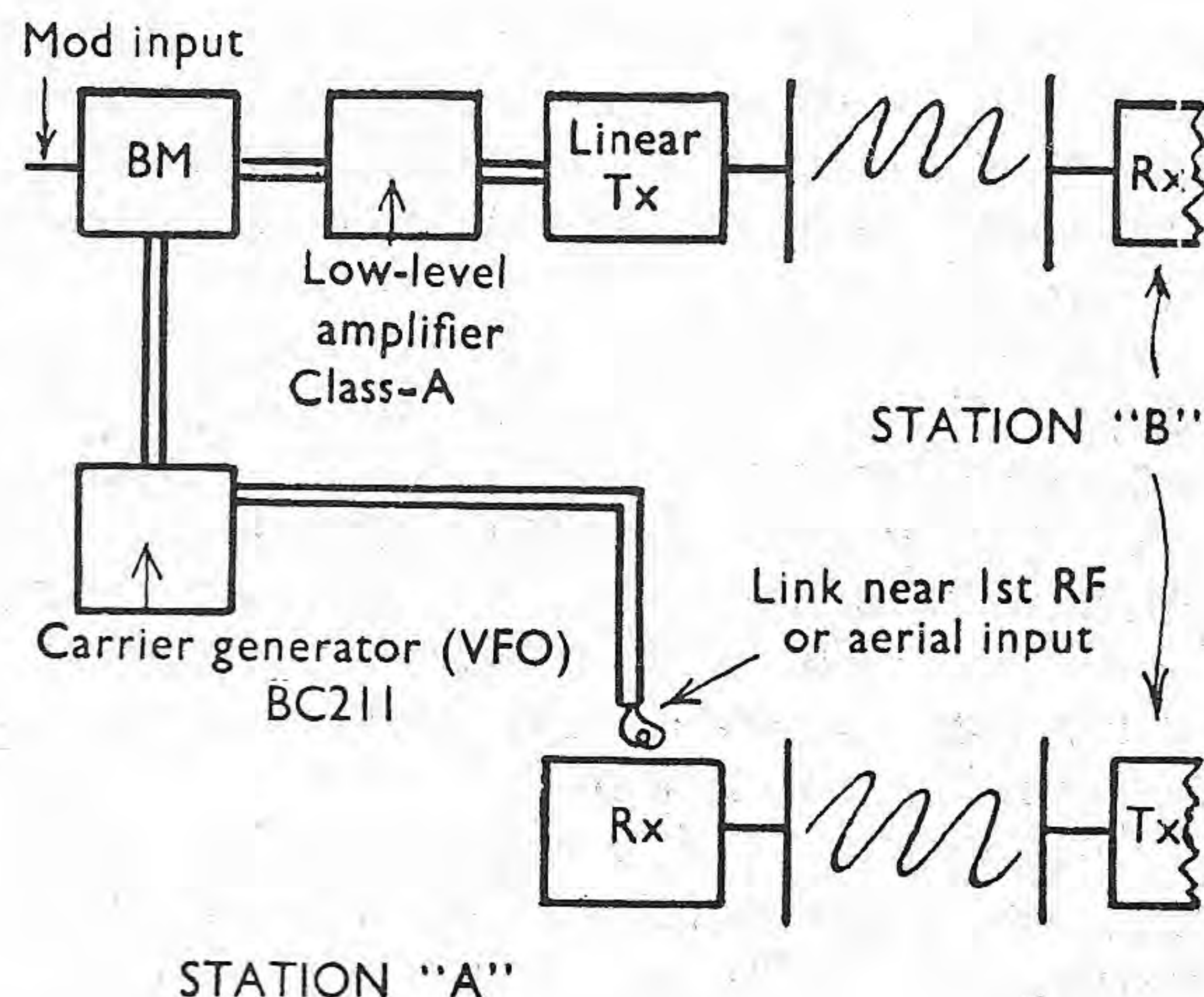


Fig. 3. Block schematic showing operating system in amateur SSSC working. Basically, the Tx VFO is used to provide carrier re-insertion on the receiver side, in the case of stations tuned to the same operating frequency.

him on suppressed carrier on the same frequency, 7100 kc, since the VFO is common to the transmitter also. Station "B" will automatically hear "A" replying if he moves his receiver frequency to that indicated on his VFO 7100 kc, and a normal QSO should result.

Conclusion

In conclusion, it should be stated that the reception of suppressed carrier signals in commercial practice entails the use of receiving equipment employing highly complex circuits involving automatic frequency control, automatic gain control, limiters and filters. Even then this does not guarantee a 100 per cent "circuit" against the effect of very severe multi-path and selective fading, and adjacent channel interference.

The design of such equipment is probably rather beyond the scope of amateurs at this stage in the development of SSSC working and the notes on suppressed carrier reception outlined earlier in this text are suggestions which, in the writer's opinion, are likely to be most suitable and convenient for amateur purposes.

shown in Fig. 3. It will be noted that a common oscillator for carrier suppression and re-insertion is employed. The following notes, with the aid of Fig. 3, explain the working.

Assume station "A" is calling CQ on, say, 7100 kc. Station "B" looking round the band hears the unintelligible signal of "A" and moves his VFO up to the frequency indicated on his receiver, i.e., 7100 kc. This VFO then provides the re-inserted carrier and the signal is demodulated normally.

On station "A" going over, "B" calls him on suppressed carrier on the same frequency, 7100 kc, since the VFO is common to the transmitter also. Station "B" will automatically hear "A" replying if he moves his receiver frequency to that indicated on his VFO 7100 kc, and a normal QSO should result.

In conclusion, it should be stated that the reception of suppressed carrier signals in commercial practice entails the use of receiving equipment employing highly com-

plex circuits involving automatic frequency control, automatic gain control, limiters and filters. Even then this does not guarantee a 100 per cent "circuit" against the effect of very severe multi-path and selective fading, and adjacent channel interference.

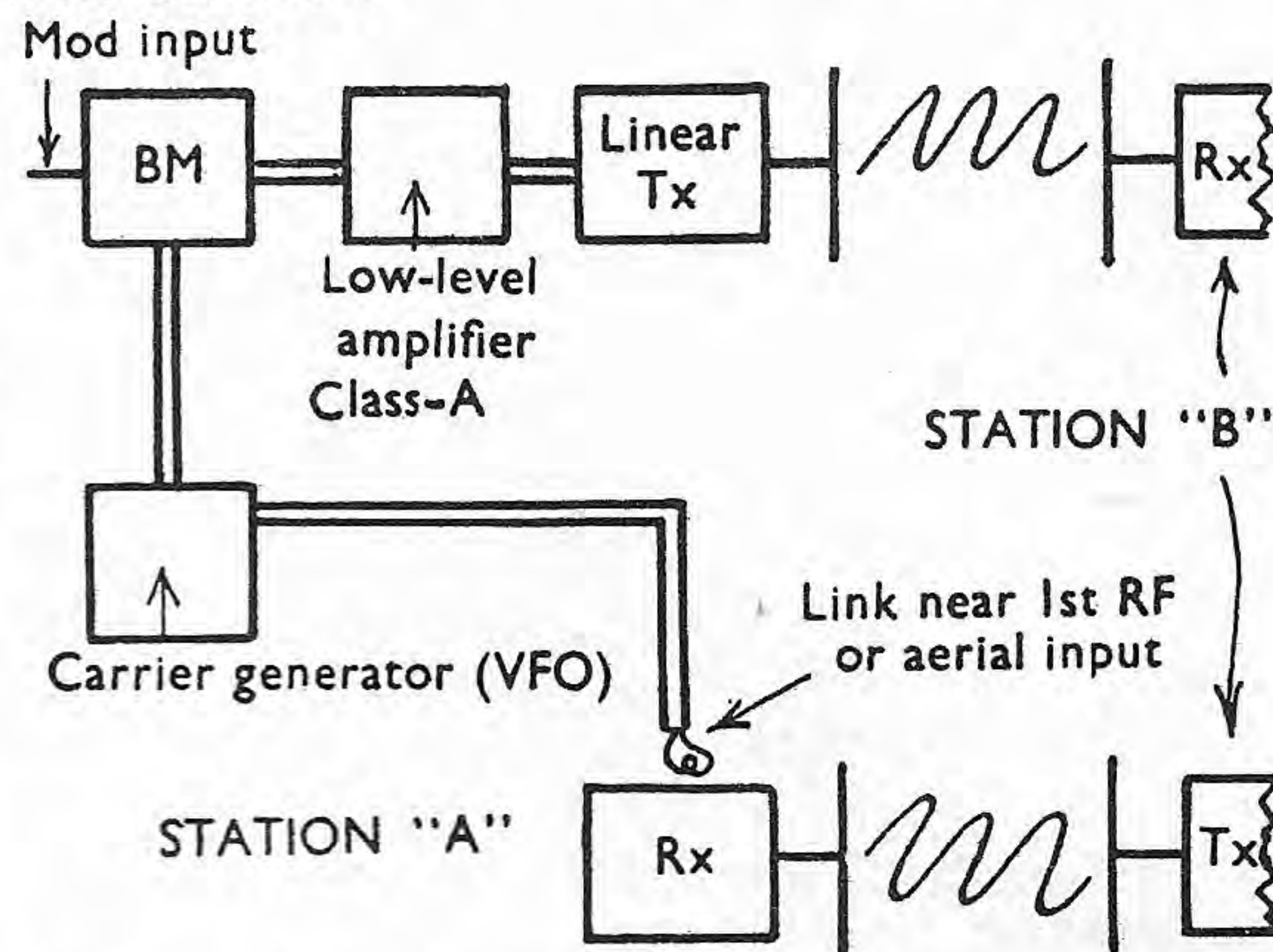


Fig. 3. Block schematic showing operating system in amateur SSSC working. Basically, the Tx VFO is used to provide carrier re-insertion on the receiver side, in the case of stations tuned to the same operating frequency.

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NEW APPROACH TO S-METERS

Measuring Signal Level Against Local Noise

By H. C. WOODHEAD

THE measurement of signal strength, as far as amateur transmission is concerned, is a matter that must appear to many to be far from satisfactory. That this is the case is evident from the discussion that goes on about it. The "R" code (or should it be the "S" code?) is almost universally employed in amateur telephony working, though from the fact that some of the more conscientious operators feel constrained to prefix their report with, "According to my S-Meter . . .", there are obviously some doubts about the reliability of the system.

How many workers in the amateur field have complete confidence in the value of the reports they give? Presumably a number based on a logarithmic scale is more satisfactory from a technical point of view than a report giving the signals as "twice as loud as the man from next door but one." It certainly gives some idea of the condition in which the signal is being received, particularly if details of QRM and QSB are also taken into account, but it still leaves a great deal unspecified. For instance, an S5 signal on one receiver may quite well be an S9 on another, so presumably one should specify the type of receiver in use. Again, if a standard "all-band" receiver is lined up very carefully for best performance on the amateur bands the result will certainly be increased signal strength, as recorded, on some bands since the line up of the "all-band" receiver is usually something of a compromise. It is also necessary sometimes to narrow the reception band, to avoid QRM, to the point of switching in the crystal filter and since this arrangement usually introduces additional loss of gain in the receiver *before the point in the circuit where the S-Meter is recording signal strength*, the result is a reduction in the meter reading.

Ever since the S-meter appeared on the amateur horizon, its proper use has been the subject of heated controversy. As now fitted in any amateur band receiver, the S-meter has but one practical application—it can be used to give comparative signal levels only, as when carrying out tests with another station under stable conditions. As this article shows, any other sort of report given on the basis of S-meter readings is valueless. But if the S-meter could be used to indicate "signal level in comparison with local noise and interference," then the receiving operator is being given some useful information. Our contributor discusses the problem in detail from this angle.—Editor.

Variations due to the Receiver

It often occurs that the performance of a set varies from one end of the scale to the other and where there is an overlap in the scales it may be found that S9 + 10dB on the top of one may only be S7 on the bottom of the other.

So we see that if it is to be of any real value at all the report should specify all these conditions of working and might appear somewhat as follows :—

"Signal S8 on an Z-Type receiver used on Range 3 set to a bandwidth of 1,500 cycles, which is badly in need of alignment and may be presumed to give a somewhat pessimistic figure." To be consistent the report should go on to describe the type of aerial, its height, the height above sea level of the site itself, possibly the configuration of the local terrain and maybe even details of geological formations in the neighbourhood. By the time such a report is finished the operator at the other end might be pardoned for coming back to enquire "the engine-driver's name."

Perhaps it might be better to give every readable station an innocuous R4 and S8 and let it go at that ! It would be nearly as valuable as anything else we could say on these lines.

On the other hand it might be worth while to examine the commercial practice of assessing the signal in terms of signal-to-noise ratio to see whether that system could usefully be adapted to amateur working. There are, of course, difficulties in the way and not the least of these is devising some means of measuring the ratio. In the commercial field

this can be done quite easily by measuring, at audio frequency, the receiver output with either speech or, better still, standard line-up tone and comparing it on the meter scale (calibrated in dB) with the residual noise level when the transmitter microphone is silent. Note that the carrier is still on in this latter condition and holding back the AVC. This noise will be made up of ether noise, QRM, hum on transmitter carrier and perhaps even receiver first-circuit noise if the signal is weak.

Special Difficulties in Amateur Working

Such an arrangement would no doubt be quite satisfactory on some bands at some times in the day, for example the 80-metre band at its best; but it would be quite useless for operation on the 20-metre band at its worst. The reason is not difficult to see if we consider for a minute the make-up of noise as outlined briefly above. The commercial station is not usually worried much with QRM. It has its own assigned frequency and if QRM is experienced then one of the two stations concerned is on its wrong frequency.

In amateur operation, however, as we know only too well, this is far from being the case. QRM is the rule rather than the exception and its level is likely to be greater than all the other noises put together and even more, at times, than the signal itself. Since it forms the main part of the noise and is also so variable it is no use whatever adopting it as a basis of comparison with the signal. A "signal-to-QRM ratio" might be +30 dB one minute and -20 dB the next. That is to say, the signal 30 dB louder than the QRM one minute and the QRM 20 dB louder than the signal the next.

One way of overcoming the difficulty would be to relate everything in the way of a signal to the inherent noise on the band in the absence of any signal and make the measurement at RF, so that we do not distinguish in our measurement between modulated and unmodulated carrier, nor do we take any account of percentage modulation. The method employs a meter to read the anode currents of the auto-controlled RF and IF stages which is a measure of the AVC voltage developed, which is in turn a measure of the magnitude of the signal

being received. This is obviously not the same as the AF method in commercial use, for any noise coming from the transmitter itself (such for example as hum on carrier), would not be indicated; whereas in the AF measurement carrier hum would result in a low signal-to-noise ratio. Similarly, in the AF method a 50 per cent. modulated transmitter would have a lower S/N ratio than if it were modulated 100 per cent. Nevertheless, we shall be making a useful comparison between the level of received carrier and the basic radio noise.

There is no doubt that the AF method is the more desirable one to adopt because it does give the level of the effective signal (speech) in terms of background interference, whereas the RF method only approximates to this, ignoring the effect of carrier noise and percentage modulation. In spite of its shortcomings, however, the RF measurement is probably more suitable for assessing the strength of amateur telephony signals just because the extremely variable nature of the background noise in a crowded amateur band does not provide any fixed basis for comparison by the AF method.

Telegraph Working

In the case of CW the conditions are much the same, except that the two methods are more likely to give the same results since percentage

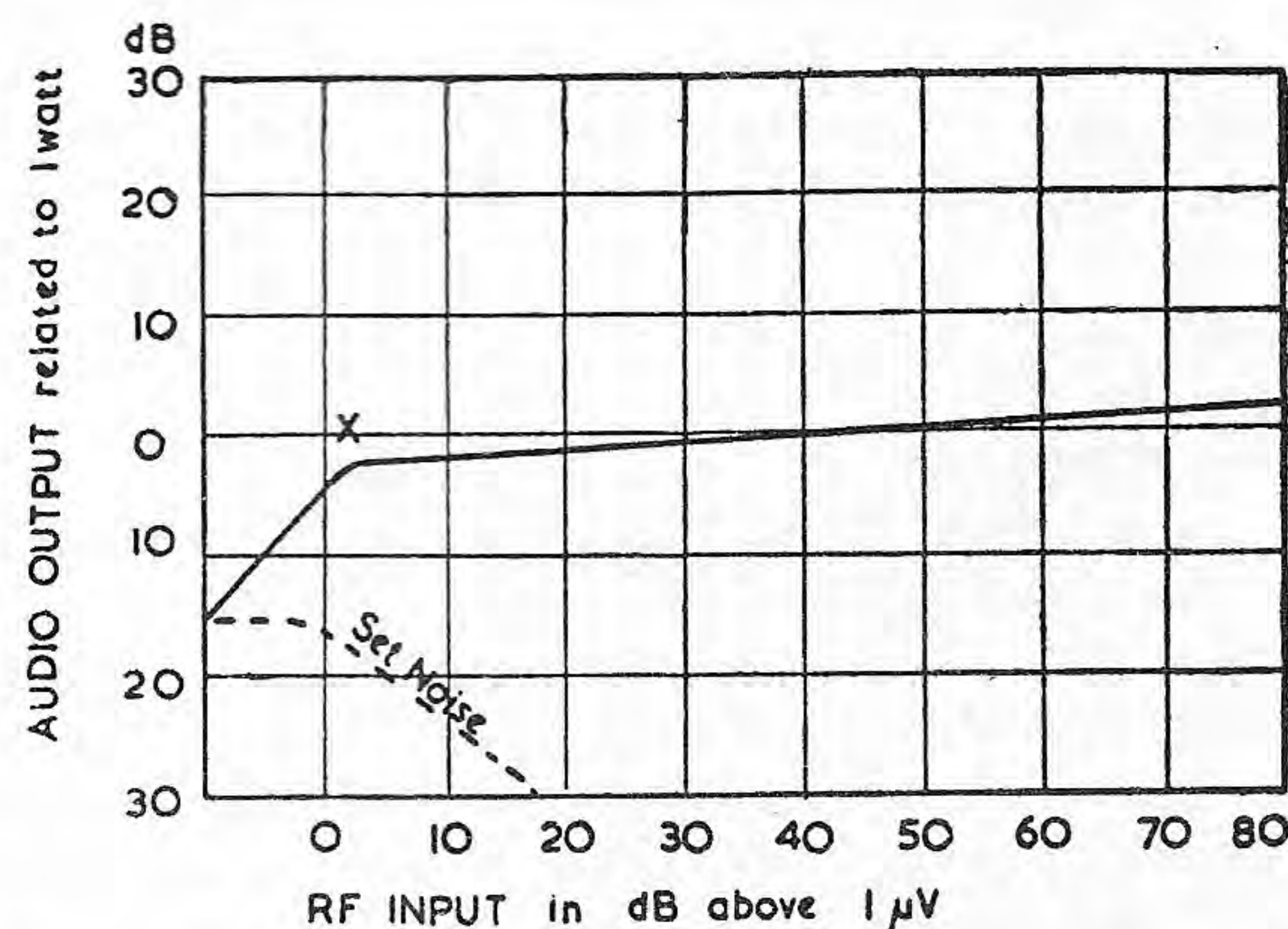


Fig. 1. The AVC characteristic of a typical communications-type receiver. The S-meter is operative only above point X, and will not register on incoming noise if it is below this value.

modulation and carrier hum are no longer factors which affect the measurement.

At this stage someone is sure to remark that all this is quite obvious and is the reason that most receivers are fitted with a suitable S-meter. But is that the same thing? The S-meter, as we have seen earlier, can give results which may differ widely from one receiver to another and though it has some relation to the magnitude of the received signal, its meaning is by no means precise. Some writers say one S-point should equal 3 dB and others that it should be 6 dB. Nothing is laid down and the designer is free to choose as he thinks fit. A dB is, however, always a dB and we know that it means a ratio of 1.26 to 1.

One practical solution in many cases would be to retain the existing S-meter but to recalibrate it in terms of dB which really do mean something. This will not be entirely sufficient for if we are to give the signal report in terms of its S/N ratio we must first measure the noise. If certain precautions are taken we should be able to get a reading for radio noise on our dB meter and this could serve as a basis for our report.

Measuring Signal-to-Noise Ratio

The procedure then would be something like this: The receiver is first tuned to the quietest part of the band, or even outside the band, where only general noise is heard and the meter reads minimum, let us say 10 dB. Suppose we now tune in a signal which gives a steady reading of perhaps 65 dB; the report is obviously "S/N ratio 55 dB." If the signal happens not to be steady but varying in a regular manner between 60 dB and 35 dB, the report will be "S/N 50dB with —25 dB QSB." Supposing again that the noise is high, as much as 30 dB on the quietest part of the band, and the wanted signal is varying between 45 dB and 30 dB (the noise reading), then the report will be "S/N 15 dB with —15 dB QSB." That is to say a margin of only 15 dB at the best of times fading right down into the noise level.

It may be that the noise reads 20 dB and the signal a steady 50 dB until another signal comes up on the same frequency, not loud enough to spoil the transmission but keeping the meter

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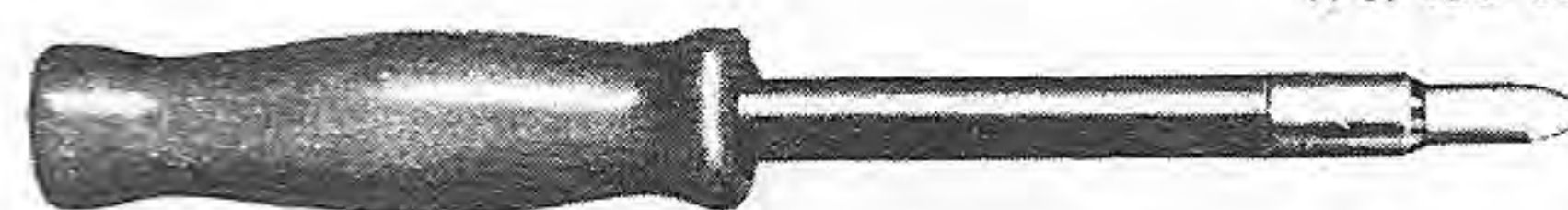
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up to 35 dB when the wanted transmission switches off at the end. The report will be "S/N 30 dB, QRM/Noise + 15 dB," from which it is to be inferred that there is a workable margin of 15 dB between the wanted signal and the QRM. If a local transmitter should come up right on the wanted transmission, completely blotting it out and kicking the meter up to 80 dB (which Heaven forbid), the report would be "S/N 30 dB and Sig/QRM -30 dB."

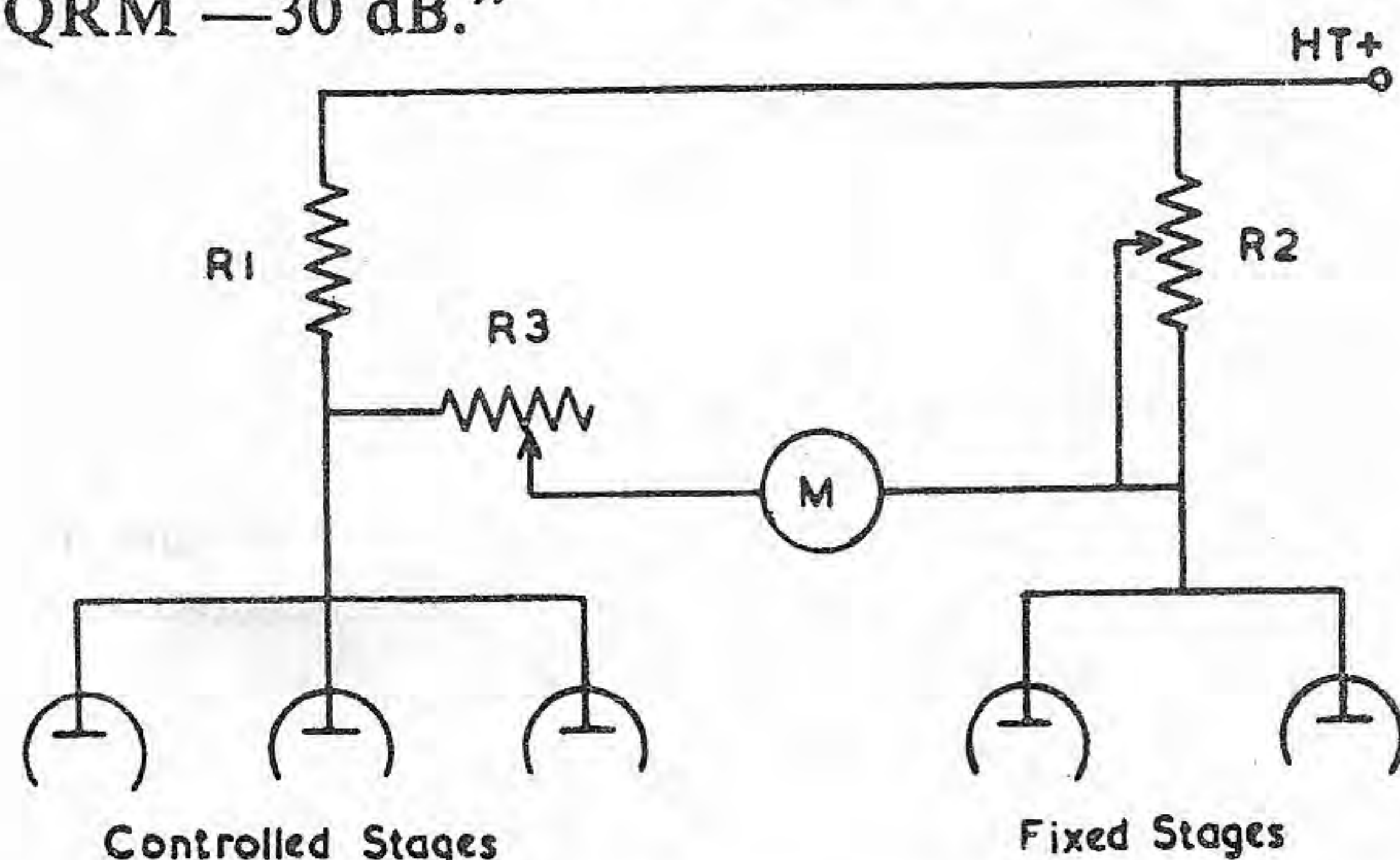


Fig. 2. Usual circuit arrangement for the S-meter connection. For the purpose discussed in the text, R1 should be 100 ohms; R2 more than sufficient to reduce the meter reading to zero; and R3 will depend on the meter range and the number of controlled stages. An instrument reading 0-5 mA or less is suitable for M.

Calibrating the Meter

The calibration of the S-meter in terms of dB is fairly simple if a signal generator calibrated in dB level is available or if an HF attenuator can be employed in conjunction with an uncalibrated oscillator. It can be carried out on a low frequency range as it is unaffected by the range setting because it is a calibration of the AVC characteristic (Fig. 1) in terms of the meter scale reading and is not an absolute measure of signal level.

An example is shown in Fig. 3b compared with the more usual form of S-meter scale

shown in Fig. 3a. A new scale may be made for an existing meter by drawing it out very carefully with a drawing pen (not a mapping pen) and indian ink on a sheet of good quality, fine-grained paper, and fixing it over the existing scale with Bostic cement. Great care should be taken with the selection of the paper, as some papers have very fine fibres on the surface, particularly if they have been treated with an india-rubber, which are liable to obstruct the movement of the pointer. If care is taken the finished scale can have quite a professional finish.

It may be arranged in certain circumstances (perhaps in the design of a home constructed set or in the use of a convertor in front of the normal receiver), to retain manual control of the first RF stage so as to permit independent adjustment of the maximum overall gain of the set to give a fixed reading for the noise level, and the meter will then not carry the anode current for this stage. If this is done the meter scale can be arranged as shown in Fig. 3c, and it will then read the S/N ratio directly. It will, of course, be necessary to check the noise setting from time to time by adjusting the gain of the first RF stage until the meter reads on "N" in the quietest part of the band.

And also, of course, when changing from one range to another or even perhaps when changing from one end of one range to the other.

The difference between the method proposed and the more usual S-meter is that whereas the latter is a measurement of signal level in terms of an unspecified unit which will vary from one receiver to another, the former is a comparison between the signal and the noise with which it has to compete, and this will be a definite figure at any one time for a particular locality.

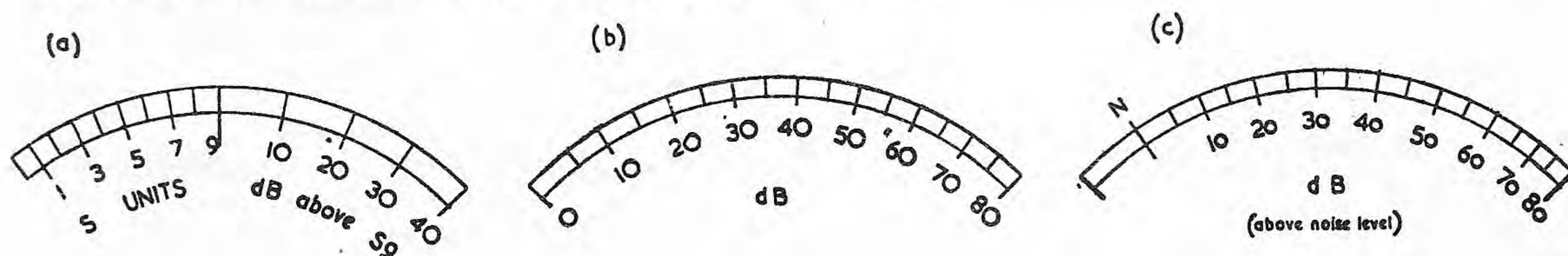


Fig. 3. Some typical scale arrangements for the S-meter when it is to be used as described in article

HOW'S UR OBS IQ?

Official Bulletin Nr 284, March 15, 1951
ARRL invites applications for its Official Observer appointment. League members residing in any Canadian or U.S. section are eligible. The various classes of appointment include categories for phone and CW checking which require only receivers and individual skill. All interested amateurs are requested to write ARRL HQ for application blanks, a sample O.O Bulletin and full information on how to qualify for O.O appointment.

Official Bulletin Nr 285, March 21, 1951
To assist scientific studies now being made of aurora borealis and effects on V.H.F. propagation, A.R.R.L. solicits cooperation of amateurs operating on 50 mcs and up. First report should give the call, location, type of antenna, xmitter power and type receiver used. Observation

should include band, time, call station heard or worked, signal strength, and if possible, beam direction for best signal, signal quality of modulation readability, and opening duration. If not all these points are observed, your report may be helpful still, so send it to A.R.R.L. attention of W1HDQ.

Official Bulletin Nr 286 deals only with U.S. hams, and has no VE application.

Official Bulletin Nr 287, April 6, 1951
Amateur radio will be featured on TV this month on the Faye Emerson show, with an interview with Martin Block, W2MGE, disc jockey of radio and movie fame, and Marx Kaufman, W3IUC. An actual demonstration of mobile network will be shown. To see this, check your nearest TV station, for time and date of show - mid-April.

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80-watt	3/4"	x 6 1/2"
100-watt	1 1/8"	x 6 1/2"
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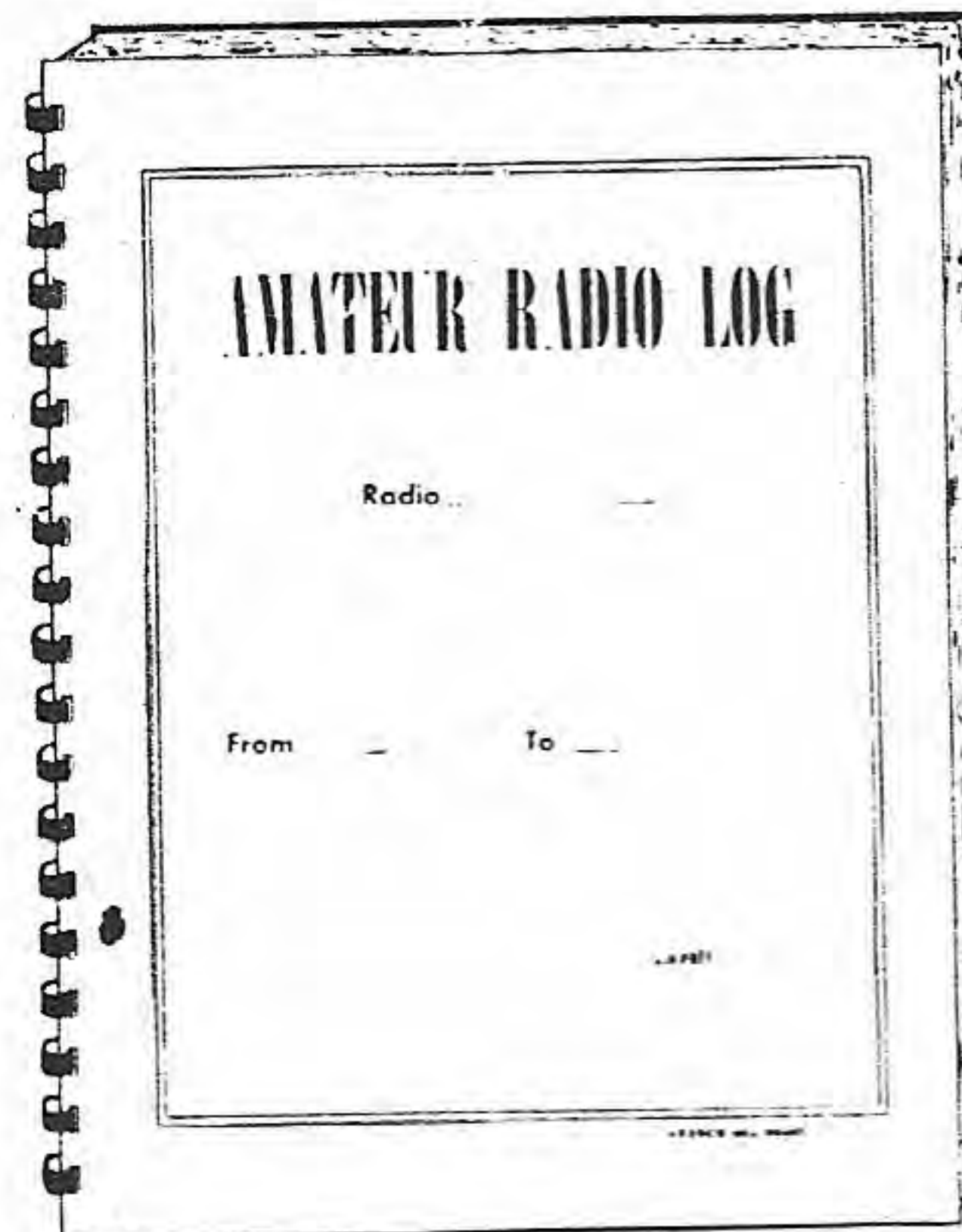
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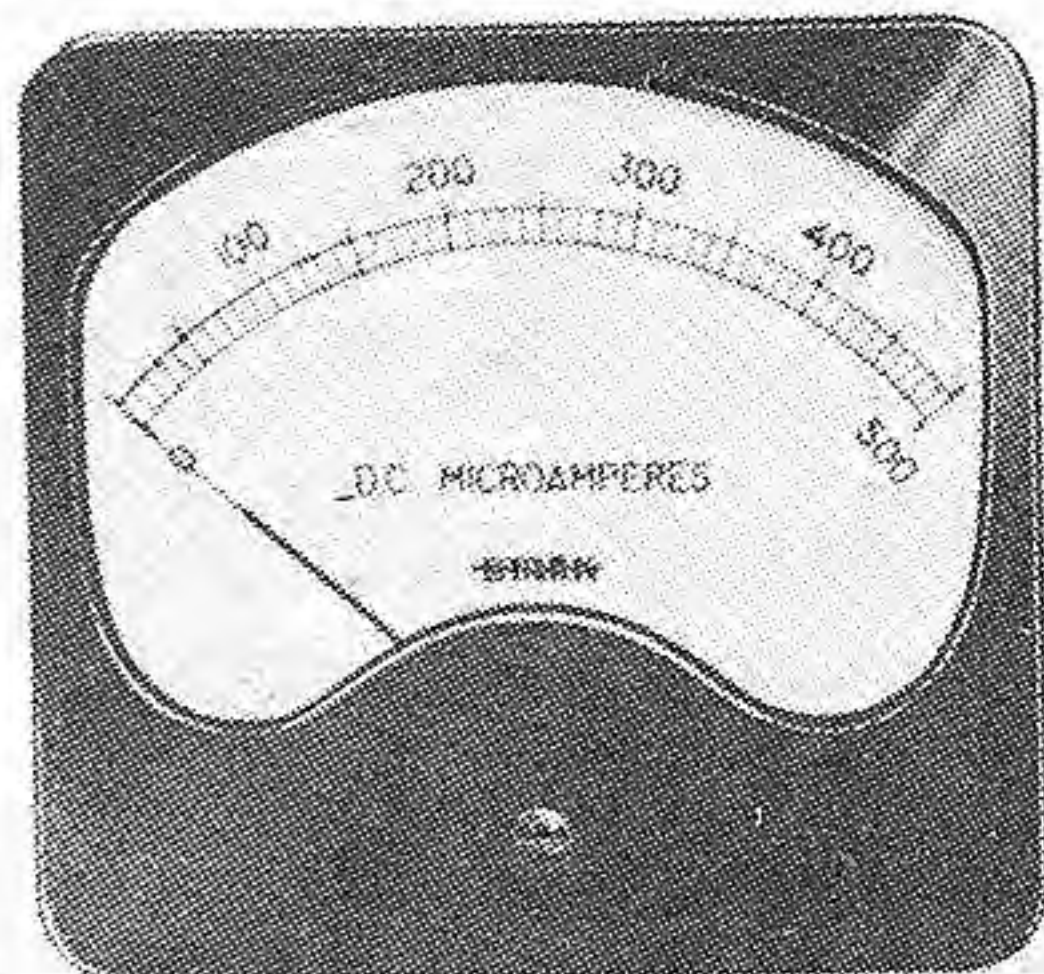
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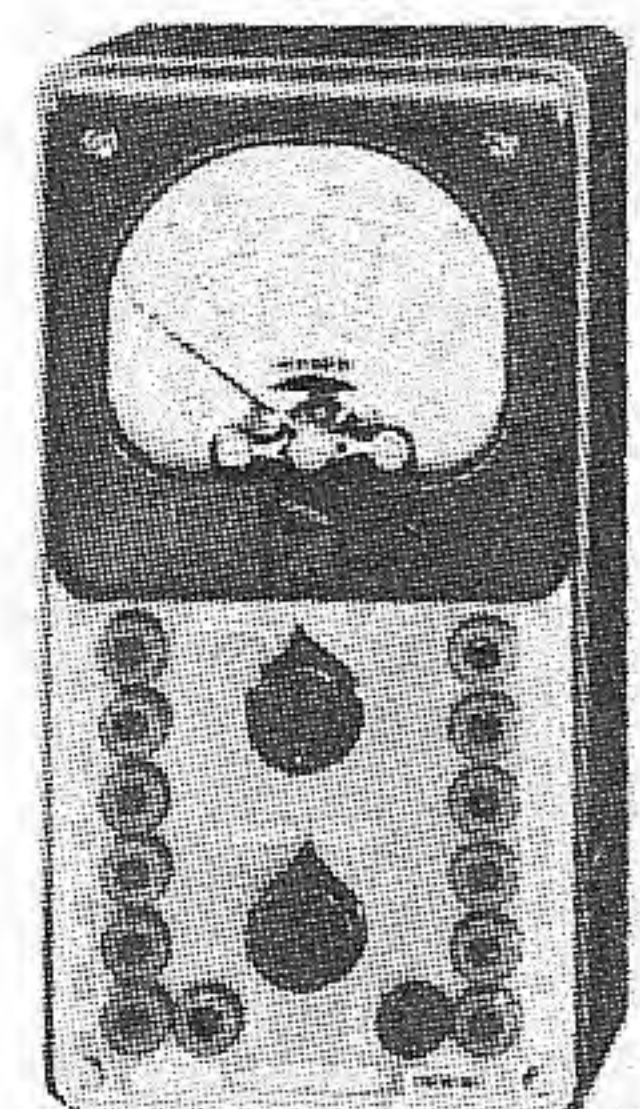
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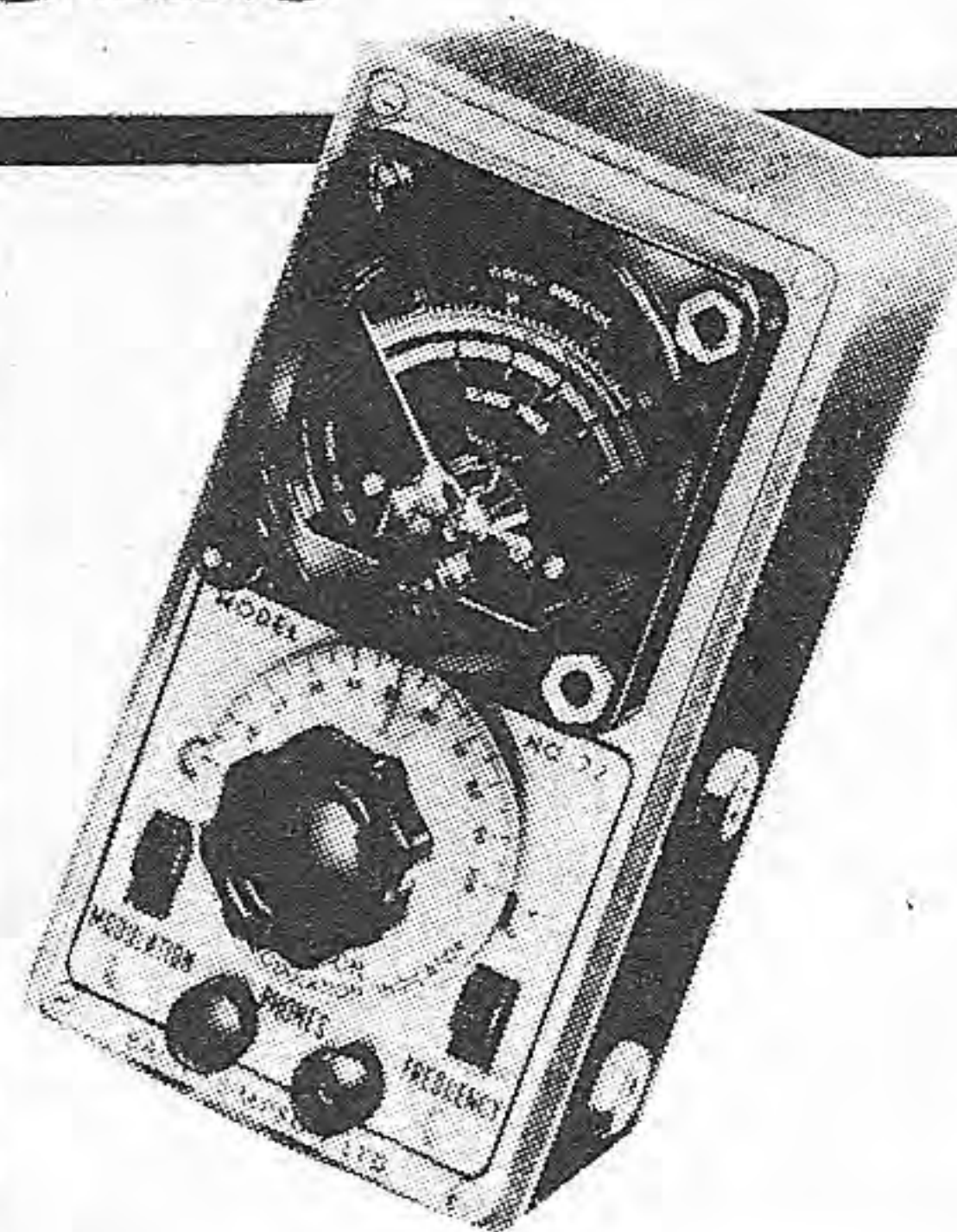
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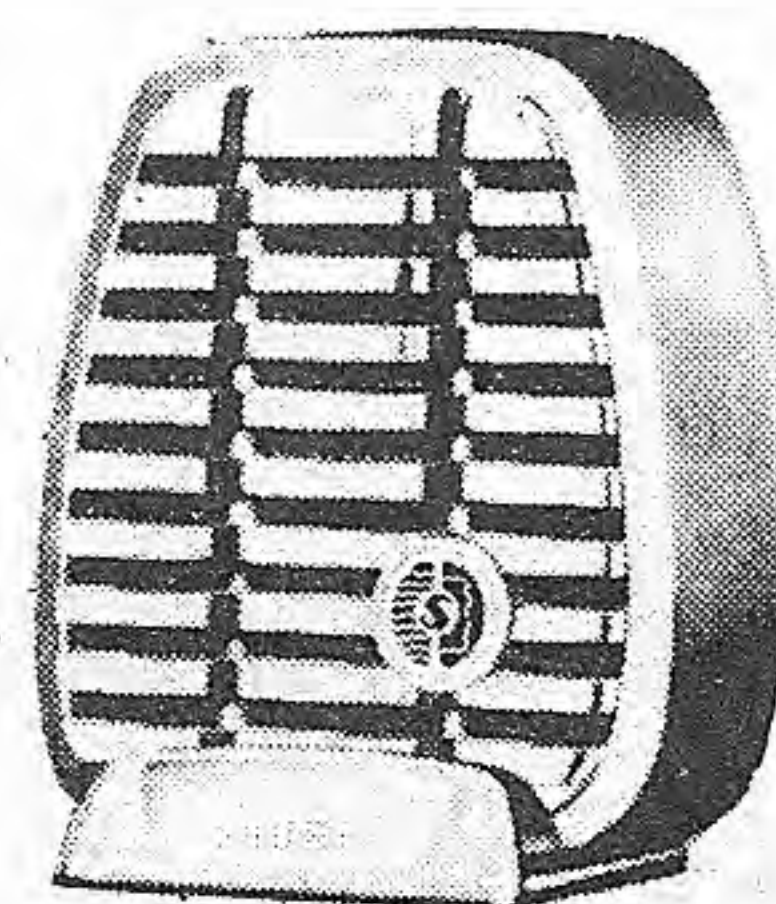
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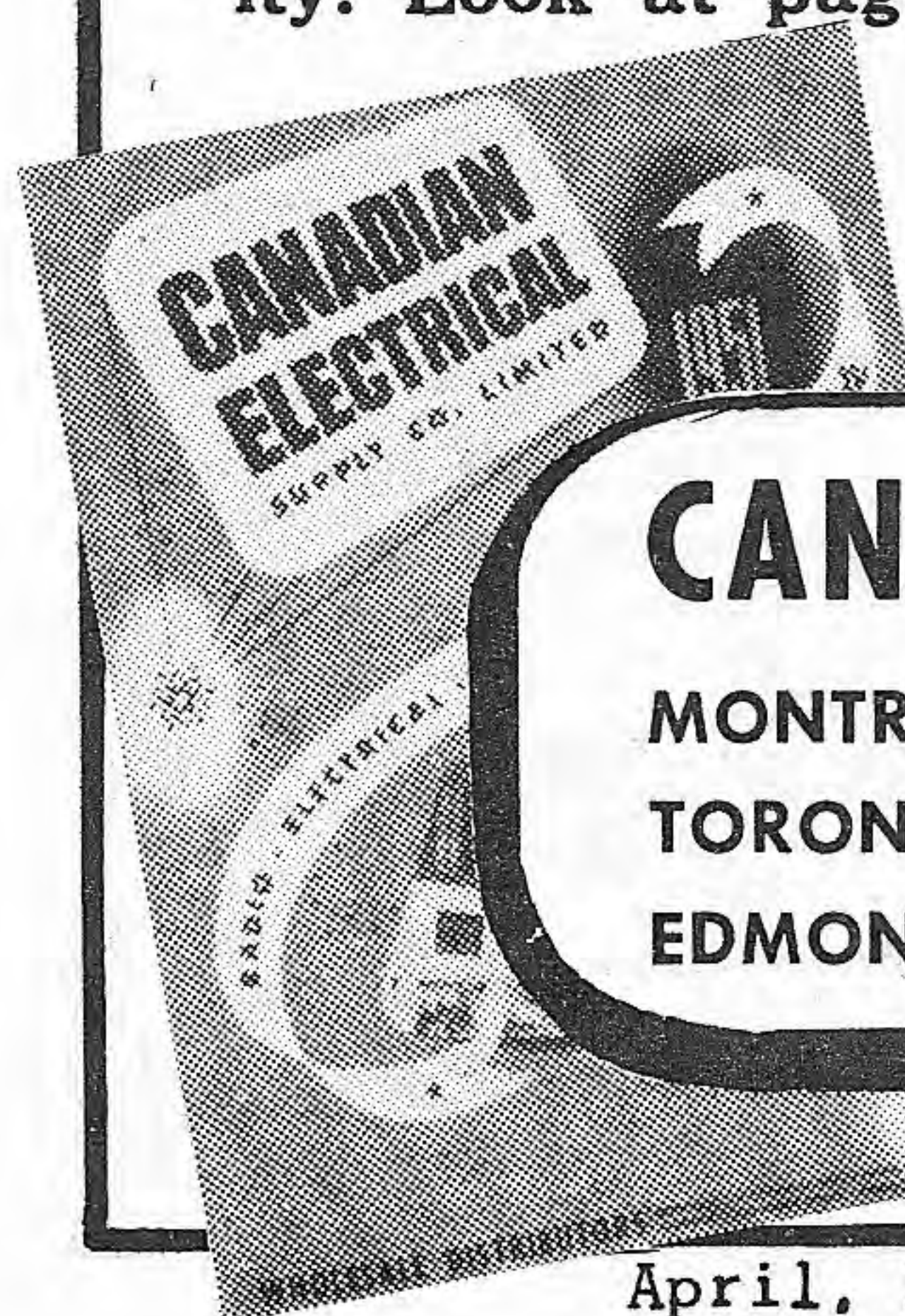
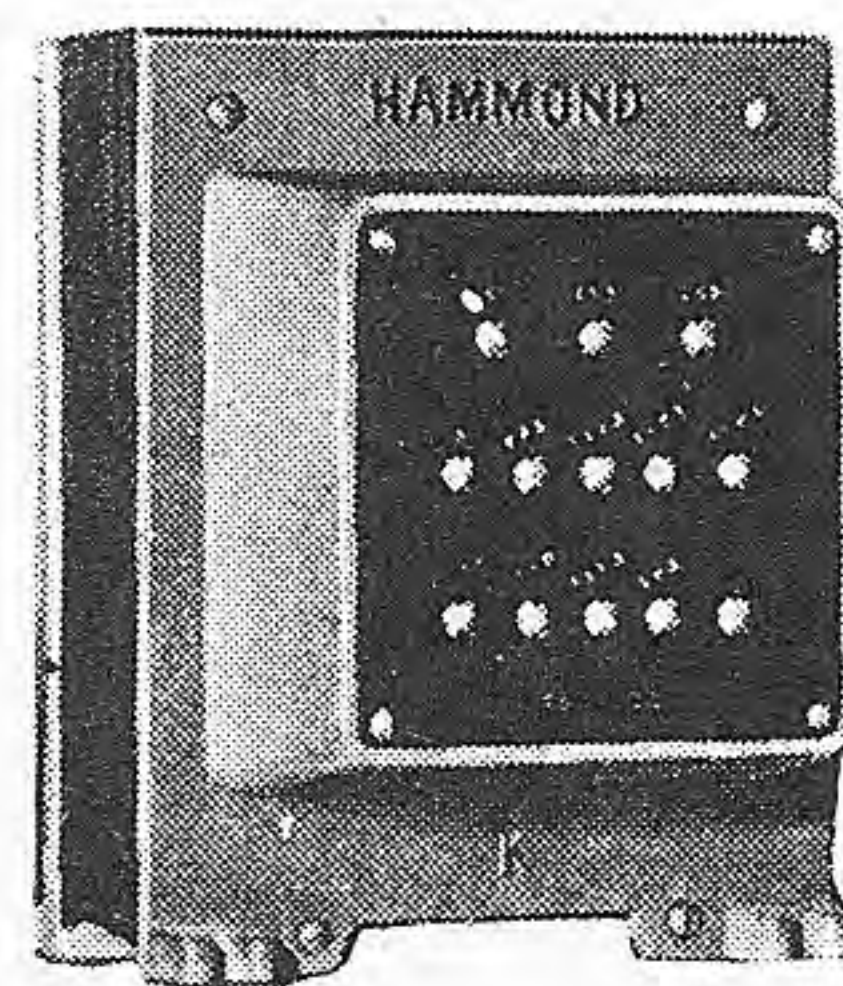
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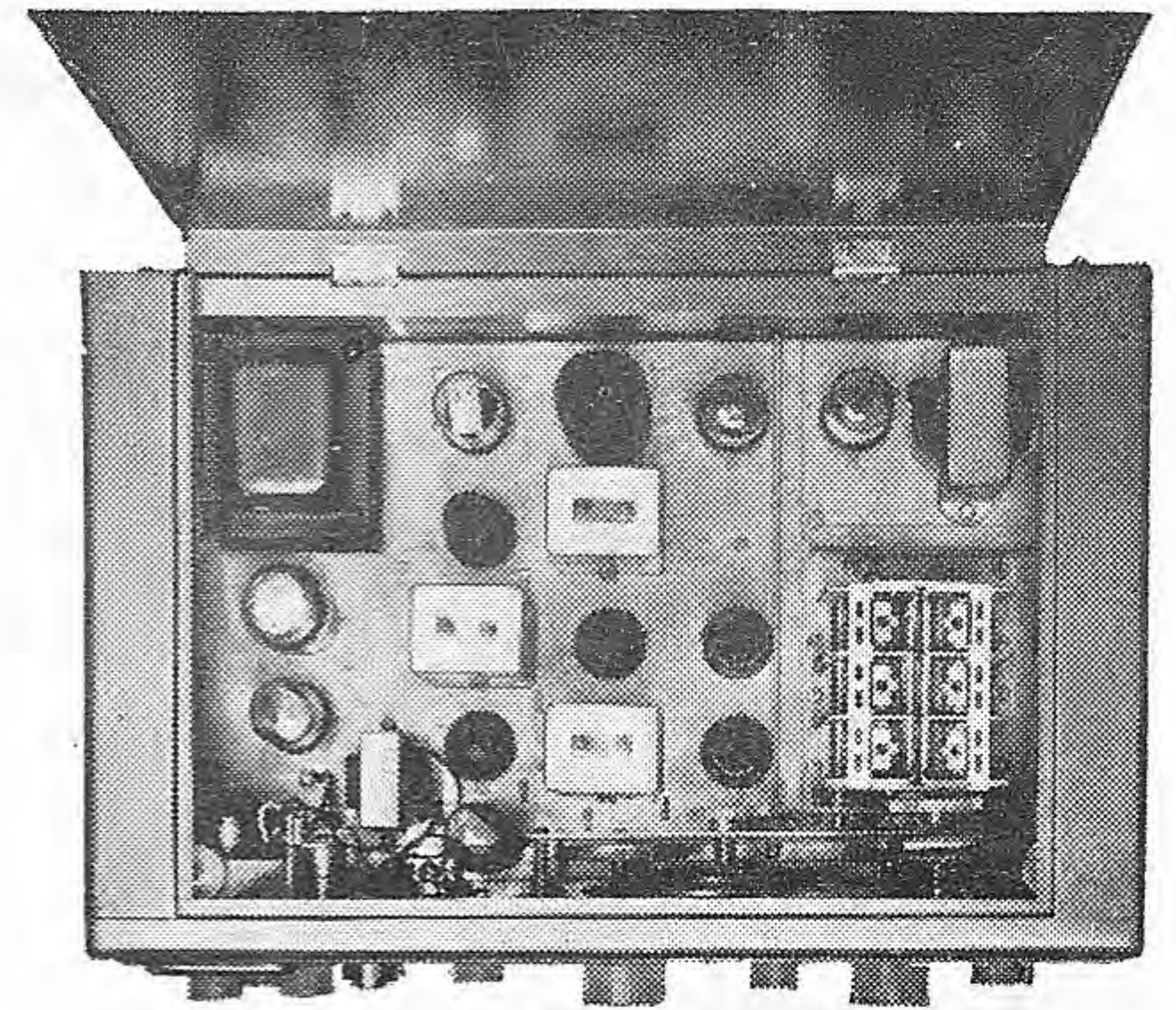
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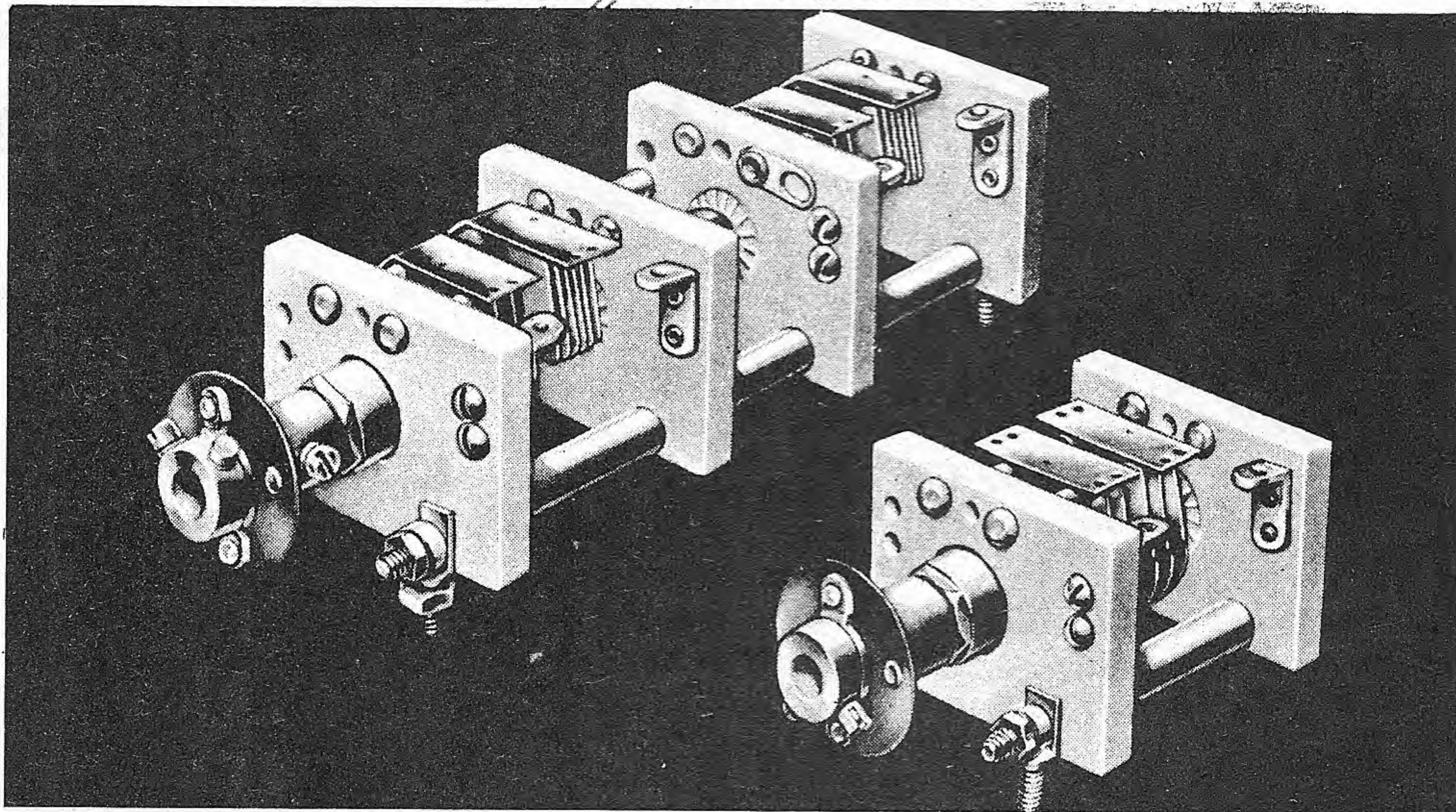
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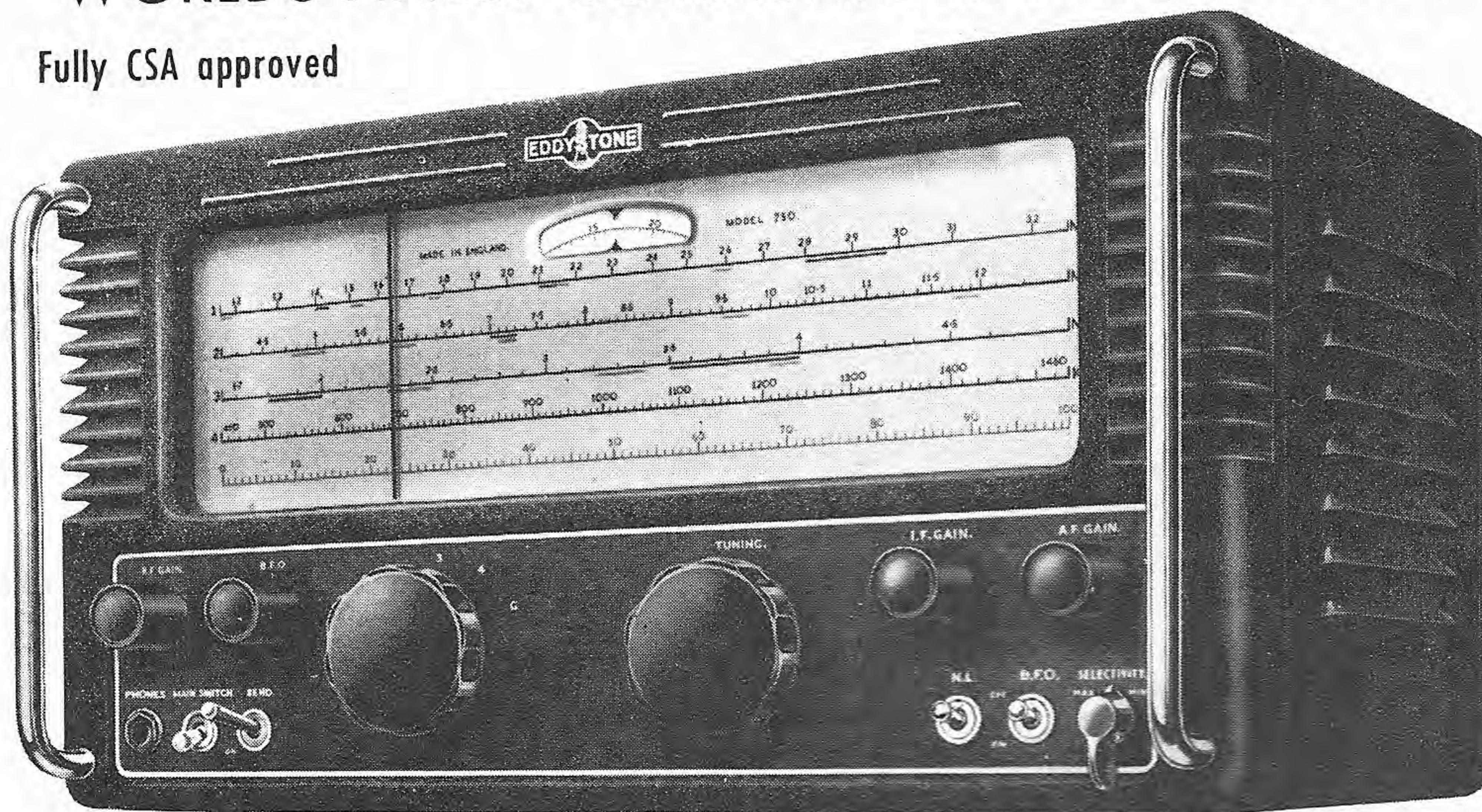
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- Synchro-Mesh Geared Dial Drive
- No tuning backlash at all
- Complete coverage 480kc through 32mc.
- Accurately calibrated linear dial scale
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- No drift from line voltage variations
- Voltage regulated oscillator supply
- Mobile vibrator supply operation
- All-available Miniature tubes
- Highly effective series noise limiter
- More eye appeal than any other receiver
- More performance for your investment

Write today for an illustrated brochure giving many more important reasons why you'll be glad you waited for the Eddystone 750. Hear it and see it—the most beautiful communications receiver built—before buying any.

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Western Agents

119 PENDER STREET W.,

VANCOUVER, B.C.

DX PREDICTIONS

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

PREDICTIONS FOR MONTH OF MAY, 1951

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	14	14	14	14	14	14
Africa		7	-	-	-	-	-	-	-	-	-	-	7
Caribbean		14	14	7	14	14	14	14	14	14	14	14	7
S. America		14	14	7	14	14	14	14	14	14	14	14	14
Australia		14	7	7	7	-	-	-	-	-	-	-	14
U.S. - West		14	14	14	7	14	14	14	14	14	14	14	14
U.S. - Central		7	7	7	7	14	14	14	14	14	14	14	14
U.S. - South		14	14	14	14	14	14	14	14	14	14	14	14
Vancouver		14	7	7	7	14	14	14	14	14	14	14	14
Watrous		7	7	7	7	7	14	14	14	14	14	14	14
Montreal		4	4	4	4	7	7	7	7	7	7	7	7
Sackville		7	7	4	7	7	7	7	7	7	7	7	7

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

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	14	7	7
Africa		7	-	-	-	-	-	-	-	-	-	-	7
Caribbean		14	14	7	14	14	14	14	14	14	14	14	7
S. America		14	14	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	14	14	14	14	14	14
U.S. - Central		14	14	7	7	14	14	14	14	14	14	14	14
U.S. - South		14	14	7	14	14	14	14	14	14	14	14	14
Vancouver		14	7	7	14	14	14	14	14	14	14	14	14
Watrous		14	7	7	14	14	14	14	14	14	14	14	14
Toronto		7	7	4	7	7	7	7	7	7	7	7	7
Montreal		7	4	4	7	7	7	7	7	7	7	7	7

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	14	7	7
Africa		7	-	-	-	-	-	-	-	-	-	-	7
Caribbean		14	14	7	14	14	14	14	14	14	14	14	7
S. America		14	14	7	14	14	14	14	14	14	14	14	14
Australia		14	7	7	7	-	-	-	-	-	-	-	14
U.S. - West		14	14	14	14	14	14	14	14	14	14	14	14
U.S. - Central		7	7	7	7	14	14	14	14	14	14	14	14
U.S. - South		14	14	7	14	14	14	14	14	14	14	14	14
Vancouver		14	7	7	7	7	14	14	14	14	14	14	14
Watrous		7	7	7	7	7	14	14	14	14	14	14	14
Toronto		4	4	4	4	7	7	7	7	7	7	7	7
Sackville		7	4	4	7	7	7	7	7	7	7	7	7

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

50,000 HAMS CALL ME

By GEORGE H. FLOYD
Electronics Department



"Lighthouse Larry"



THIS article is a lament from an unknown. I used to have a name all my own. I even had a perfectly good amateur radio call: W2RYT. But now? Just call me Lighthouse Larry.

Say the magic words "Lighthouse Larry" to any one of at least 50,000 amateurs in this country and they will immediately come back with: "Oh, you mean the editor of the G-E *Ham News*." *Ham News* is an eight-page bimonthly publication, with a circulation of 65,000, published especially for amateur radio operators—for hams, that is.

Ever since I started editing this publication five years ago I have been pursued by a little man who really *is* there: Lighthouse Larry, the little cartoon character with a radio-tube body who signs all of the *Ham News* articles and answers thousands of letters a year from hams all over the world.

As such, Lighthouse Larry (so named because of his lighthouse-tube body) is the personification of the engineering and electronic skill of our Company which is available to ham radio operators. Lighthouse Larry is really a genius,

because he is all of the genius of the General Electric Company rolled into one package.

I created Lighthouse Larry, but in the Frankenstein manner he has turned on me, so that you might say that I am his alter ego, his right-hand man, his lackey.

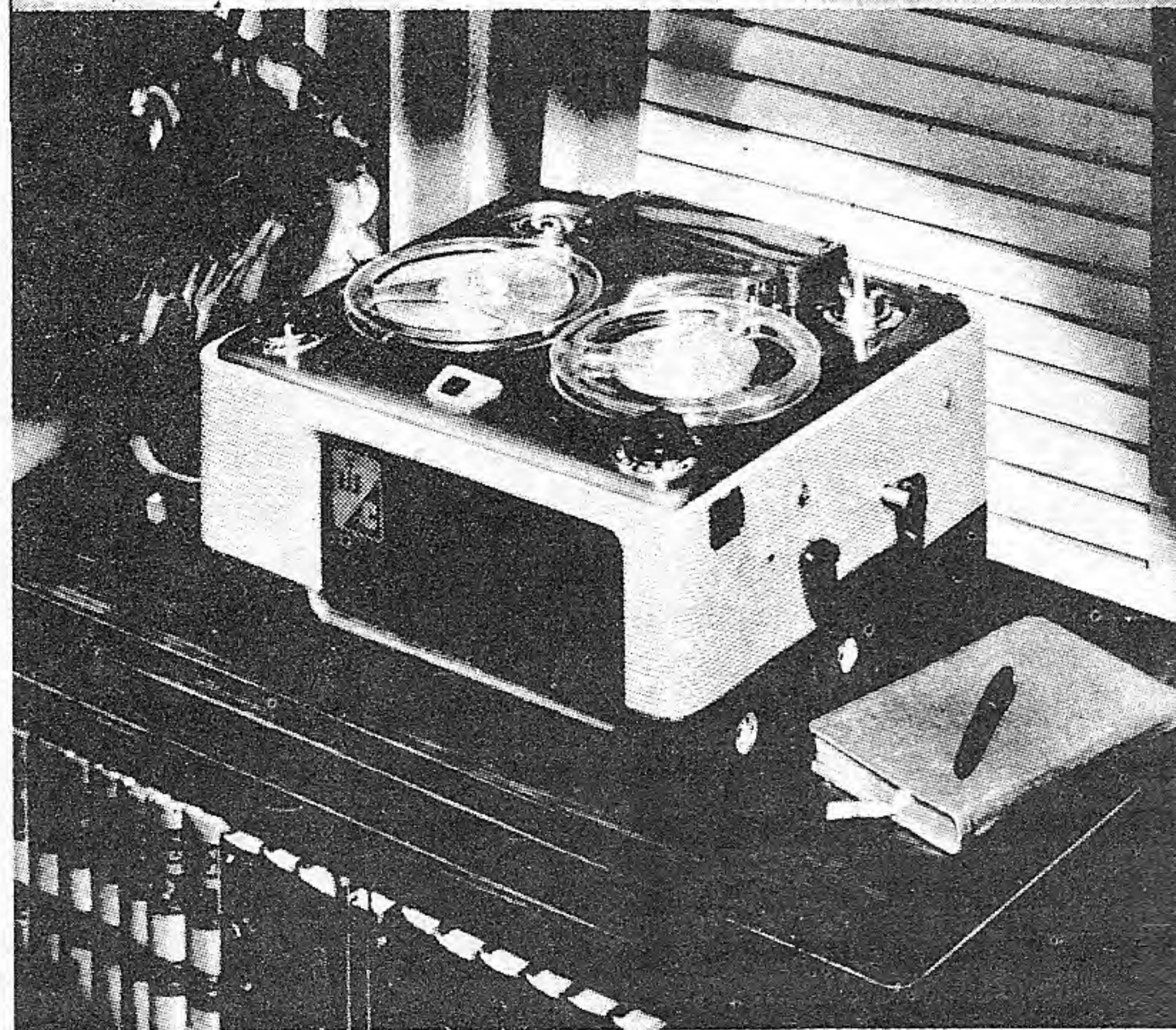
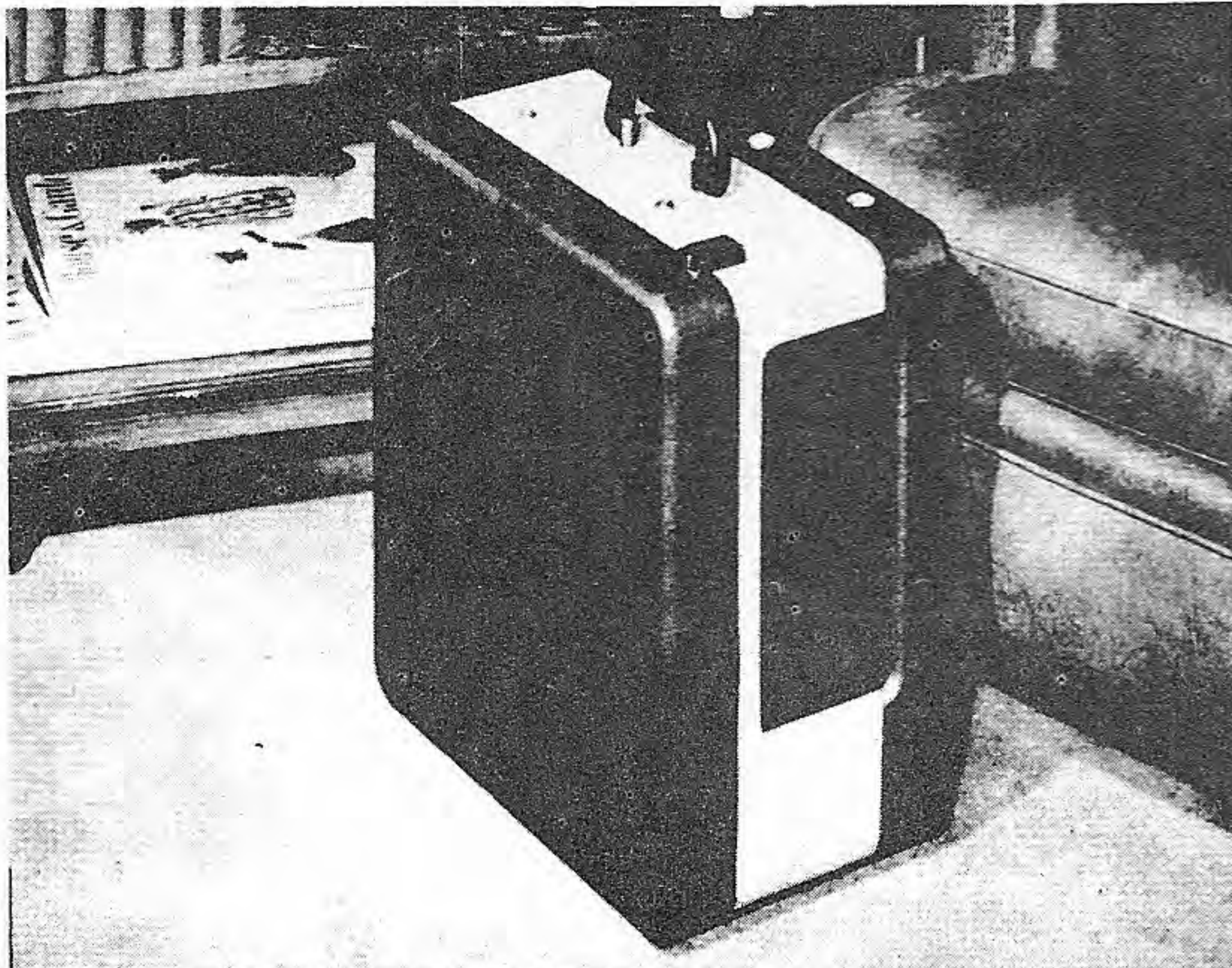
The little fellow has even gone international. In Mexico, Spain, and all the Spanish-speaking countries he's known as Megatroncito. By any standards or names he's a well-known little guy.

If any of the foregoing sounds a little out of the ordinary, it's only because it

Skywire



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SEE IT!... HEAR IT!

- Records or plays in both directions without inconvenient reel turnover.
- Two speeds in both directions, $3\frac{3}{4}$ and $7\frac{1}{2}$ plus "fast."
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- Standard equipment: one full 7" reel, one empty 7" reel and microphone!
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THAT CAN BE FOUND ONLY IN THE SPECTACULAR NEW
WEB-COR TAPE RECORDER*



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VANCOUVER WINNIPEG MONTREAL HALIFAX ST. JOHN'S Nfld.

concerns an extraordinary group of people called radio amateurs, or hams, as they call themselves.

Hams are amateurs only in the strictest sense of the word; that is, they are in the game without any thought of pecuniary gain. In any other sense they are far from amateurs. Some of the most spectacular advances in the field of radio communication have been made by hams.

In fact, in 1912 the amateurs of the country were given exclusive use of all the short-wave bands, because the professional radio engineers of that day felt that the short-wave bands were useless for dependable communication use. The hams went right ahead and used this space and in a relatively short time proved that the space was valuable indeed—so valuable, in fact, that it wasn't long before commercial interests were clamoring for use of the space themselves.

By getting on the air and operating under all sorts of conditions, the amateurs provided the radio art with a wealth of information, and in so doing proved the engineers wrong. Needless to say, the hams lost most of this short-wave space, but they do have small portions of it yet, assigned to their exclusive use.

Amateur Contributions

Many technical advances in the radio field have come from amateurs. One ham developed a theory on the way radio waves bend when traveling through the air. Another developed an extremely selective receiver. Still another, D. E. Norgaard of the Company's Research Laboratory, designed and developed a simplified transmitter which sends out only half a radio signal.

A high percentage of the electronics engineers and technically trained people in this country are radio hams. Some take up ham radio as a hobby after they become engineers, while others go into engineering or technical work because of their prior interest in amateur radio. (In my own particular case I switched from a journalism course in college to an engineering course because I had become interested in electronics with my ham station.)

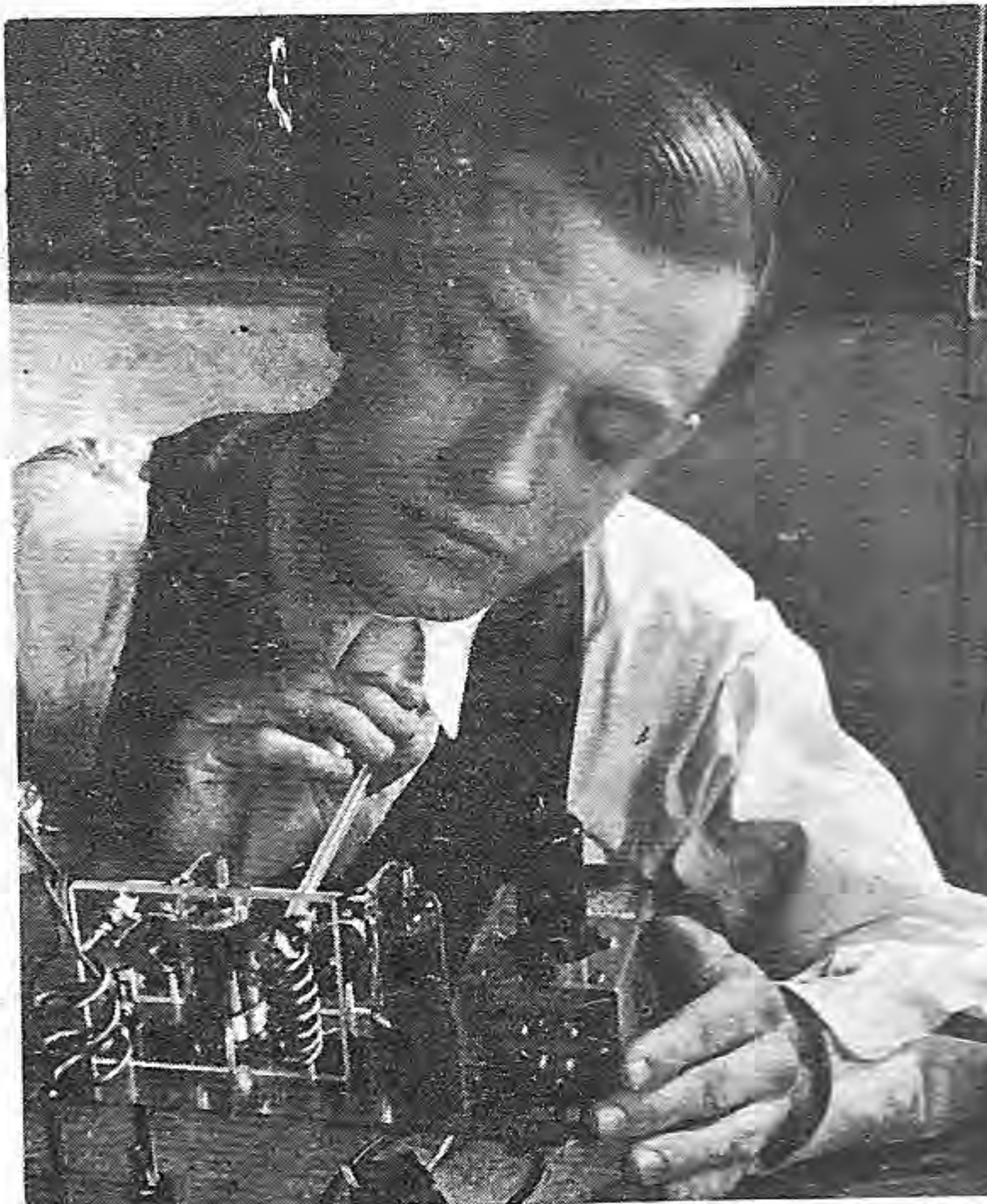
My job is acting not only as *Ham News* editor but also as General Electric's personal ham advisor. This gives me the opportunity to answer some 3000

letters a year from the Company's amateur customers.

Most of the questions can be answered in a straightforward manner, but others—well, for example: "Dear Lighthouse Larry, please design me a television receiver. I don't want it to have more than five or six tubes." That letter was answered, but not, I regret, to the satisfaction of the writer. Even the finest brains in the Company haven't been able to design a television receiver yet with only five or six, or even ten tubes.

Another lad had trouble making his crystal set work, so he packed it in a

LIGHTHOUSE LARRY



The author at work on a short-wave transmitting equipment, a hobby of which he never seems to tire.

shoebox and sent it to me. Fortunately there was little wrong with it, so I repaired it and sent it back to him.

Neither of these two correspondents were hams; that is, they did not yet have their amateur license, but I imagine in several years they too will attain the required proficiency and become hams.

Not all of the questions received pertain directly to amateur radio. Take the case of the ham who wrote me for information on how to fix his electric blanket. After this was furnished, he again wrote me, and I quote:

"It is really fine to be able to call on someone for assistance occasionally, especially when the neighbors have the idea that a ham is a combination of Steinmetz, DeForest, and Armstrong.

"I don't know what experience you folks may have had in trying to keep unsullied the name of ham radio, but as for me, I have had to take on such bi-

zarre jobs as converting 1931 farm radios to a-c, replacing the innards of maltreated jewelry-store superhets, advising on chicken-coop wiring, and checking the spark of a reluctant Model A Ford—just a few of the reasons I appreciate a hand now and then."

A great deal of my correspondence concerns television, but not quite in the way you might think. In fact, since the advent of television, quite a few radio editors have gotten gray-haired. You see, the average sensitive television receiver, because of the very nature of television itself, frequently picks up a lot of other radio and electrical signals in addition to the television signal it is supposed to receive.†

All this has put a lot of letters in my mail basket and has provided material for several issues of *Ham News*. One gadget, designed to prevent amateur interference in television receivers and described in *Ham News* last December, is now so well known that it was mentioned in a recent article in *Reader's Digest*.

Humorous and tragic incidents occur almost daily on the ham bands. Many amateurs court their wives-to-be over the air—in some cases across the whole United States. While this was not true in my own case, it might have been.

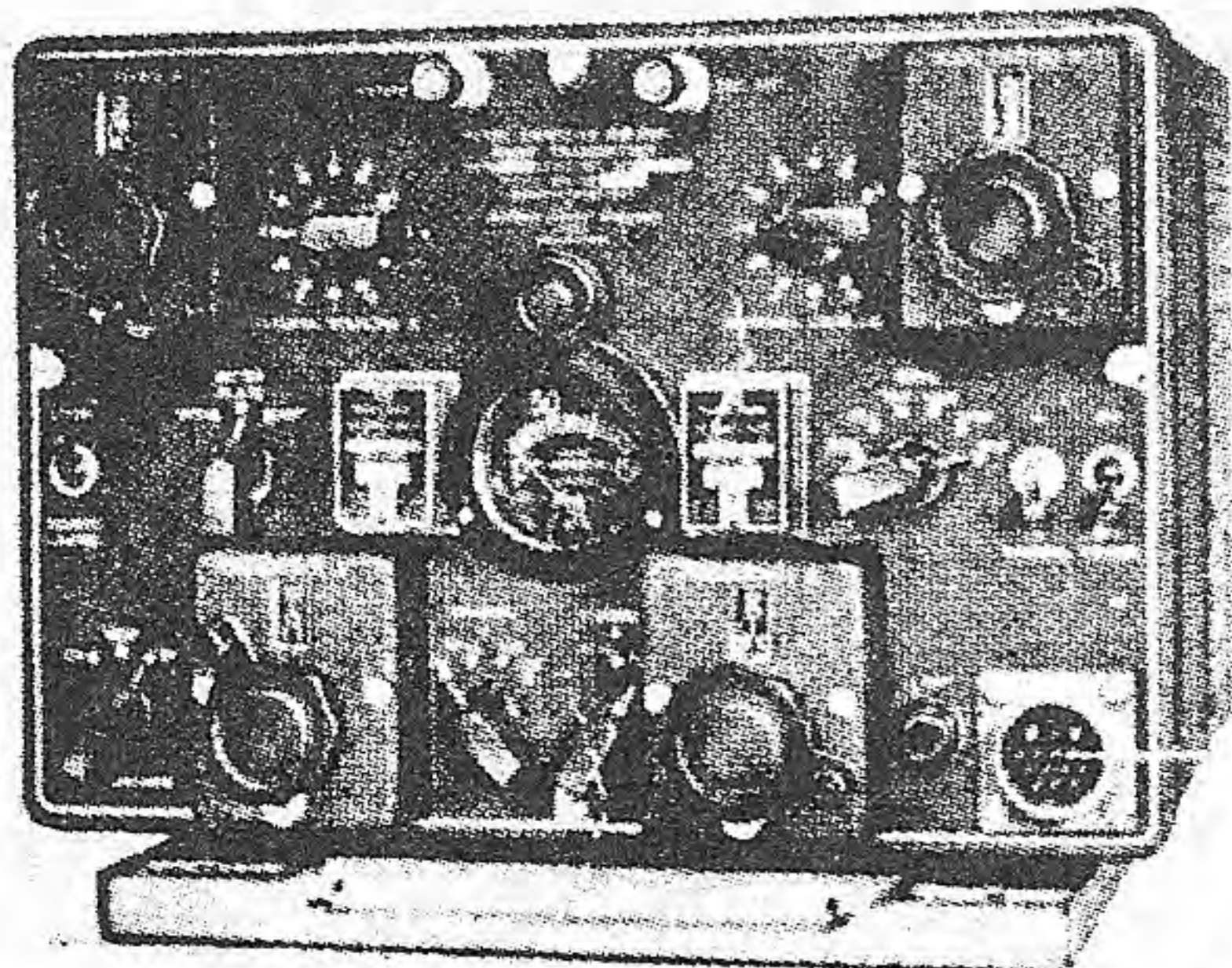
I was an active amateur in Arizona in prewar days and had been in the habit of talking quite often to a young lady amateur in Alabama. We had even reached the point of exchanging photographs.

We stopped our over-the-air conversations when summer came, each looking forward (so I thought) to resuming our talks when fall rolled around. When this time arrived, I did manage to communicate with her amateur station, but the only person there was her dad, also a ham. It took a little time to get the story out of him, but he finally explained that another ham in California had beaten my time. He had a transmitter which permitted him to talk to the girl during the summer. He was evidently quite a fast worker, for she had married him before the summer was over.

Another time a ham's transmitter was

† Electric razors, automobiles, trolley cars, electric heating pads, medical equipment, electric trains, oil furnaces, electric mixers, faulty light bulbs—all are capable of creating interference in a television receiver, particularly if it's outside the normal range of a TV station.

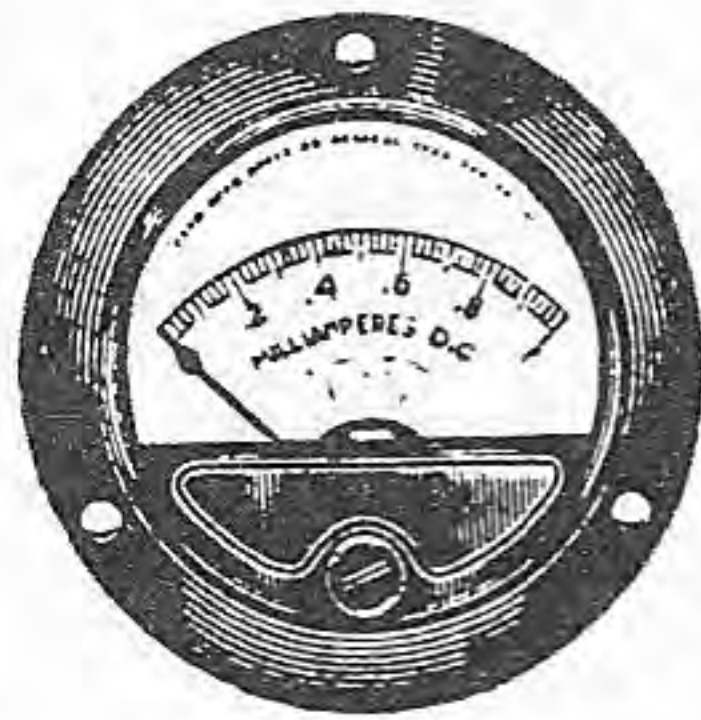
Take Advantage of These Bargains Now!



These excellent ATL-7 transmitters are in top condition. Both 12 & 24 volt DC models are available now!! These are complete with tubes, and will give a 36 watt output. Range of 1.5 to 20 megs. covers all ham-bands on C.W. or Fone. Instruction manual available. Quantity is very limited - but look at this price -

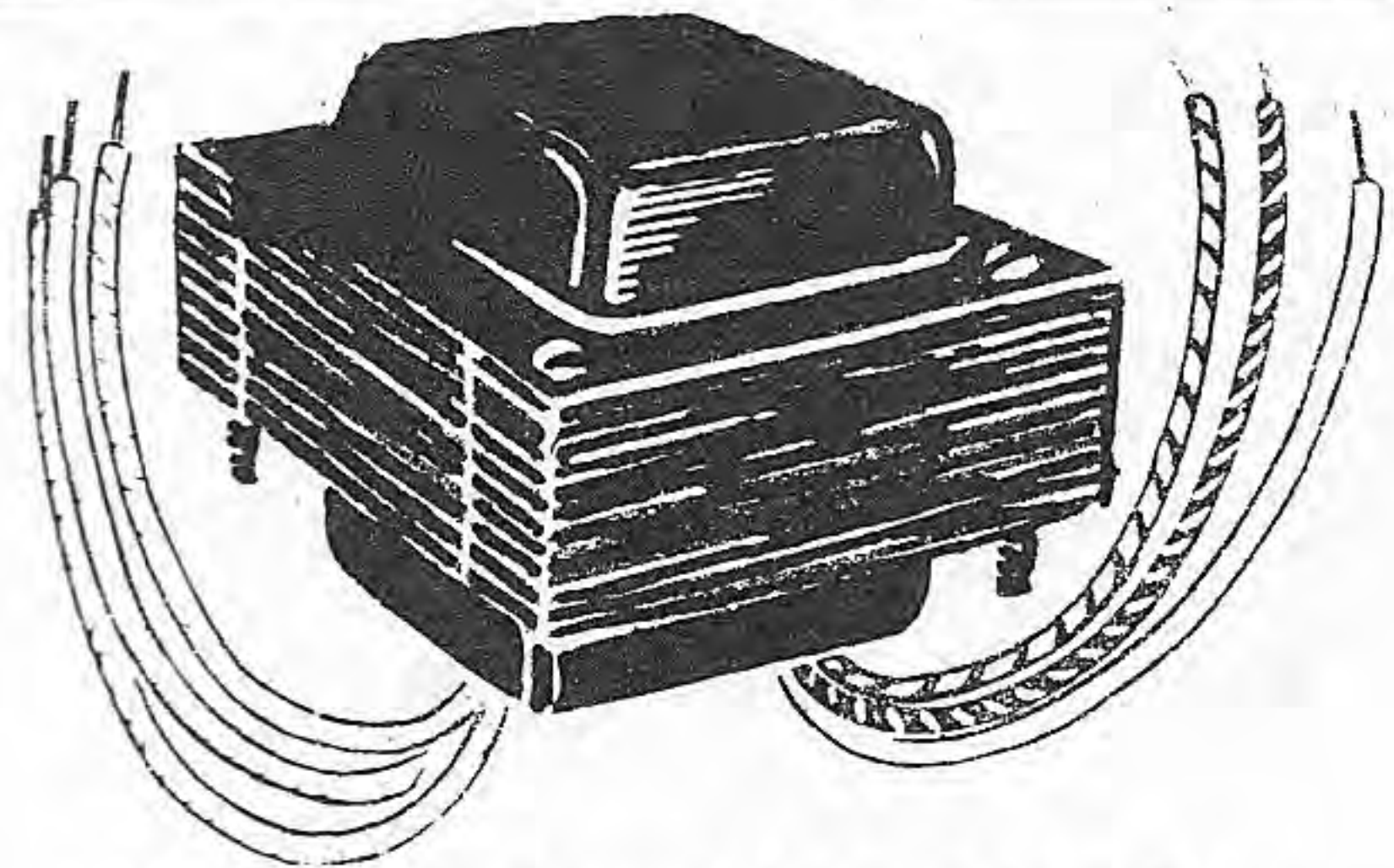
\$19.50 each.

COMPLETE WITH ALL TUBES



HERE'S A REAL BUY!!!
2 1/2 INCH ROUND METER WITH VOLT-OHM-M.A. SCALE. THE BASIC MOVEMENT IS 6 MA FOR FULL SCALE READING. 250 OHMS PER VOLT. IDEAL FOR BUILDING A LOW COST SMALL V.O.M. TEST UNIT FOR THE SHACK. THE PRICE IS ONLY - \$3.95 each!!!!

All Purpose Power X'formers

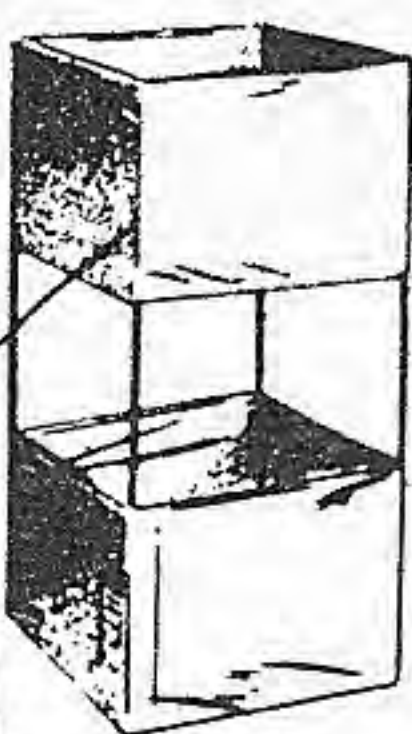
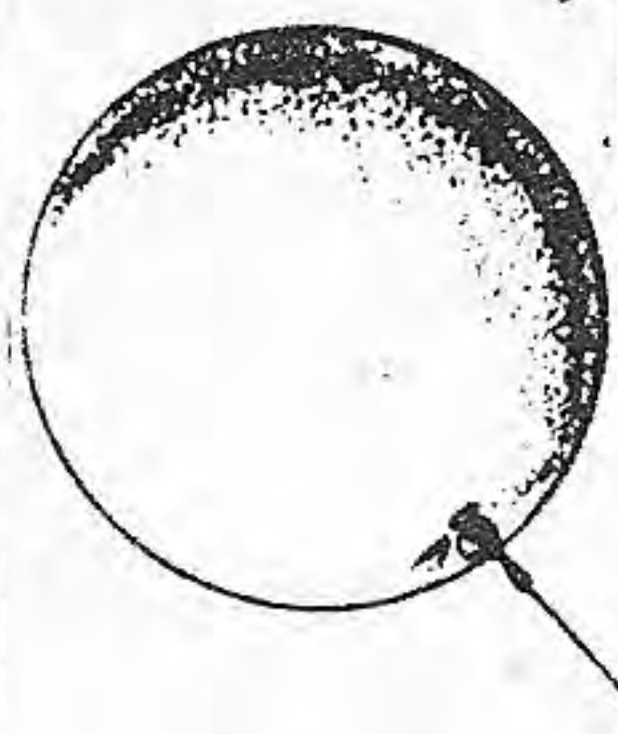


These are all 60 cycle, 115 volt AC primary types - ideal for hamshack. Compare these prices with any other makes available today.

300 - 0 - 300v at 100 ma.	•	275-0-275v at 60ma.	•	280 - 0 - 280 v at 65 ma
6.3v at 3 amperes.	•	6.3v at 3 amperes.	•	6.3v at 2.1 amperes.
5v at 3 amperes.	•	5 v at 3 amperes	•	5v at 2 amperes.
ONLY - \$3.50!!	•	PRICED AT \$2.75	•	3 1/2 X 2 1/4 X 3 5/8 in
				X mounting --- \$2.75

NOT MANY LEFT!!!

ARMY



Originally made to take up emergency radio antennas, these balloons and kites are beautifully made of the finest materials. The balloons inflate to approximately 4' in diameter and have a lifting capacity of 3 to 5 lbs. Made of extra heavy rubber and come sealed in metal cans. Each balloon has its own hydrogen generator which works when simply put in water. The box kite is scientifically designed. Its strong aluminum frame folds up like an umbrella so kite can be stored in a small space.

BALLOONS and KITES

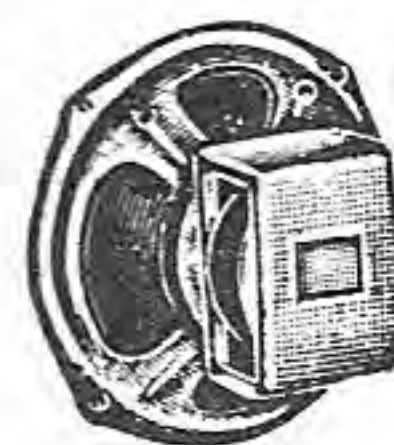
One balloon, with hydrogen generator - \$2.50
One kite, - \$2.95

HANDMIKE CARBON



Brand New - Complete with press-to-talk switch, four foot cord and plug. SALE PRICED AT \$1.95 ea.

HIGH QUALITY P.M. SPEAKERS



4" PM	-----	\$1.95
5" PM	-----	\$2.15
6" PM	-----	\$2.50
10" PM	-----	\$4.50
10" PM	Rola made --	\$6.50
12" PM	-----	\$7.95

THE RADIO CENTRE

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Supplies for Repairmen & Amateurs

heard on the air, but no one was talking; all that could be heard were the sounds of heavy breathing. Because the operator of this station had just been ill, his amateur friends several hundred miles away became worried, so they telephoned the police in his home town. The police, realizing that the ham lived outside town, called on the state police, and they, in turn, hurried to the amateur's home. Fortunately he had just fallen, literally, asleep and snoring—at the switch.



Another rescue proved to be the real McCoy. An amateur in Alaska was talking to another ham in California when, for no apparent reason, the Alaskan amateur became silent. The California ham, realizing that something might be amiss, contacted his local coast guard. This unit alerted the coast guard in Alaska by radio, who rushed to the amateur's home. He had been overcome by gas from a faulty heater, and they were in time to save his life.

Amateurs being rescued by the police or the coast guard are in the minority; it's usually the other way around. That is, the hams have an enviable record of providing emergency communication in times of national or local disaster.

Texas Disaster

All of us remember the Texas City explosion in April of 1947, when the freighter *Grandcamp* disintegrated at her dock. This disaster killed 600 and injured 2000. Three hours after the first explosion amateur operators began moving in from other cities with their portable transmitters and receivers to handle urgent messages regarding requests for ambulances, plasma, oxygen, and gas masks.

Every conceivable means of communication must be employed in a disaster of this sort, because phone lines and telegraph lines, even if still intact, cannot handle thousands of messages in the time required. Suppose that the mayor of the town is told that a new group of injured has been discovered. Ambulances are required.

Because in many cases the hams in Texas City were only the first link of a radio network, some rather unusual radio paths came about to speed these emergency messages on their way. One route was from Texas City to Puerto Rico to Dallas to Honolulu to Fort Worth. Messages were getting into Fort Worth via this path 30 minutes after they left Texas City. It might seem strange that a circuitous route like this would be necessary, but the very volume of traffic required that amateurs use every possible means, no matter how roundabout, to get the messages delivered.

When a tornado swept across western Texas and Oklahoma, killing 134 persons and injuring 1300 early in 1947, ham operators sprang into action.

Distant Places

But that was only one of the routes used. Amateurs as far away as Canada, Bermuda, and even Iwo Jima and Japan were on the air handling distress traffic from the Texas City disaster scene.

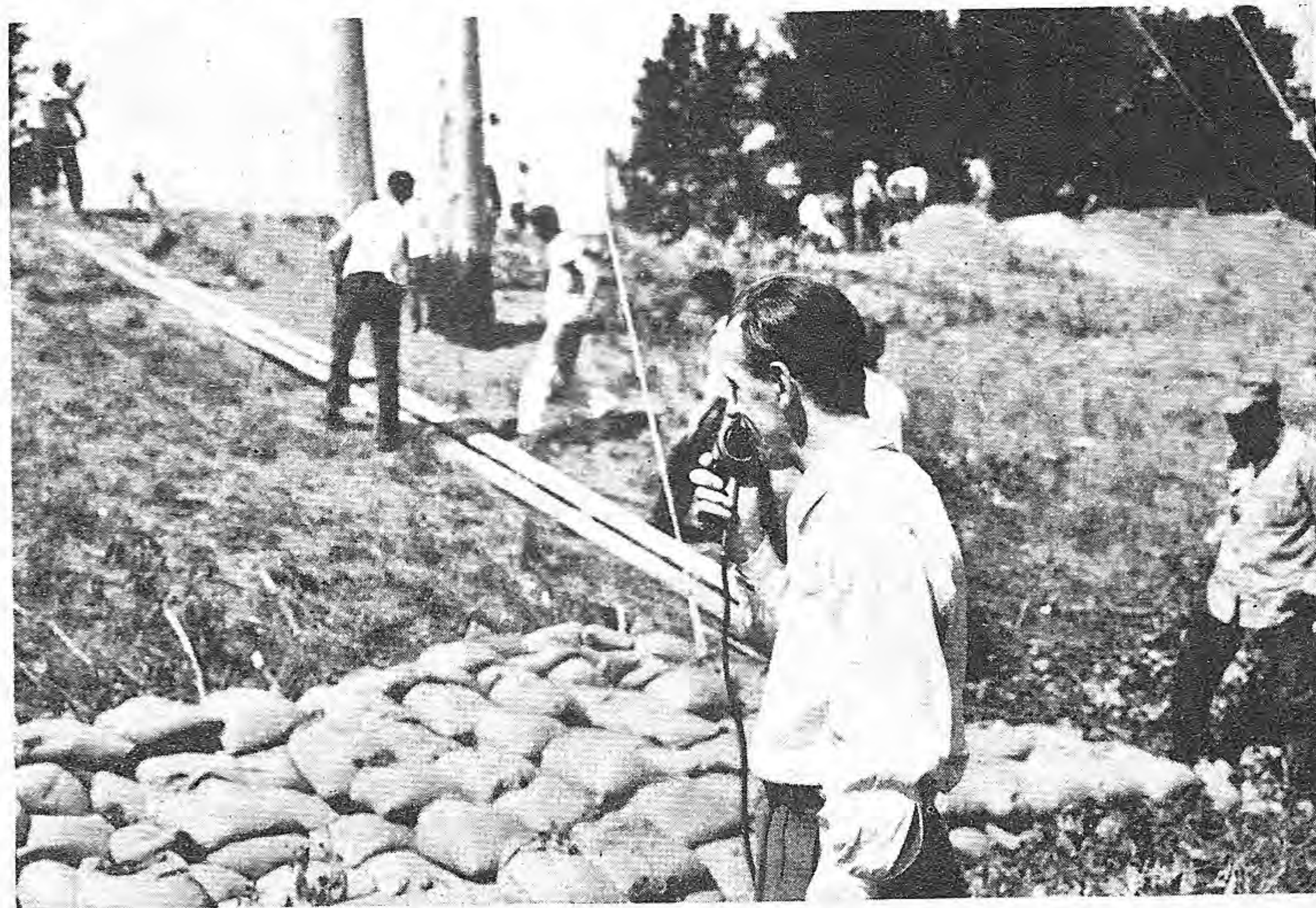
In a national disaster of the sort just described the amateurs usually get appropriate recognition of their services through newspaper articles. However, hardly a week passes but that hams in some section of the country are doing the same sort of job on a smaller scale, usually without publicity. Every hurricane, tornado, heavy snowstorm, or flood brings suffering and loss of normal communication paths. And where nor-

mal communication breaks down, you will invariably find radio amateurs glued to their rigs getting the message through until the emergency has passed. flood brings suffering and loss of normal communication paths. And where normal communication breaks down, you will invariably find radio amateurs glued to their rigs getting the message through until the emergency has passed.

I myself have managed to handle emergency traffic on two separate occasions. The first time the city of Tucson, where I was then living, had a flash flood that tore down the Southern Pacific Railroad telegraph wires. With other amateurs in Tucson I relayed train orders around Tucson from both the East and the West.

The Long Beach earthquake in the late 30's provided my other opportunity to help. In this case messages were sent from Long Beach over all imaginable paths, and I was receiving messages sent from Long Beach via New Zealand. These messages were addressed to all parts of the United States, and I had the job of speeding them in the proper direction.

But that was some time ago. Today I'm settled down in Schenectady, working for the Company's Electronics Department. And, after a day at work talking with hams, writing to hams, designing units for hams, and writing articles for *Ham News*, I dash home to indulge in my own hobby—I did mention that, didn't I?—ham radio.



Here a ham uses a mobile transmitter.

Photo Courtesy QST
Skywire

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LARGEST STOCK IN
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shielding. Use 2mfd
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completely shielded
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5v at 2 amperes
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6.3v at 7.5 amperes.
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#14762 - Hammond Heavy Duty.
Primary 115/230v/60cy.
500-0-500v at 4 amps!
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Used on Thyatron DC
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Priced at \$50.00 each

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Type K-2471. Input of
8 kv, 64 amperes with
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Output 12 kv, 42.5amp
with 218 ohm impedance
Pulse duration - 2
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115v/60 cy primary
5v ct at 3 amperes
6.3v at 10 amperes
Potted mounting -
just \$3.50

#20257 - Filament Xformer.
Primary 115/230v
60 cy. 4 windings.
6.3v at 1 ampere
6.3v at 2 amperes
6.3v at 1 ampere
6.3v at 1 ampere
Windings 2,3,4
tapped at 4 volts.
Net price - \$3.10

#12234 - Auto Transformer
50/60 cyles with
230/115 volts. A
husky unit rated
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#18845 - Jefferson Choke
30H at 450 mils.
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istance - \$7.00

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20H - 100 mils.
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#10353 - Copper Wire Prod
10H - 200 mils.
82 ohms - \$2.00

#13238 - Copper Wire Prod
10H - 150 mils.
120 ohms - \$1.75

#17935 - Jefferson Choke.
14H at 165 mils.
200 ohms - \$2.00

#12434 - Hammond Choke.
120H at 40 mils.
1400 ohms, with
20 kv insulation
\$10.00 !

TELETRONICS

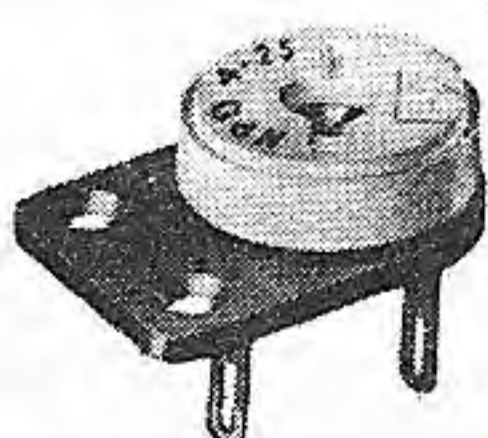
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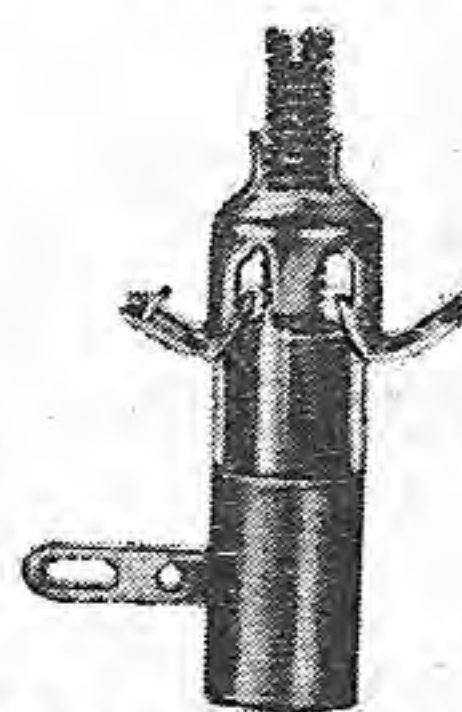
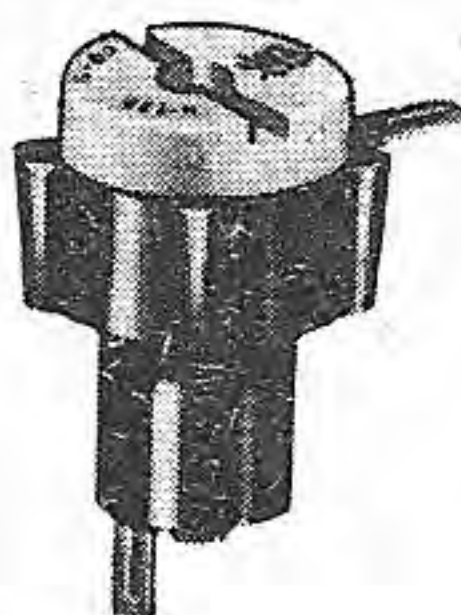
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3-12 MMF
5-25 MMF
5-30 MMF
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**Type 554
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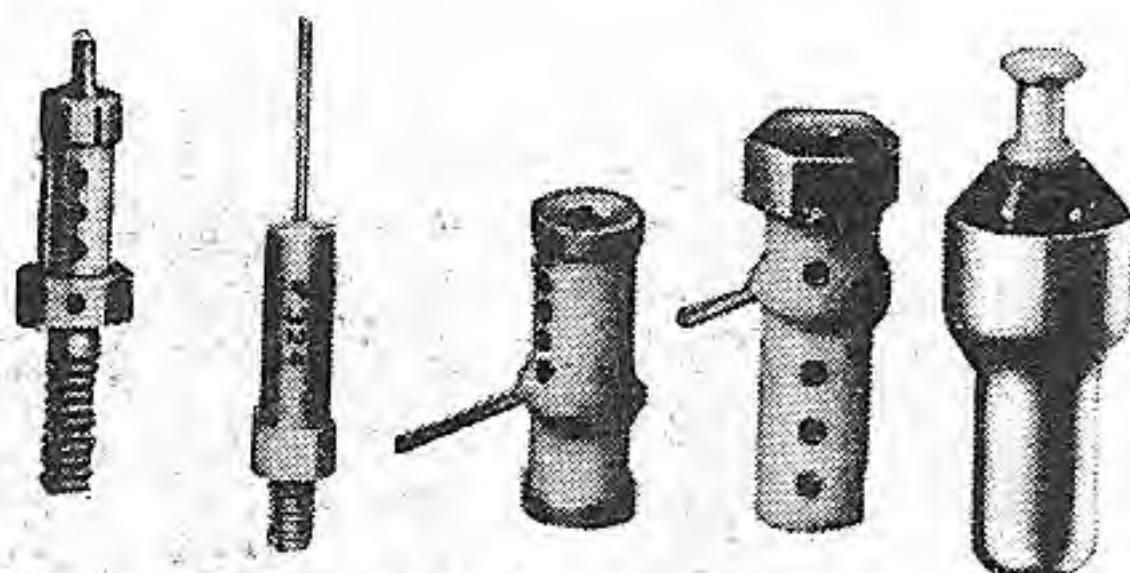
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Type TS2A Ceramic Trimmer
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3-12 MMF 5-20 MMF 7-45 MMF

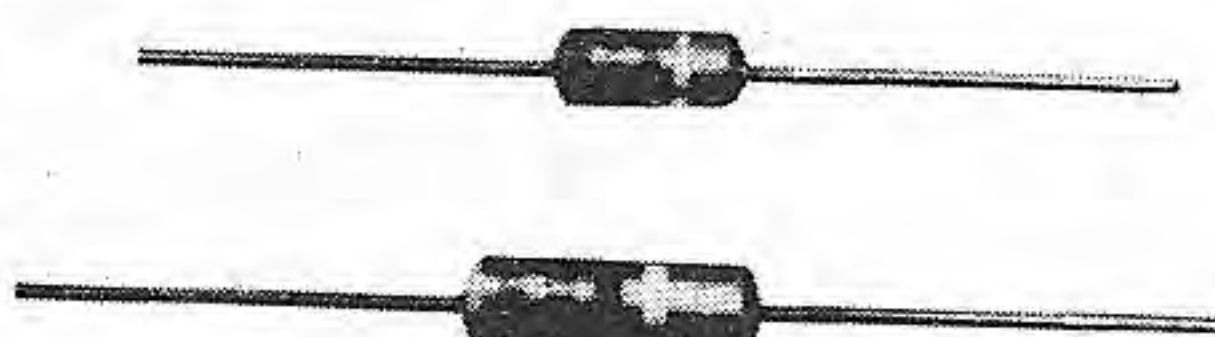


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.75-3 MMF

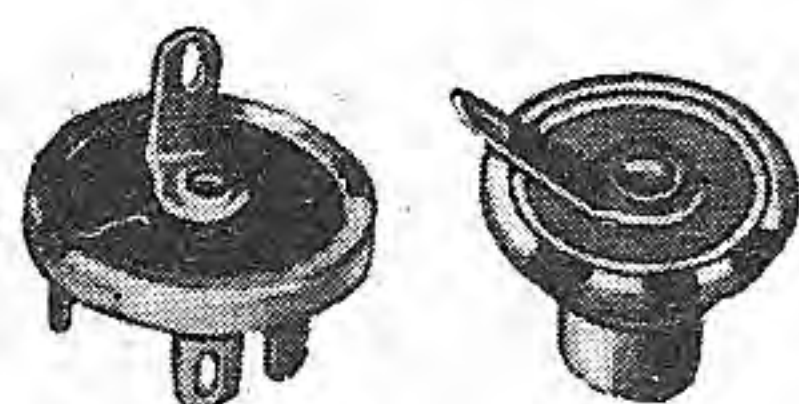


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Types 323
and 324
Insulated**
**Type 2322
Type 2336
Type 325**

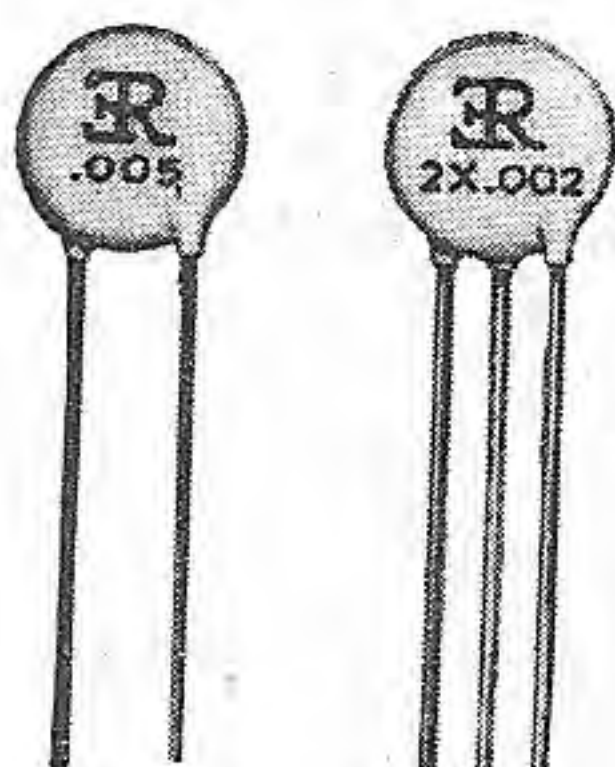
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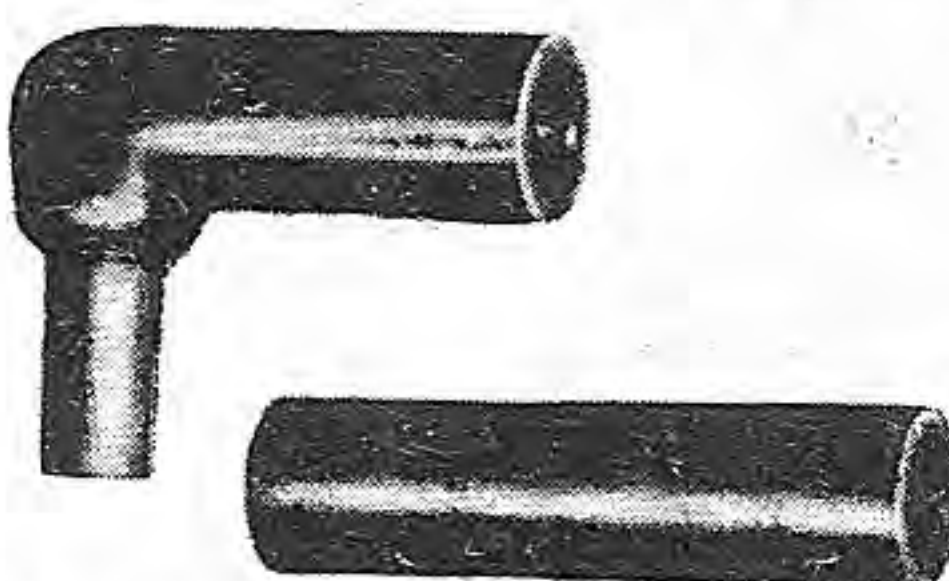
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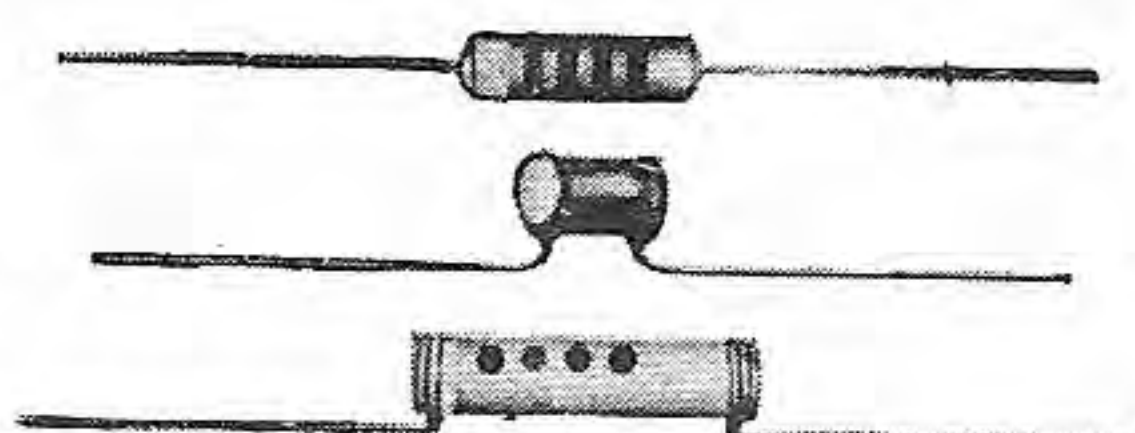
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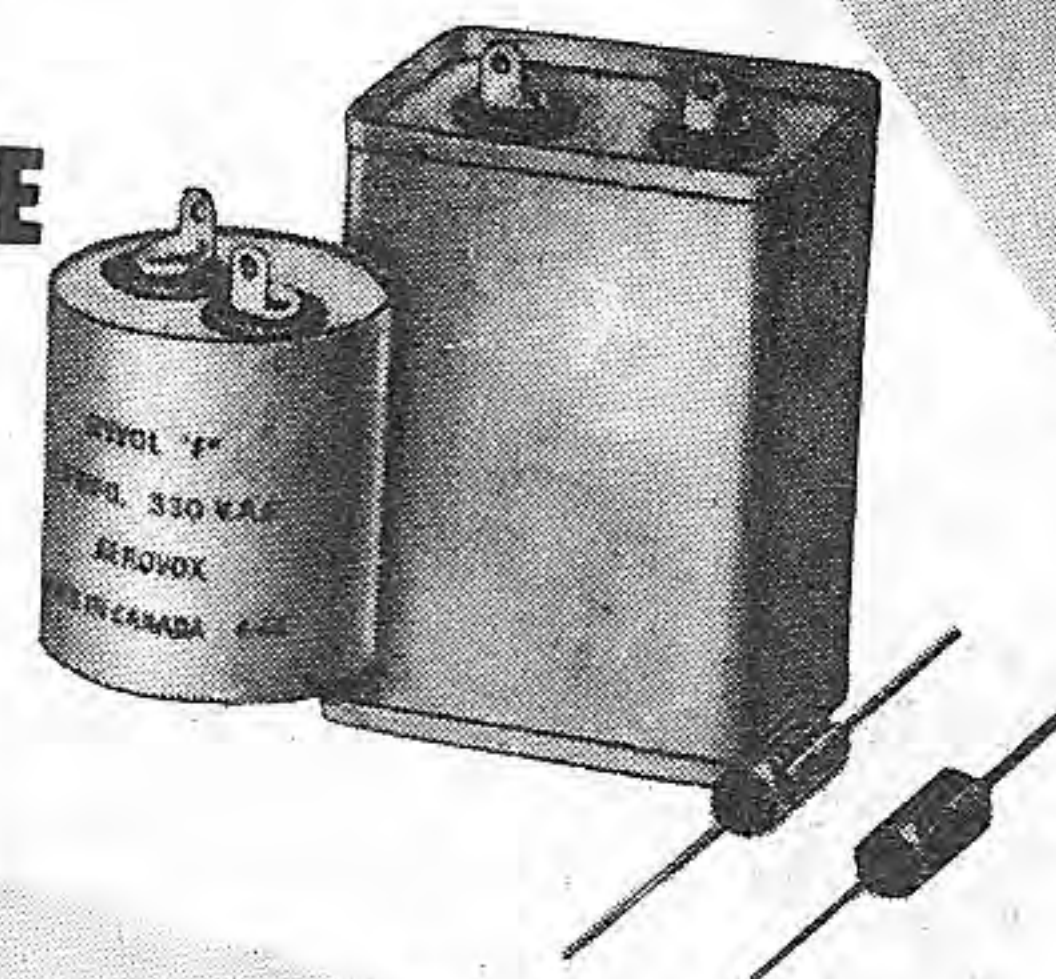
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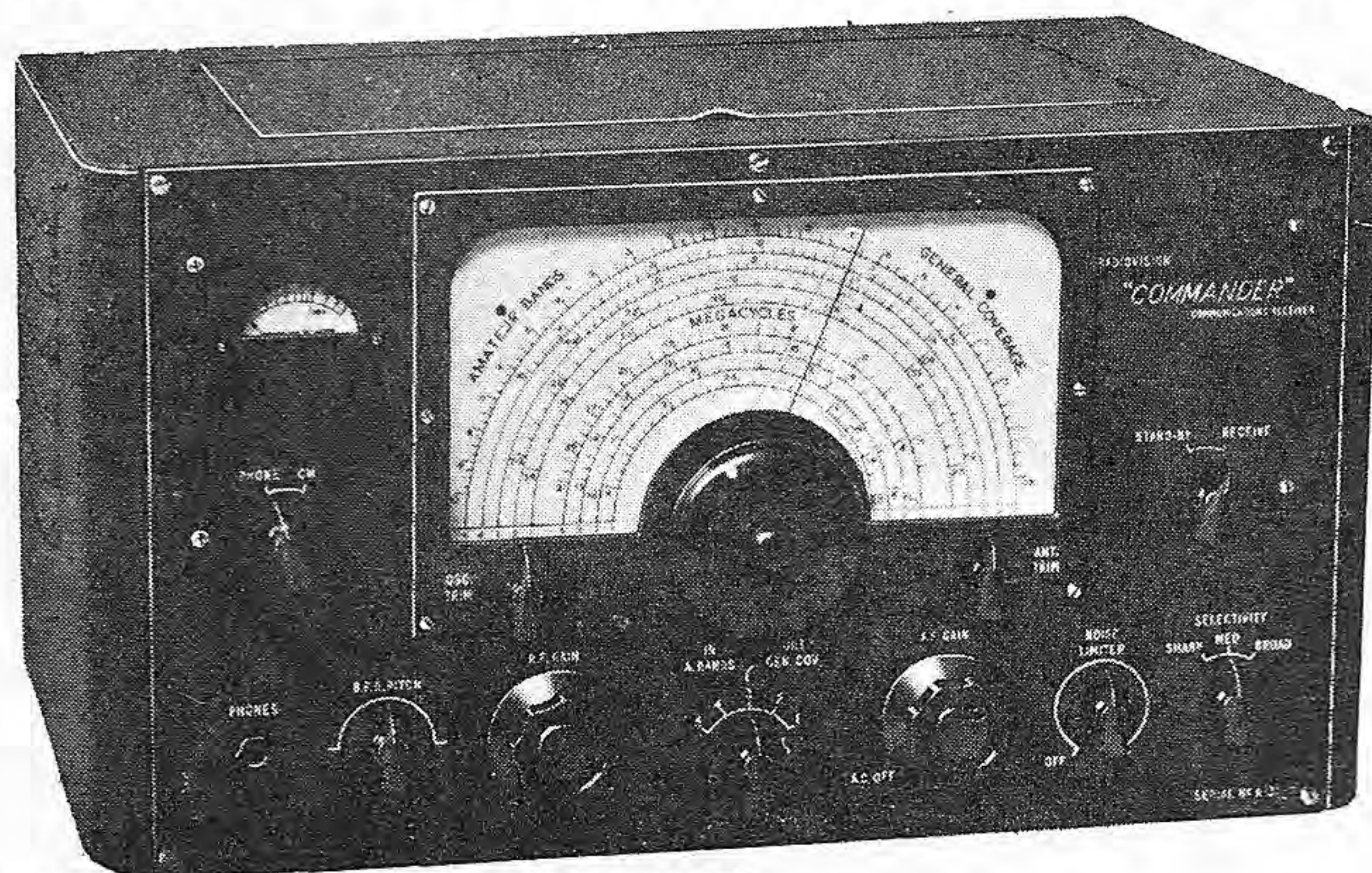
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TELEVISION

TELEVISION MIXER, OSCILLATOR and AFC

By Franklin L. Burroughs*

*This is the fourth of a series of articles on
Television by Sylvania Engineers.*

Last month's article "Television RF Amplifiers" described antennas and RF amplifier circuits suitable for television receivers. In this article we will discuss the mixer (or frequency-converter), and oscillator circuits.

Since there are no combined oscillator-mixer tubes of the pentagrid or triode-hexode types which will perform adequately in the high television band—174 to 216 Mc. - all modern television receivers capable of tuning the channels from 54 to 216 Mc employ separate oscillator and mixer tubes or duo triodes such as the Sylvania 7F8. In this article these two sections of the receiver will be considered separately.

Mixer

The function of the mixer in a superheterodyne television receiver is to change the frequency of both the video and sound carriers simultaneously. The input signals, applied to the control grid of the mixer, are the video and sound carriers coming from the preceding RF amplifier stage, and a signal from the local oscillator. The frequency difference between the local oscillator signal and the video carrier signal is the intermediate frequency for the video channel, and the frequency difference between the local oscillator and sound carrier signals is the sound channel intermediate frequency. At the present time the recommended frequency for the sound IF channel

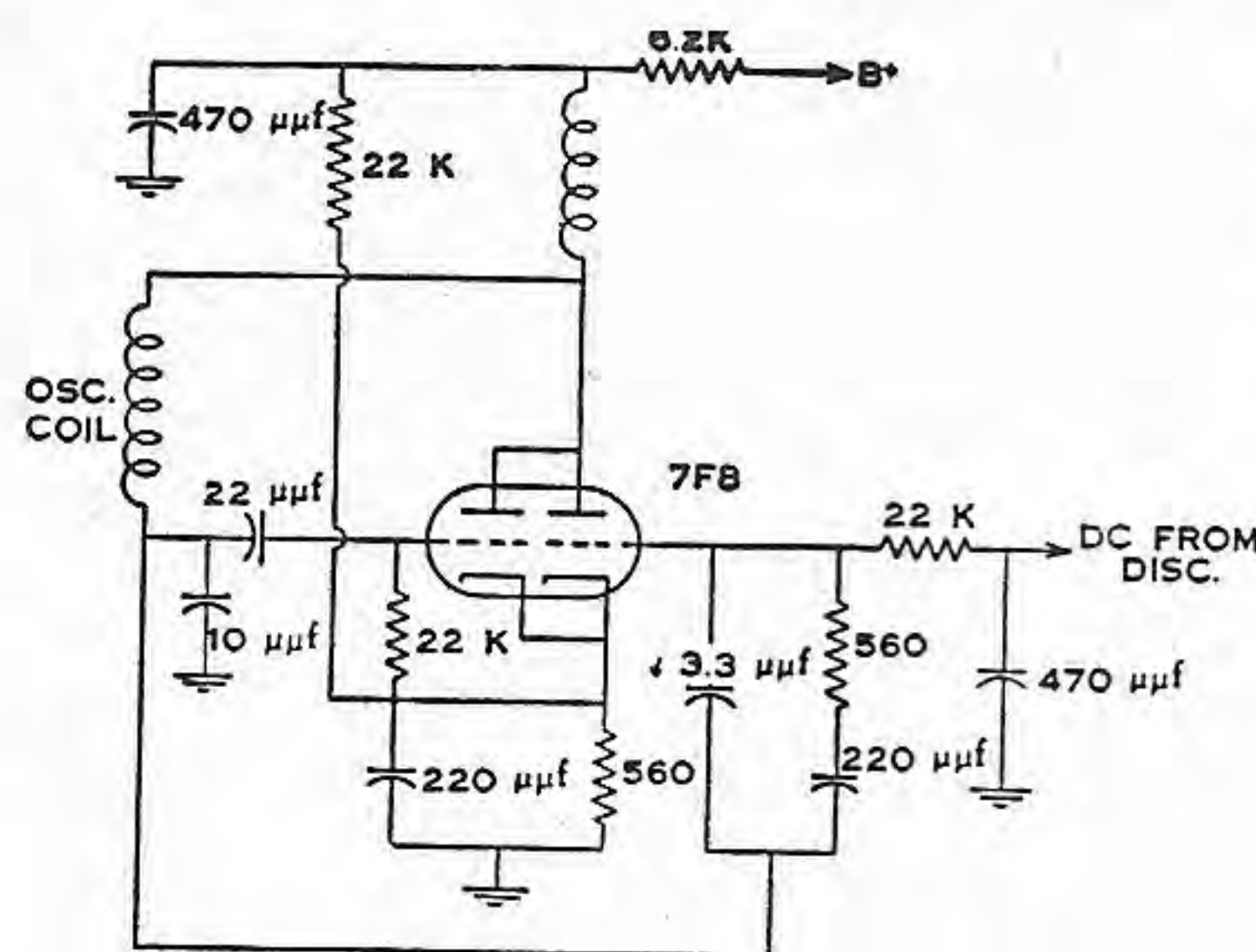


FIG. 1
OSCILLATOR EMPLOYING AUTOMATIC
FREQUENCY CONTROL

lies in the range from 21.25 Mc. to 21.9 Mc. With a few exceptions, which will be described later, in present day television receivers the local oscillator is operated higher in frequency than the video and sound carriers. Then, since the video carrier frequency is 4.5 Mc. below the sound carrier, the video IF channel is 4.5 Mc. higher in frequency than the sound IF channel. For example, on channel 2 the video and sound carrier frequencies are 55.25 Mc. and 59.75 Mc. respectively. With the local oscillator generating a signal at 81 Mc., the sound IF channel is 21.25 Mc., and the video IF channel is 25.75 Mc.

In order to obtain a reasonable conversion gain over the wide band of frequencies accommodated by the mixer stage it is necessary to use a tube which has high gm, sharp cut-off, and low input and output capacitances. Also, since the circuits in the mixer grid must tune to frequencies as high as 216 Mc., a tube having a small physical structure is required. The mixer input circuits are tuned to frequencies so far removed from those amplified in the plate circuit (the sound IF and video IF) that a

considerable amount of grid-plate capacitance can be tolerated without regenerative effects. Triodes are often used as mixer tubes, although there are many receivers which use in the mixer stage a high gm pentode of the same type as the tubes employed in the RF and video IF stages.

Oscillator

The local oscillator in a television receiver must supply to the mixer grid a signal strong enough to enable the mixer to operate as an efficient frequency-converter. The highest frequency of the signal generated is usually nearly 250 Mc. so the oscillator tube must have high gm and a small physical structure which keeps the internal capacitances and lead inductances to a minimum. Single or double triodes are used as local oscillators in practically all television receivers at this time.

It is important that the oscillator signal generated be free from instability due to temperature or voltage supply variations so that the sound IF is centered accurately in the pass band of the sound IF channel, and the signal carriers are properly rejected by the various wave traps in the video IF circuits. The bandwidth of the sound channel in most receivers is about 300 Kc. wide. The oscillator drift allowable in this case without re-tuning is less than .3 Mc. in 237 Mc. at the highest oscillator frequency, or less than .15 percent. To keep the oscillator frequency from drifting considerably it is necessary to construct the oscillator section of the receiver with excellent physical stability, and also to use circuits which give a minimum frequency change with temperature and voltage supply variations.

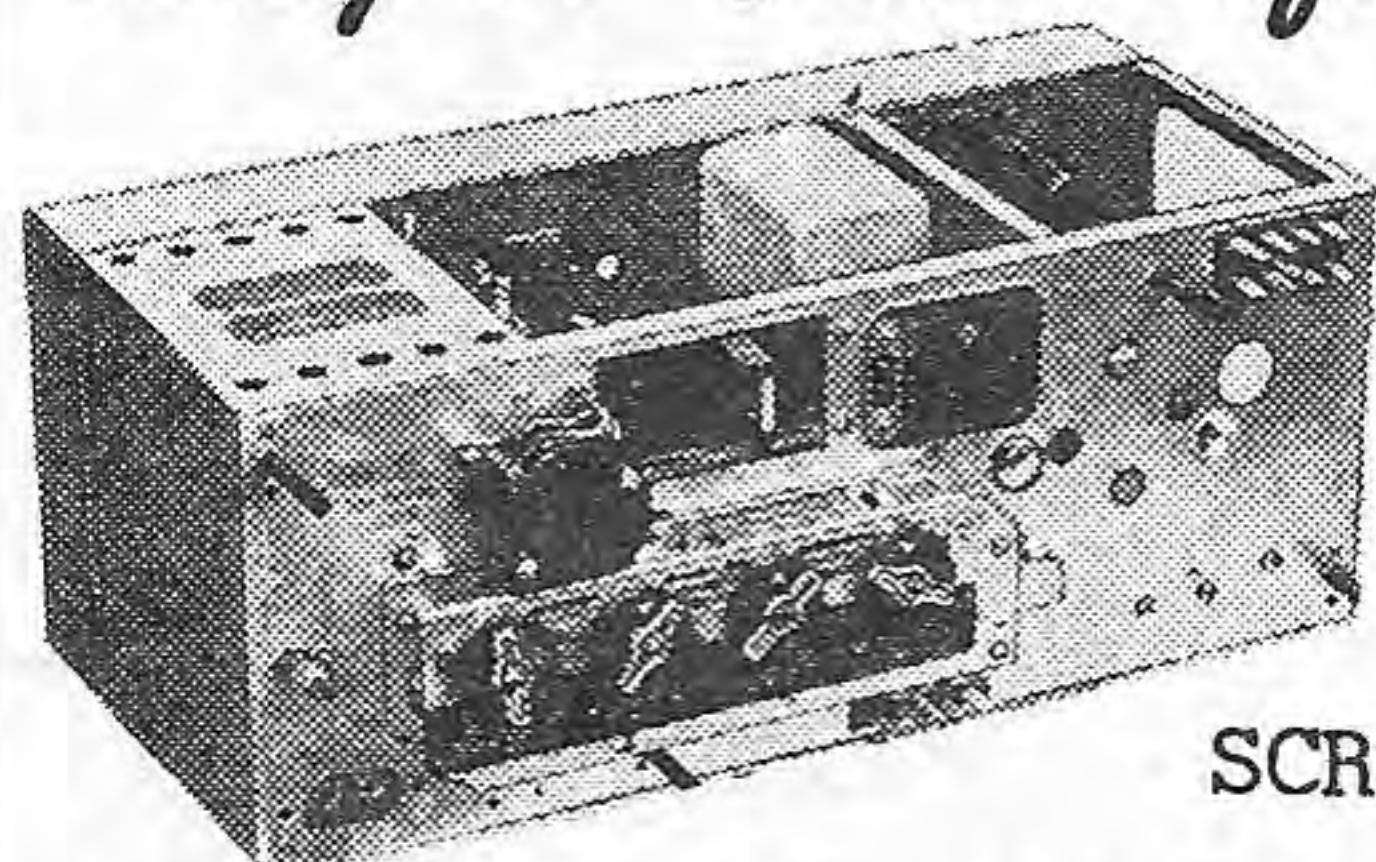
(Continued on next page)

**Franklin L. Burroughs received the degree of B. S. in Electrical Engineering in 1932 from Syracuse University. He joined Sylvania in 1937, starting in the Engineering Test Department at Emporium. In 1939 he worked in the Television Laboratory at St. Marys, Pennsylvania, and returned to Emporium the following year, where he worked in the Tube Application Department from 1942 to 1946. Mr. Burroughs served as Project Engineer in the Industrial Apparatus Plants at Emporium and WilliamSPORT. Since then he has been with the Advanced Development Section of the Central Engineering Labs at Kew Gardens and Flushing, Long Island, where he is working on television problems.*

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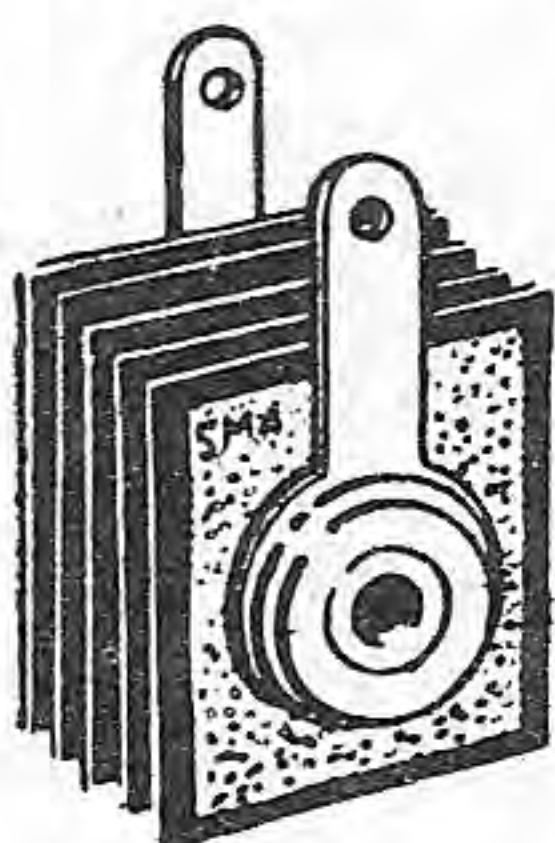


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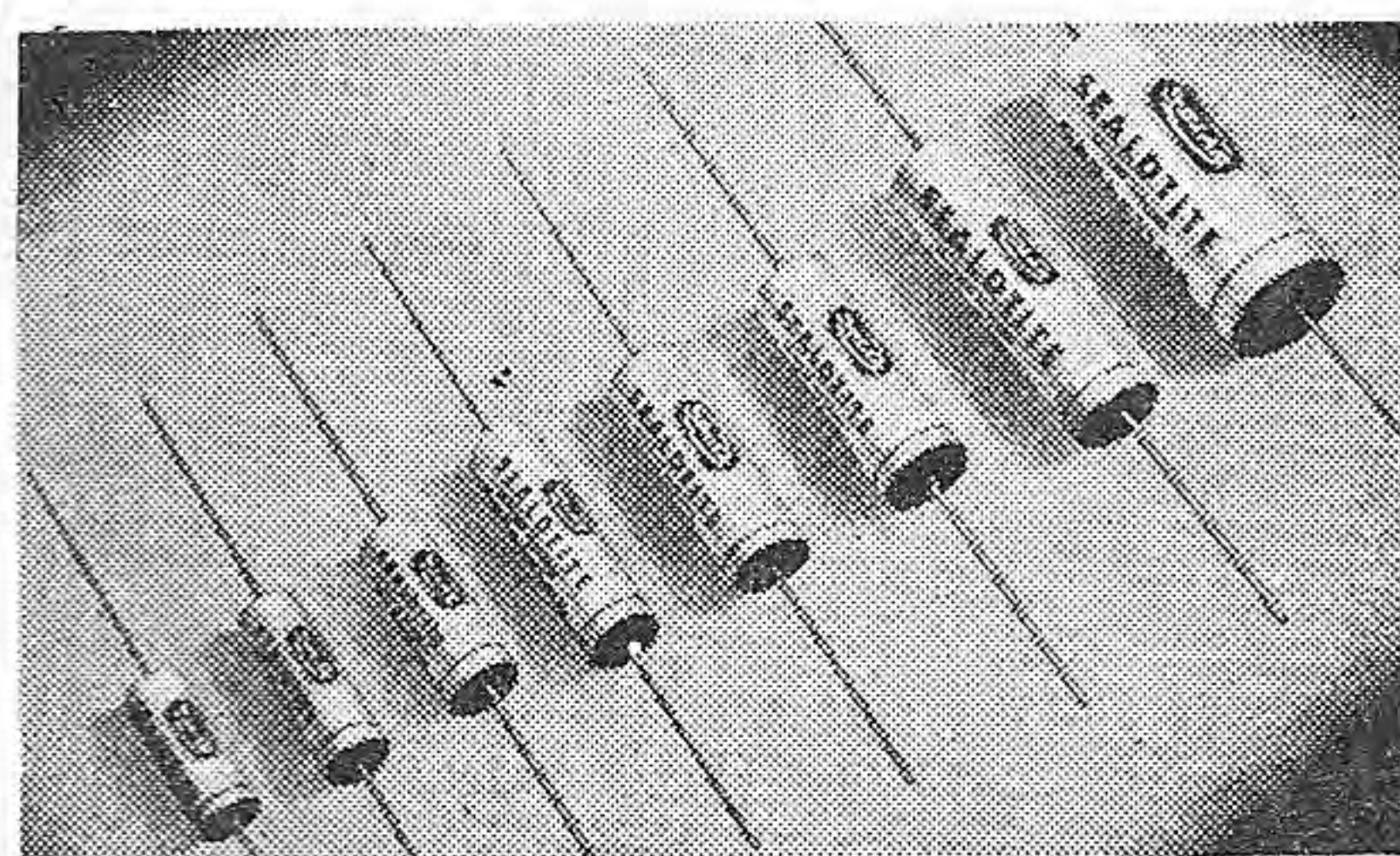
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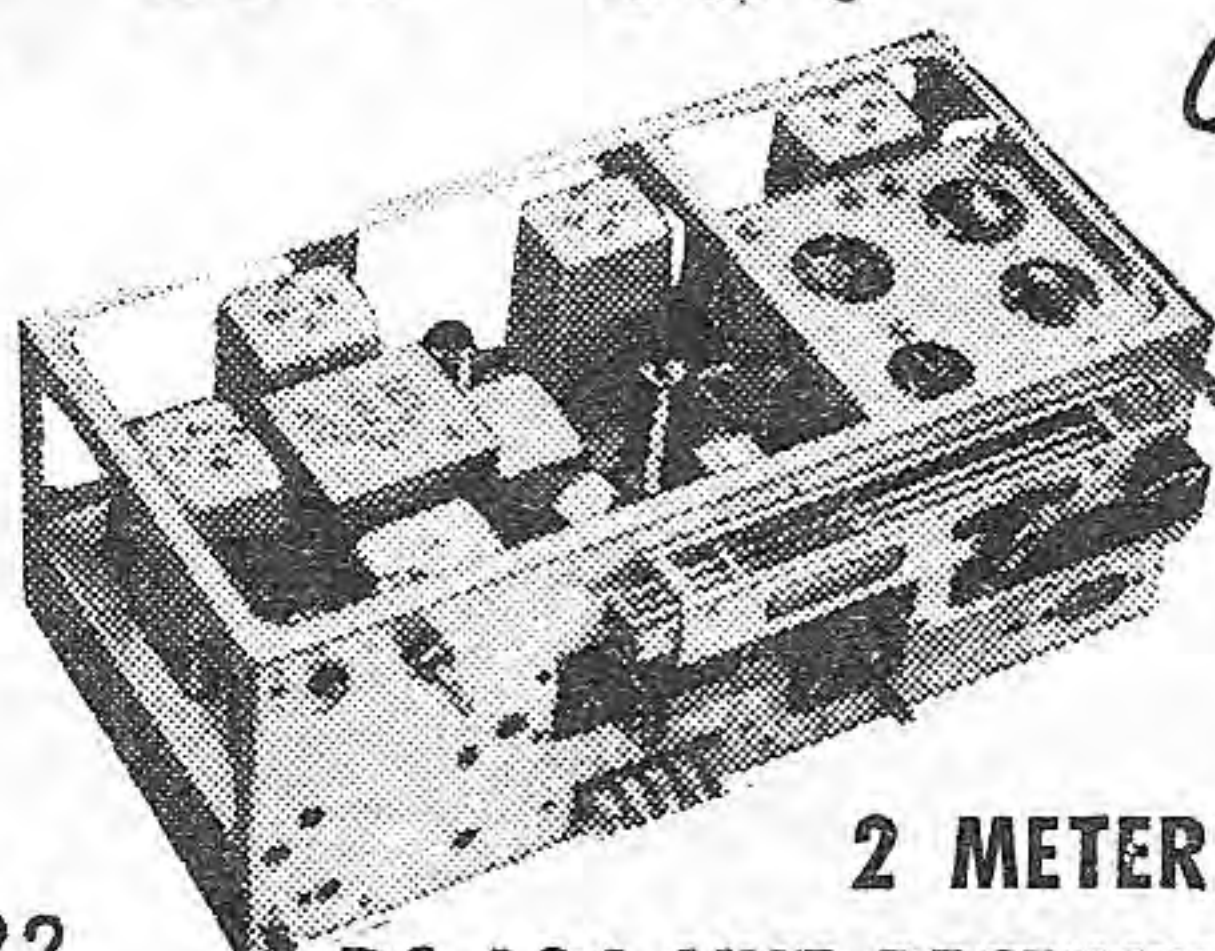
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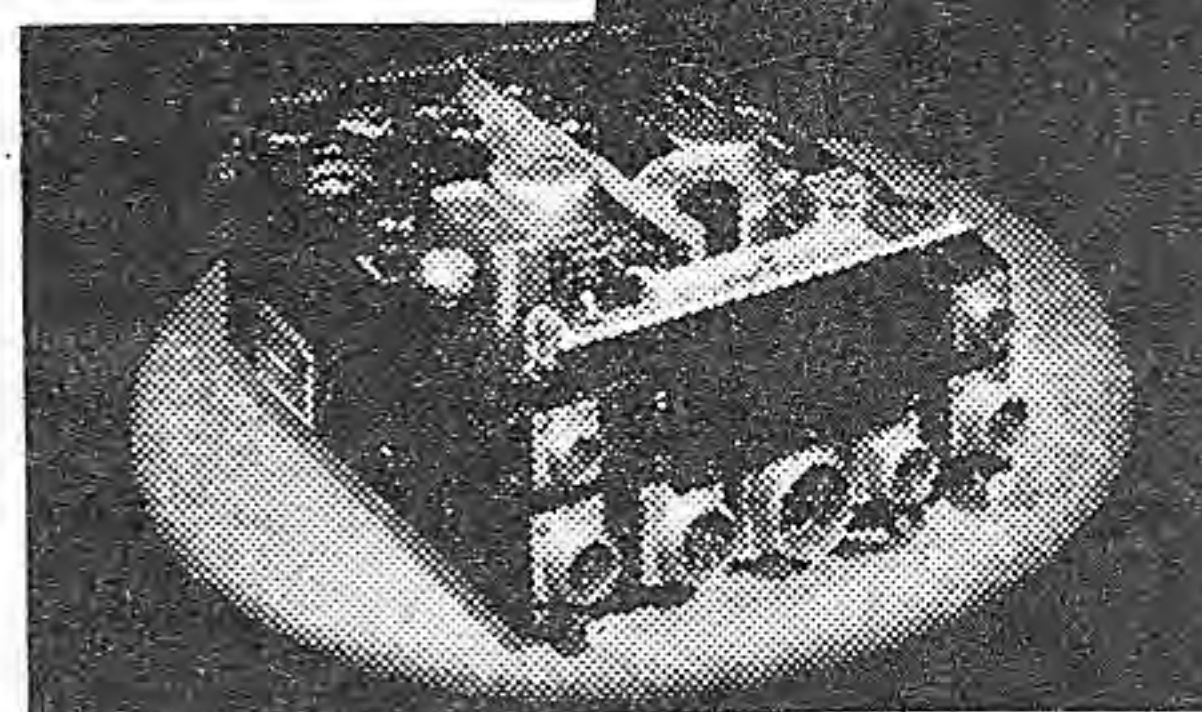
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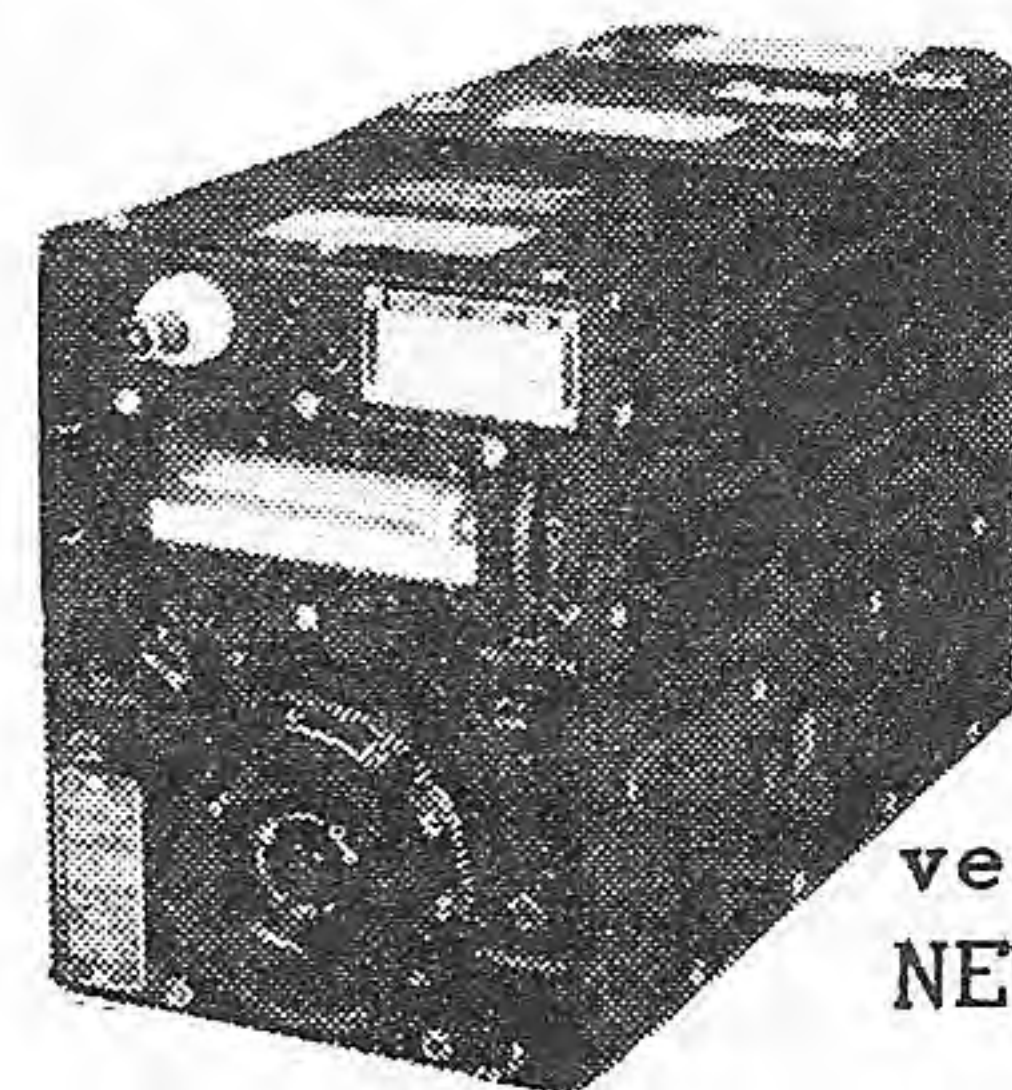
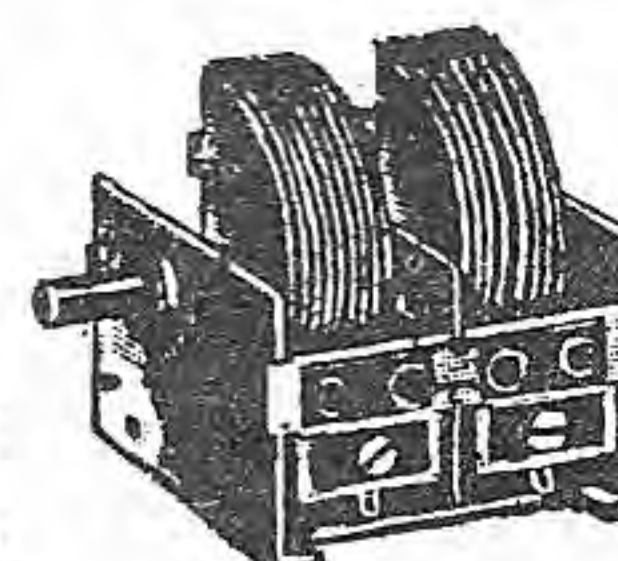
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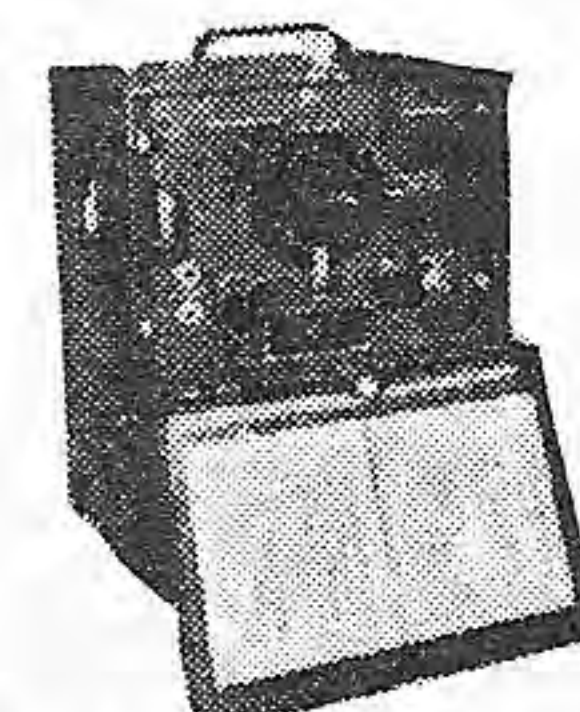
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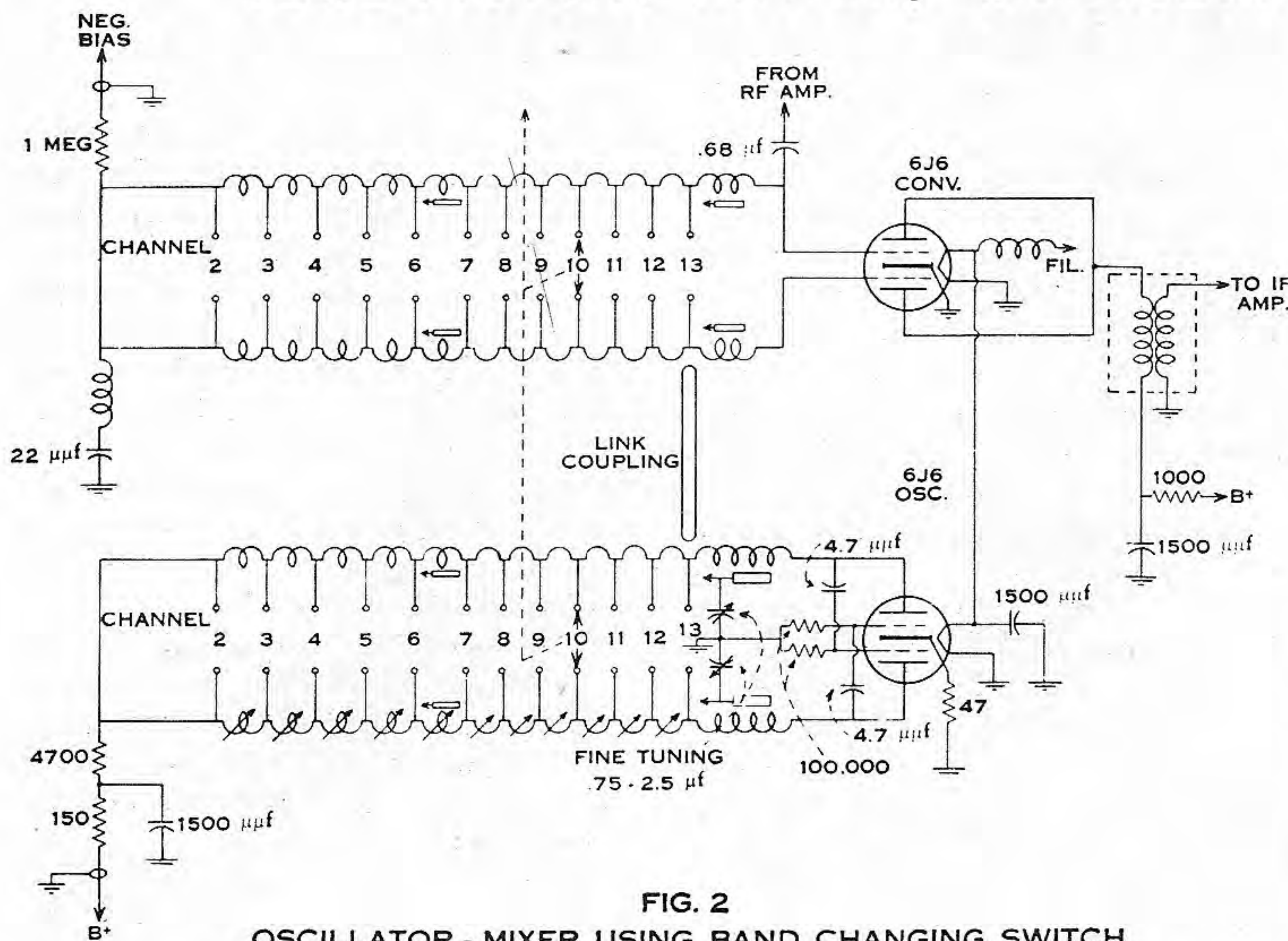


FIG. 2
OSCILLATOR - MIXER USING BAND CHANGING SWITCH

Some receivers maintain the oscillator signal at the proper frequency by an AFC system in which a frequency-regulating voltage from the sound discriminator output is applied to a control tube connected to the local oscillator. A circuit diagram of such an AFC oscillator is shown in Figure 1.

Some television receivers employ a sound receiving system known as the intercarrier sound system. A future article in this series will describe the system in detail, but for the present it is necessary to consider one characteristic of intercarrier receivers because of its effect on the local oscillator circuits. In the intercarrier system the heterodyning frequency which determines the sound intermediate frequency is the video carrier. As a result the receiver is relatively immune to local oscillator instability, and the oscillator design is considerably simplified. Also such a receiver may incorporate a simplified IF amplifier of a type which allows the local oscillator to be either lower or higher in frequency than the incoming carriers. In this case the highest oscillator frequency, for channel 13, could be less than 200 Mc.

Practical Oscillator and Mixer Circuits

There are several different practical arrangements of oscillator and

April, 1951

mixer circuits and components used in television receivers which operate satisfactorily in the twelve television channels from 54 to 216 Mc. One system uses a rotating turret which holds individual oscillator, mixer, and RF amplifier coils for each channel. As each channel is selected by a front panel control, the tuned circuit components are brought into their proper positions adjacent to the oscillator, mixer and RF amplifier tubes.

Another arrangement, the circuit diagram for which is shown in Figure 2, accomplishes the channel selection by means of a rotary switch which switches the proper inductance into the mixer and oscillator circuits as each channel is chosen. The plates of the double triode 6J6 oscillator tube are connected to pairs of series inductances in what may be considered a balanced transmission line. A shorting bar connects to opposite switch

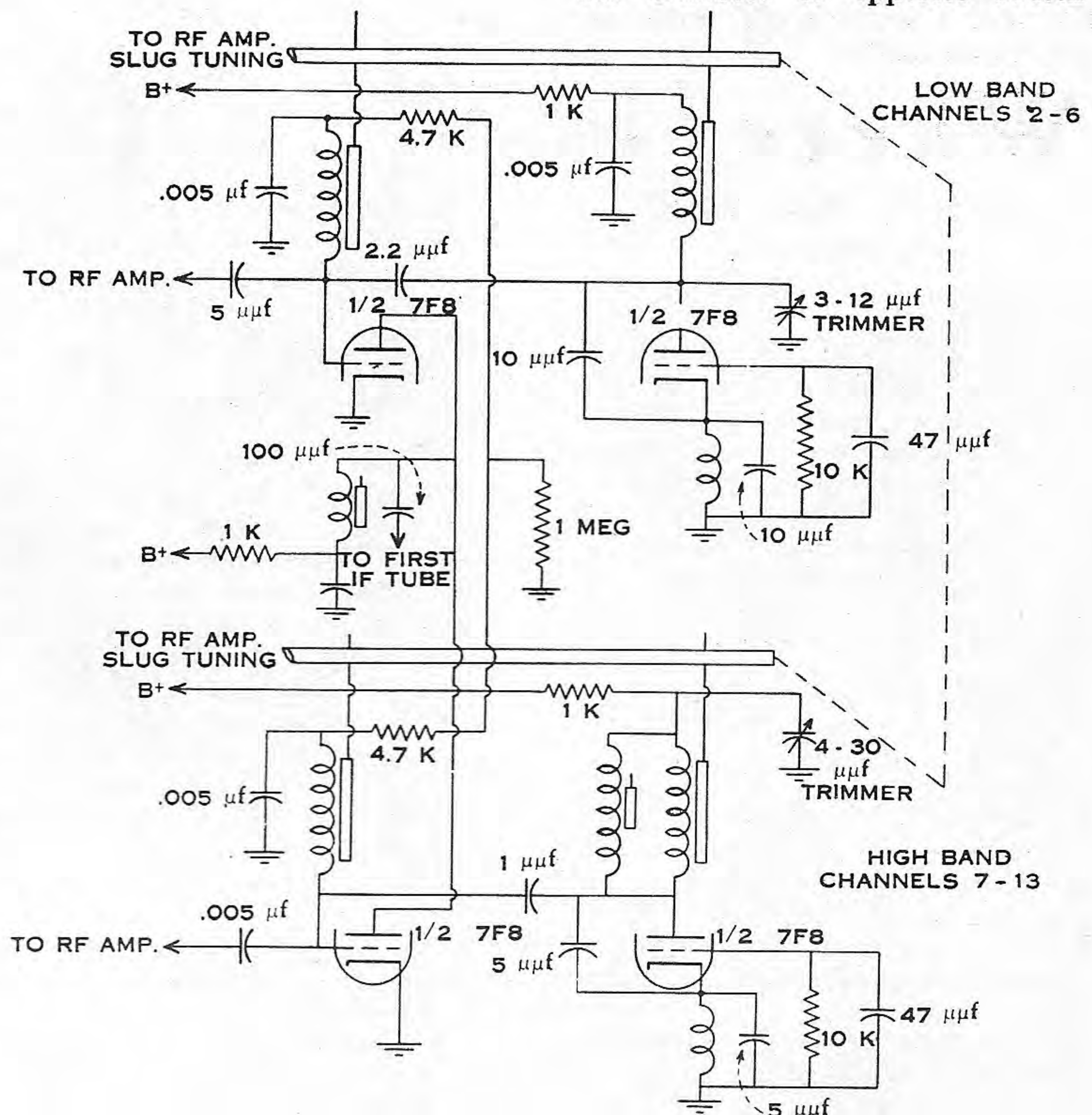


FIG. 3
OSCILLATOR - MIXER USING IRON CORE TUNING

points and moves along the line as the channel selector is rotated. The same switch selects tuned circuit components in the grid circuits of a similar double triode (and also in the RF amplifier tuned circuits which are not shown in this diagram). Magnetic coupling between the oscillator and mixer coils is used to inject the oscillator signal into the mixer grid.

Figure 3 is a circuit diagram for a mixer-oscillator system using iron cores to tune the inductances in the mixer grid and the oscillator plate circuits. In this arrangement separate triode sections are used for the low and high frequency bands since the range of frequencies tuned in each circuit is too great to cover with one slug tuned coil. The oscillator voltage in this case is coupled to the mixer grid through a small capacitor.

The RF amplifier tuned circuits (not shown on the diagram) are selected by the same bar that holds the iron cores for the oscillator and mixer coils.

Wheee!!

By H. E. "Rube" Ruble

SREPCO Inc.

Reprinted from SREPCO NEWS

"Hey, Joe, Television puts us in Business!" Unless my memory is poor, things were never like this in the radio service business. Technical development coming so fast that we have to burn the midnight oil even to stay in the race. The public so eager to try and to enjoy this new field that the saturation of the market in two years is fantastic.

It is now apparent that these new 20 to 40 tube super wonders may require some maintenance. The first man to try his hand at this repair is the hardy old radio service man. He has found familiar looking parts in these machines, though many of them function in strange ways. The old familiar testing does not always disclose the trouble and by many good sound reasons the things shouldn't work at all. Tube plates at chassis potential—grids driven positive several volts—grids directly grounded—plate input 250 volts—oscillator output 9000 volts! (Must be perpetual motion!)—25-tube AC-

DC sets. The multiplicity of wire and cable makes a full-blown spider web look like a straight, simple line. Intermittents to drive you *bats!* While the customer is calling you every hour to question your progress and you don't know how you are making out yourself, some other guy calls up, burning the wires—he is waiting to pay you \$100 for a deluxe antenna and rotator so he can get a new station in Milwaukee. If you are not driven crazy by the phone, you may be able to do a lot of profitable business.

There are some rough days ahead, however. The customers are impatient. Want service *today*. It's all very well to say they have to wait while there is such a shortage of technicians, but it will surely be held against you later when there are more men trained. We urge you to do the very best you know how with public relations, as well as technically. There is such a shortage of skilled men now that if you are able to perform intelligent repair, spend all your available time at it. Sub-contract your roof-climbing to a steeple jack or carpenter or plumber. Train a man to install and adjust and teach the customers to operate the set.

Keep using your skill to its fullest extent. You will be able to turn out more jobs, make more new customers, and create a solid foundation for a good business.

TV Abuses

In an effort to reduce the growing number of complaints about television service, the New York Better Business Bureau in cooperation with television manufacturers, dealers, distributors and service companies has launched a campaign to correct such abuses.

The major purpose of such a campaign is to "reduce current faulty and misleading practices and to inform the public of basic facts they should know about purchasing and service, helping consumers to buy intelligently and reducing the volume of unjustified complaints," according to H. R. Jackson, president of the BBB.

Jackson stated that the New York BBB had received 2202 inquiries and complaints regarding radio and television during the first five months of 1950. Of these, 1263 were complaints. The total

of TV complaints received by the Bureau since January 1 nearly equals the total of all similar ones received during the entire 12 months of last year.

More than 1000 radio, television and appliance dealers from the New York area launched the campaign at a meeting on June 28. Each dealer was presented with copies of a booklet entitled "Things You Should Know About the Purchase and Servicing of Television Receivers." It contains information on interference, antennas, guarantees, servicing and general points of buying and servicing which will keep the customer out of trouble.

The booklets are available for distribution by dealers and may be obtained at a modest cost by writing to the Better Business Bureau of New York City, 280 Broadway, New York 7, N. Y.

As the television industry expands and also as additional engineering and production know-how is acquired by the trade as a whole, it might be well at this time to re-consider the importance of good installations and efficient servicing.

Unless sets are capable of operating on built-in antennas or on indoor aerials, a TV receiver is no better than its installation. Unfortunately, some maintenance men and organizations have a tendency to become lax in this respect, and poor installations follow. There is nothing more annoying to a set owner than a receiver which doesn't work or that works poorly.

At the present time, there are something like 12,000,000 TV receivers in use or operation, these installations will require thousands and thousands of trained technicians. Based on an average of three service calls a year per set, it is easy to figure out how many repair calls will be required this year and next year in order to keep the nation's video receivers operating.

And, on top of this business, there are still some 80,000,000 radios in use in this country and these also must be maintained in working order.

The servicing industry has gained considerably in stature. TV has taught the industry as a whole to look for greener pastures. A successful television business must have a successful servicing industry, and nothing should be left undone which will assist along these lines.

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Astatic Crystal Devices manufactured under Brush Development Co. patents

Try the
HQ-129-X

SEE IT AT YOUR DEALER'S

For Crowded Bands

YOU BUY

PERFORMANCE

IN THE

HQ-129-X

VE-made for VE's

Ask the VE
nearest you
who has one
to let you
hear it.

SEE THE HQ-129-X
AT YOUR DEALER'S

Pull the weak ones out of the QRM—Tune in a "ZL" and hold on to him—Turn on the noise limiter and really kill ignition noise—That is what thousands of hams are doing every day with the HQ-129-X



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A & A's

CANADAS' RECEIVER HEADQUARTERS



\$99.50

NEW! SW-54

Brilliant new superhet covering 540 kc — 30 mc, with built-in speaker, bandspread, best communications features. AC/DC. 12BE6, 12BA6, 12AV6, 50C5, 35Z5 tubes. Tops for voice, music, code. Only 11 x 7 x 7"

A NEW HAM FAVORITE



S-77

AC-DC version of S-40.



NC-57

60 Cycles
\$170.00

S-Meter
Extra



GREAT HRO-50

50-430 kc, 480 kc — 35 mc; supplied with AA, B, C, D coils, 15 tubes. 8 watt p-p output within 1 db 50-15,000 at phono output. Many accessories available. Speaker extra.

\$599.95 60 cycle
Speaker \$24.50

NC-183

\$471.25
60cy.



FAMOUS NC-183

14 tubes plus VR-150, 5U4G. Covers 540 kc — 31 mc, plus 48-56 mc. Phono input and push-pull 8 watt audio. Two tuned RF stages. 5 bands; bandspread. Speaker extra.

Speaker - \$24.50

NBFM unit \$26.55

IMPORTANT NOTICE: New Excise and Sales Taxes do NOT apply to many stock receivers shown!! Ordering immediately can save you money - on most models appearing on this page. Write!!!

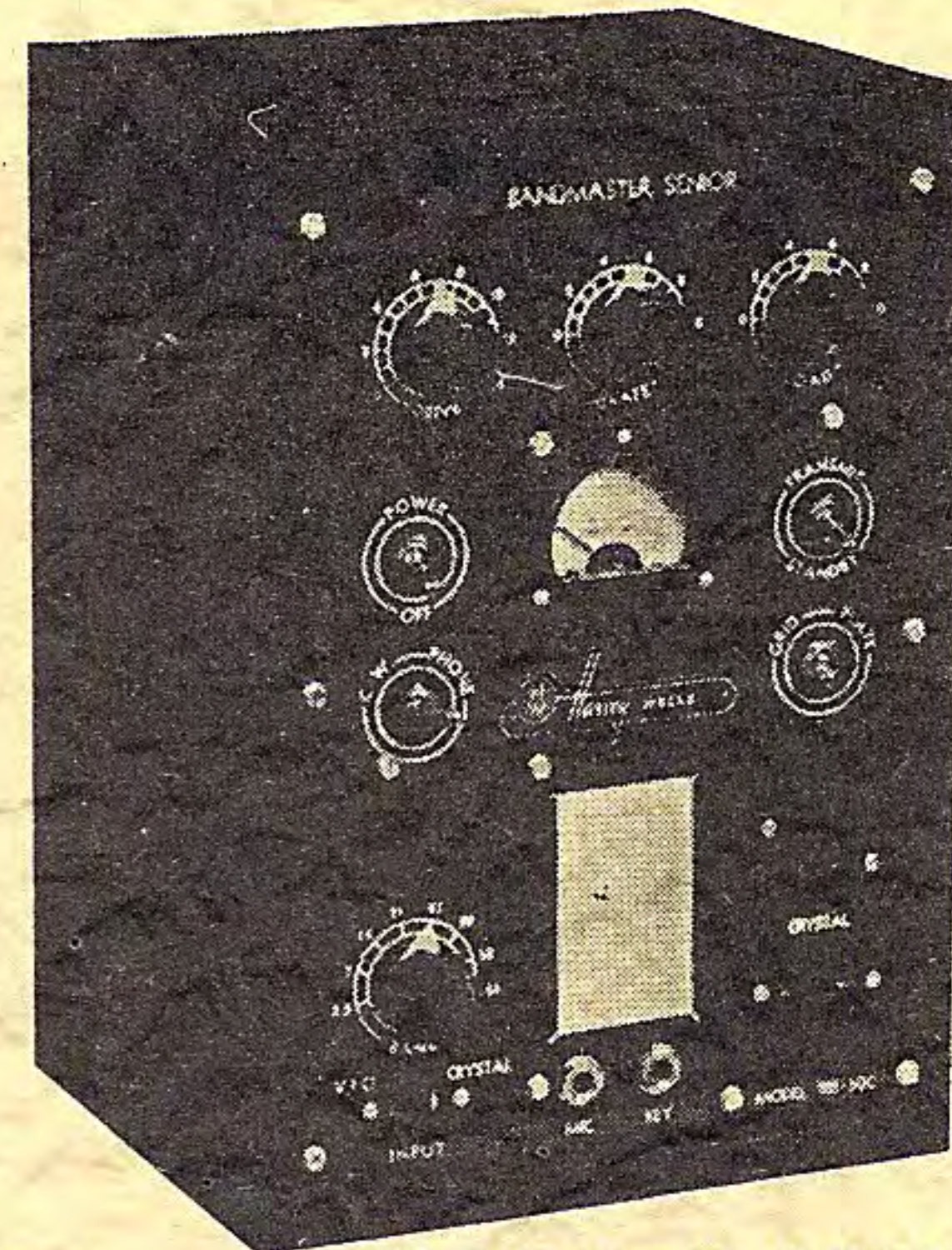
S-40B



\$185.50 in 25
or 60 cy.



Model S-53A



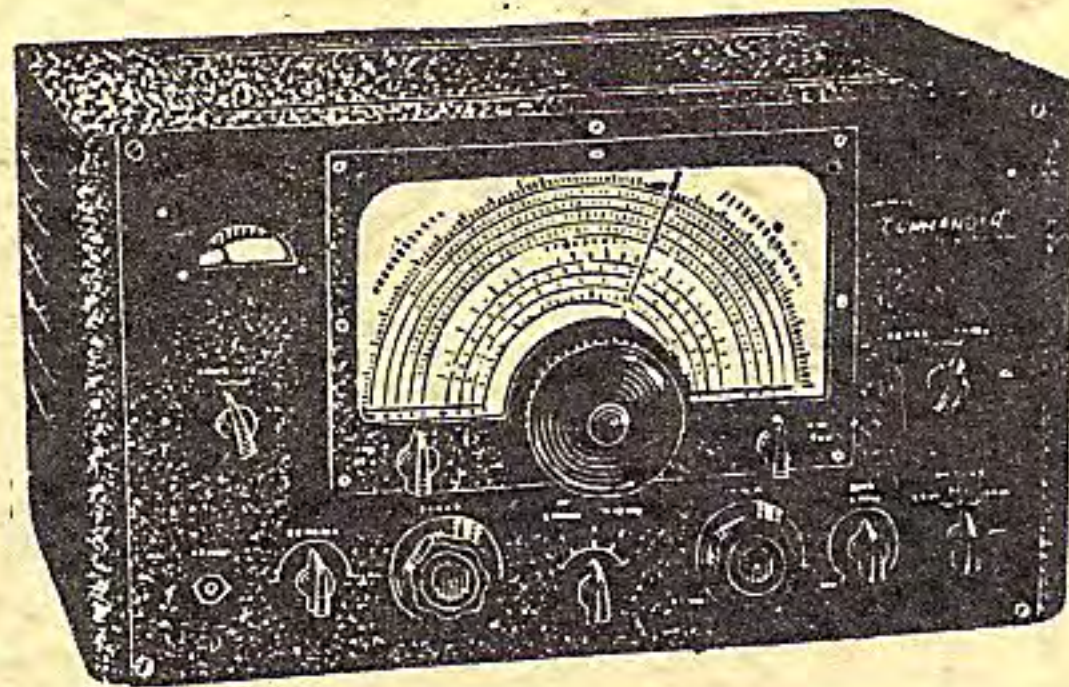
HARVEY-WELLS BANDMASTER TRANSMITTERS

Junior - \$142.65

Senior - \$182.00

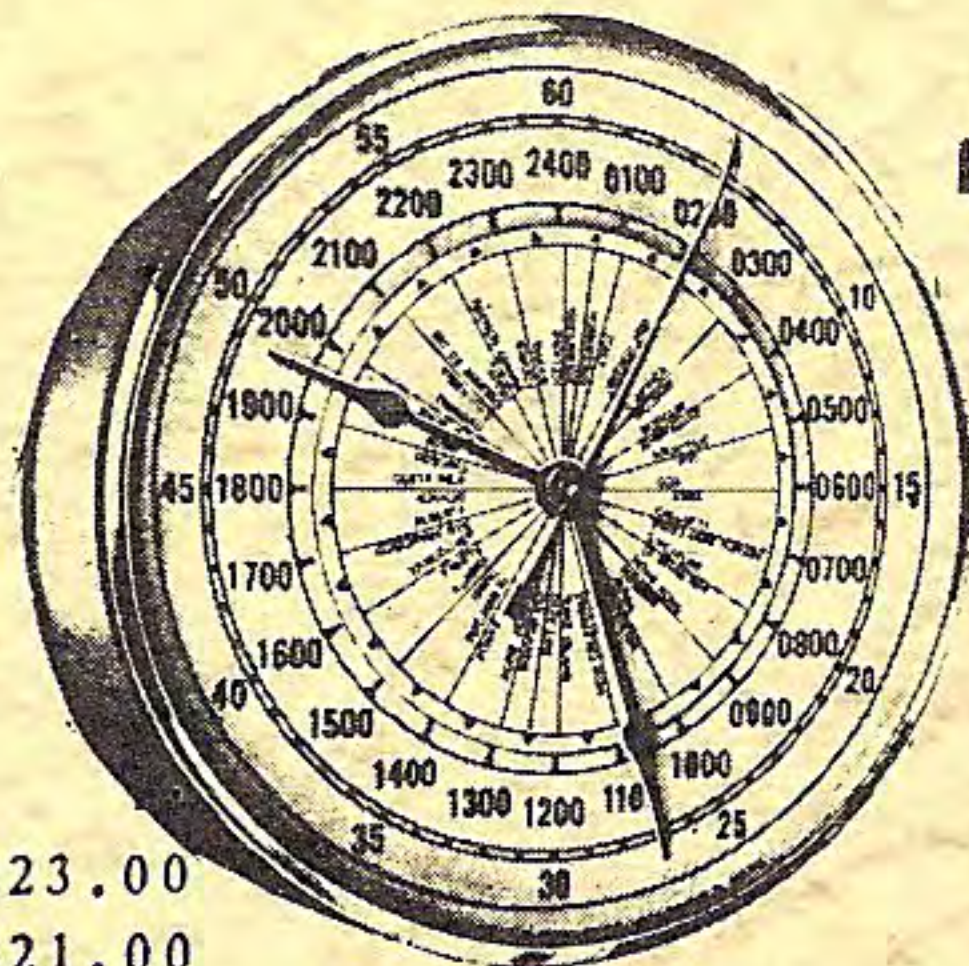
Deluxe - \$224.00

**FINEST COMMERCIAL
RIG FOR HAMS!!**

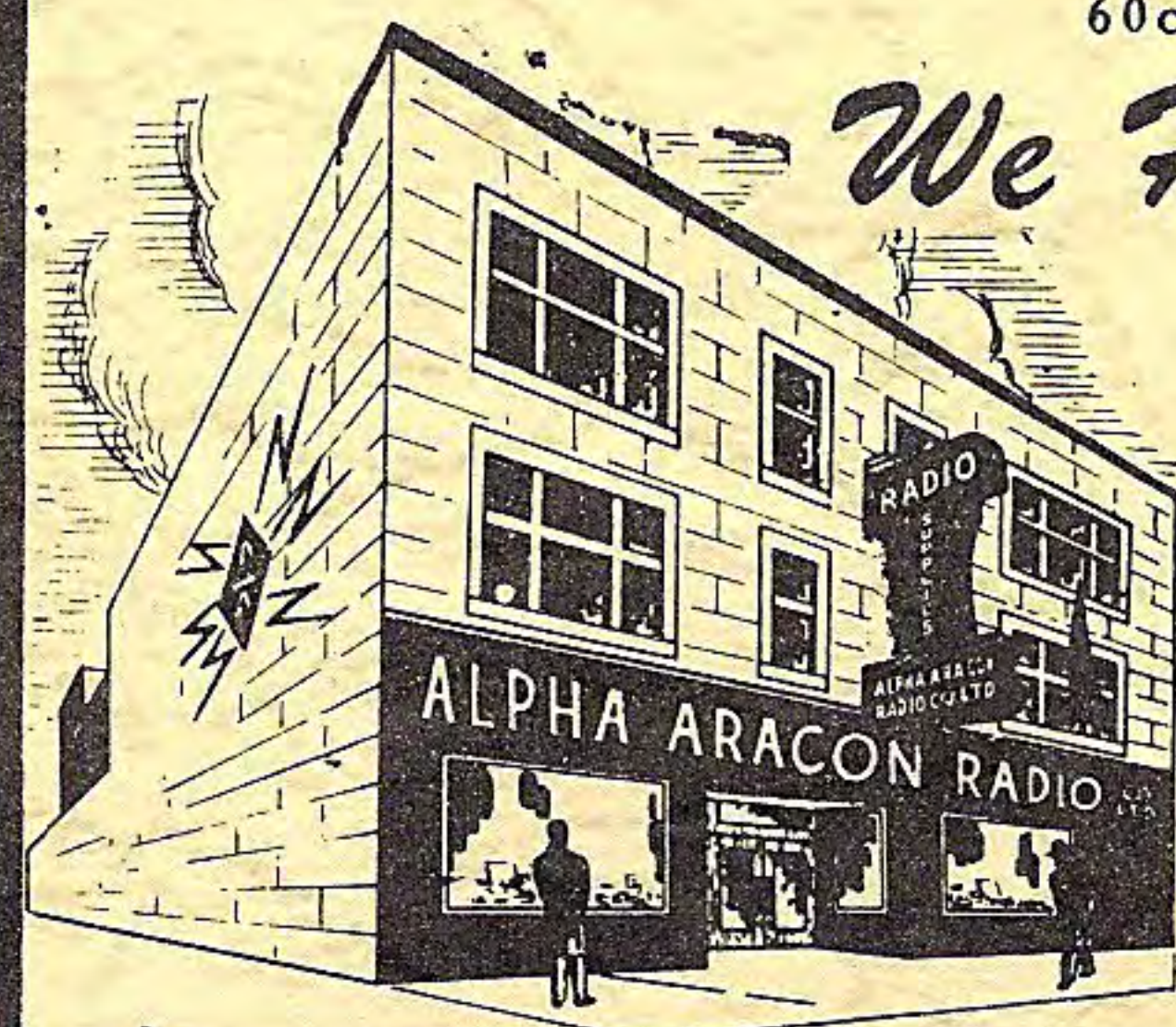


COMMANDER
25 or 60 cycles
\$285.00

25cy - \$23.00
60cy - \$21.00



Low-Priced
S-38B \$99.50



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HRO-50

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YOU'LL BUY IT!

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NEW! National SW-54
Complete \$99.50



**Latest and Finest
Version of the World-
Famous HRO Series!**

AMATEUR
NET **\$599.95**

Speaker - \$24.50
NBFM -\$26.55 net

Prices shown are subject to new Dominion taxes in some cases

NC-125

Speaker
\$18.00
net

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they're just 75¢ each. Buy several now!

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