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TELEVISION COMMUNICATIONS - SERVICE - SOUND

VOL. 13, No. 5

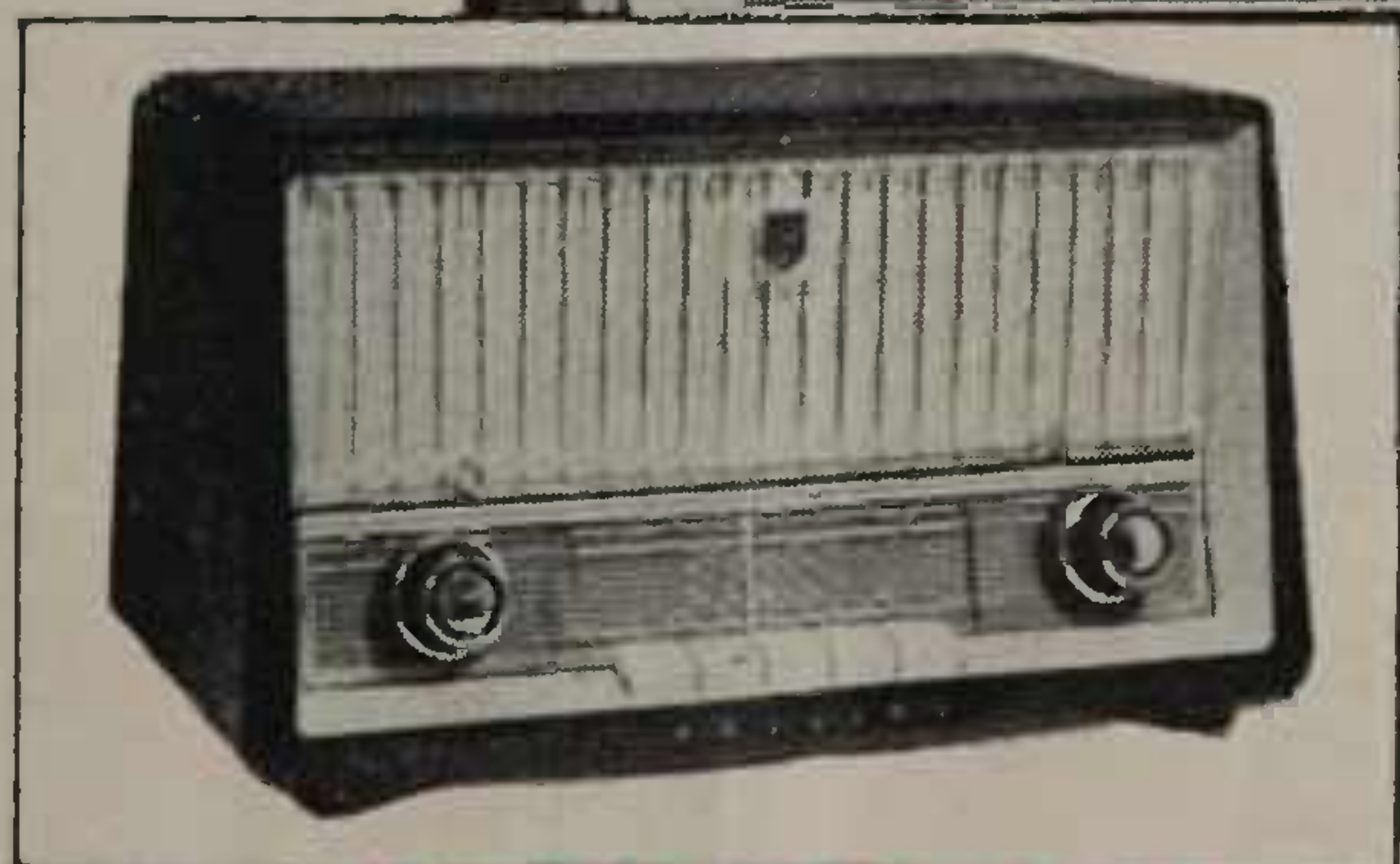
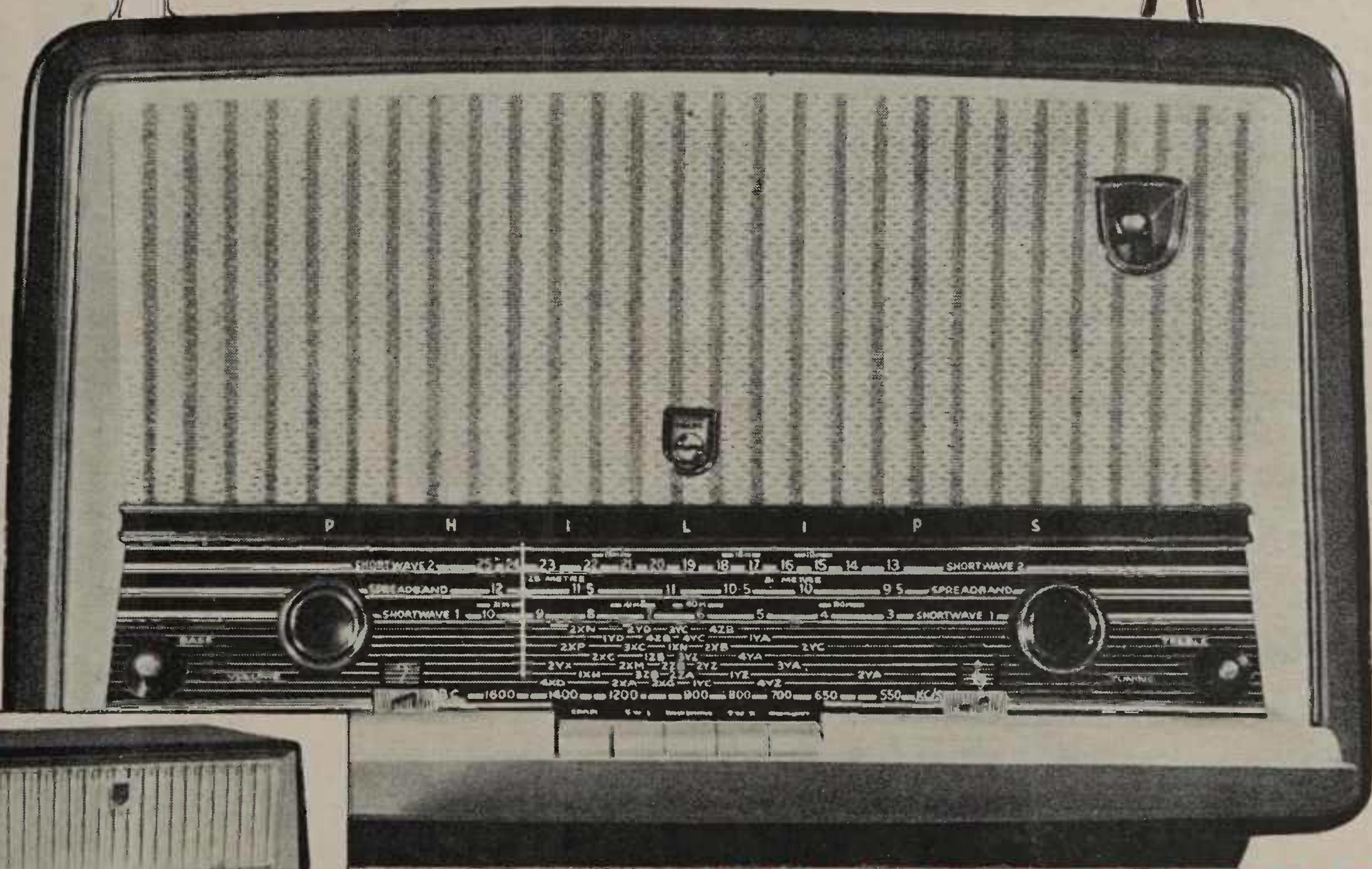
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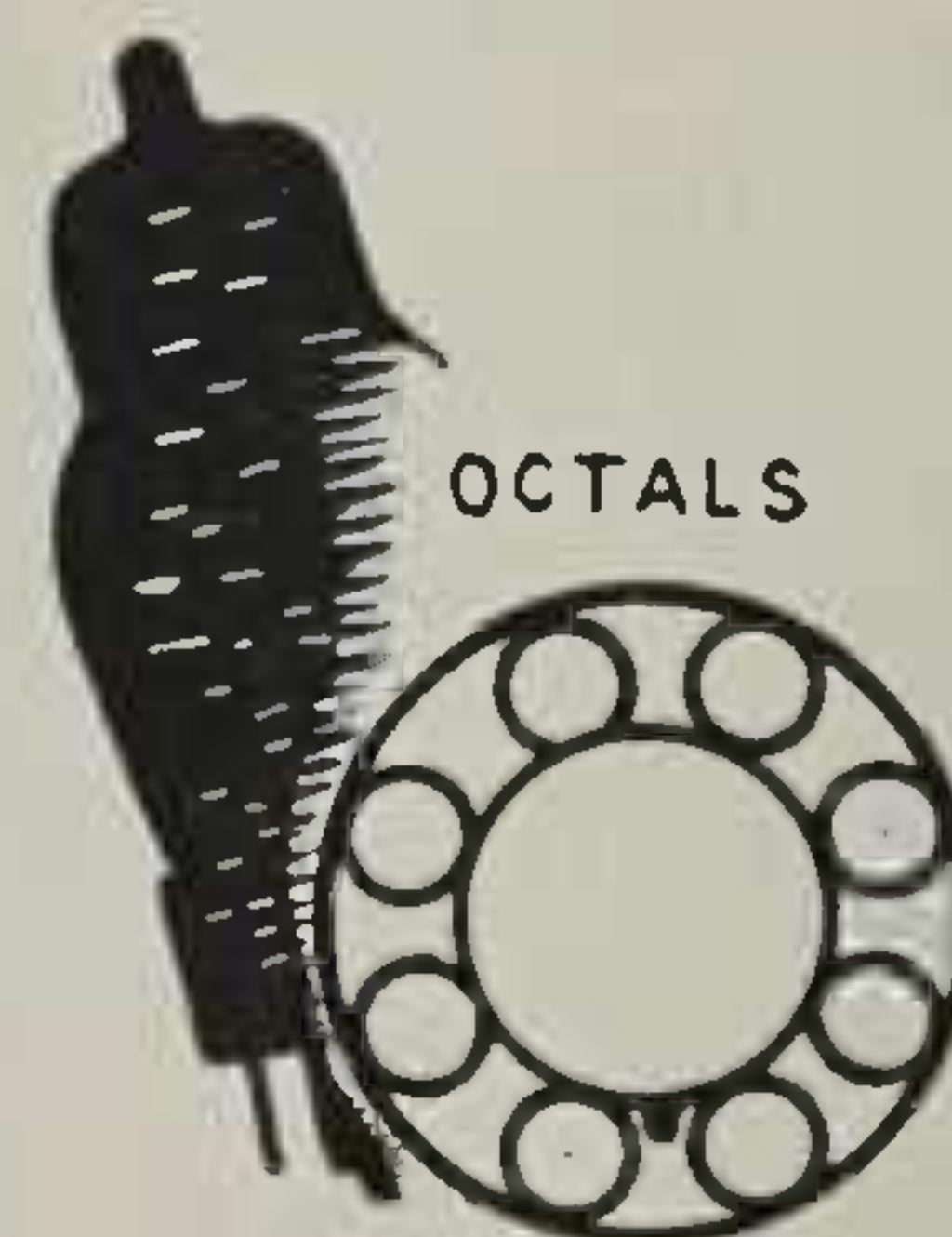
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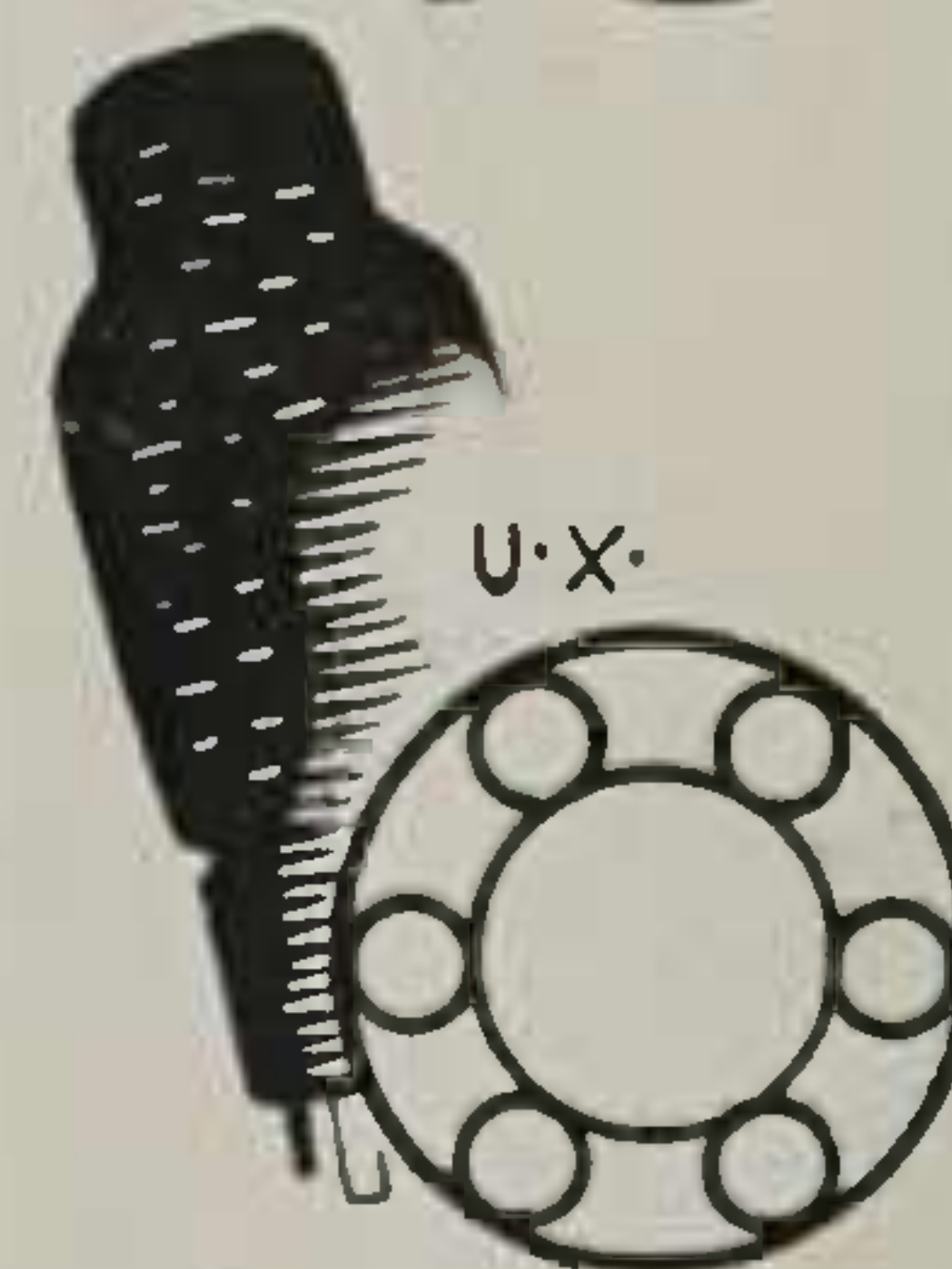
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U-X



NOVALS

Radio and Electrical Review

Vol. 13, No. 5

JULY, 1958

Official Journal of
The New Zealand Electronics Institute
(Inc.).
The New Zealand Radio and Television
Manufacturers' Federation.
The New Zealand Radio and Electrical
Traders' Federation.
New Zealand Radio, TV, and Electrical
Traders' Association (Inc.).

Managing and Technical Director:
W. D. FOSTER, B.Sc.

Subscriptions:
2s. 3d. per copy; 27s. per annum, posted.
Advertising Rates supplied on application.

CORRESPONDENCE
All correspondence and contributions should
be addressed to:
The Editor,
"Radio and Electrical Review"
P.O. Box 6361,
Wellington, New Zealand.

OFFICES AND LABORATORY:
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Radio and Electronics (N.Z.) Ltd.,
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Stereophonic Gramophone Records

The article in last month's issue of this journal on this subject seems to have created a good deal of interest among those readers to whom we have spoken since it appeared.

The main questions raised have been concerned, naturally enough, with the possible appearance of stereo records (and, of course, suitable playing equipment) in this country. Others have asked whether the cost, when it does come, will not be prohibitive, and whether it will be justified in terms of results, comparing these with what can be done at present with high-quality monaural reproducing systems.

Unfortunately, it is not possible at this stage to give unequivocal answers to any of these questions. It must be remembered that stereo discs and their associated equipment are not yet released for public sale either in the United Kingdom or the United States, although it seems certain enough that they will be made available there later this year or early next year. As with any new development, stereo disc business is likely to have a marked effect on the sale of ordinary records and their playing equipment; it seems likely, therefore, that firms in other countries, including our own, will wait to see what happens in England and America. Thus, it seems unlikely that any move will be made to introduce stereo discs here until they have been on the market in those places for some time.

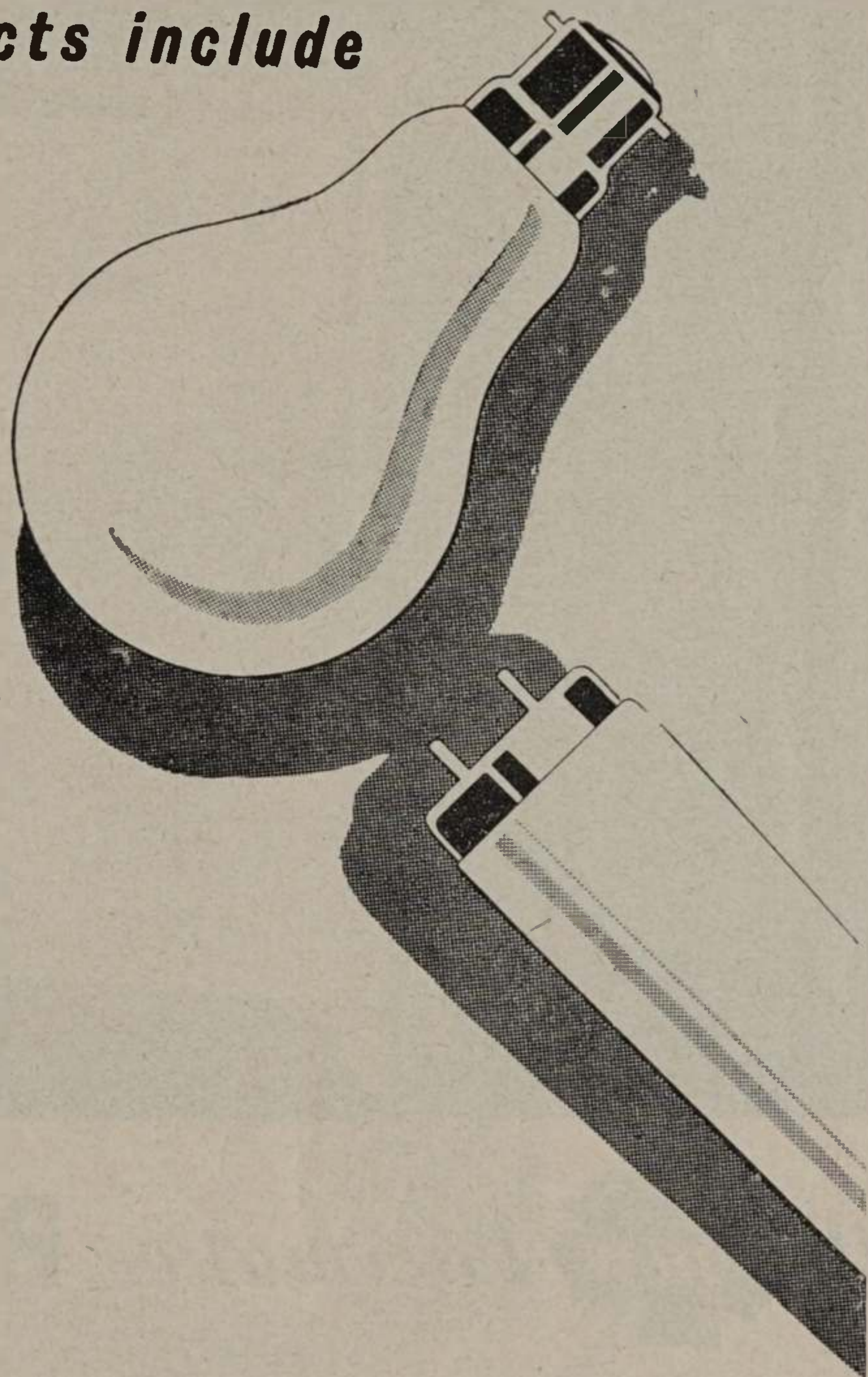
The question of whether the extra complication and cost will be worth while from the user's point of view is a difficult, if not an impossible one to answer at the present juncture. One thing that many proponents of stereo sound seem to forget altogether is that large listening rooms are desirable, if not essential, for stereophonic listening. We all know how much better is the sound of good conventional audio gear in a reasonably large room than in a small room, so that although we have as yet only limited experience of stereophonic listening, it seems to us that it will almost certainly require a large room for its success. New Zealand, by and large, is undoubtedly a country of small living-rooms. Indeed, with building costs rising all the time, living-rooms are tending to shrink rather than expand! If this hypothesis is true, then, the percentage of gramophone enthusiasts who will be able to reap the full benefit of stereo sound is likely to be severely limited. Then again, the expense of the equipment is likely to limit the probable market still further.

All this is not to say that we should not have stereophonic equipment available for those who want it. It will surely come, sooner or later, but the point we want to make here is that no one should be unduly disappointed if we do not get it here for some time, especially since its real advantages are by no means proven, whatever anyone may say about the sale of stereophonic tape equipment in the U.S.A.

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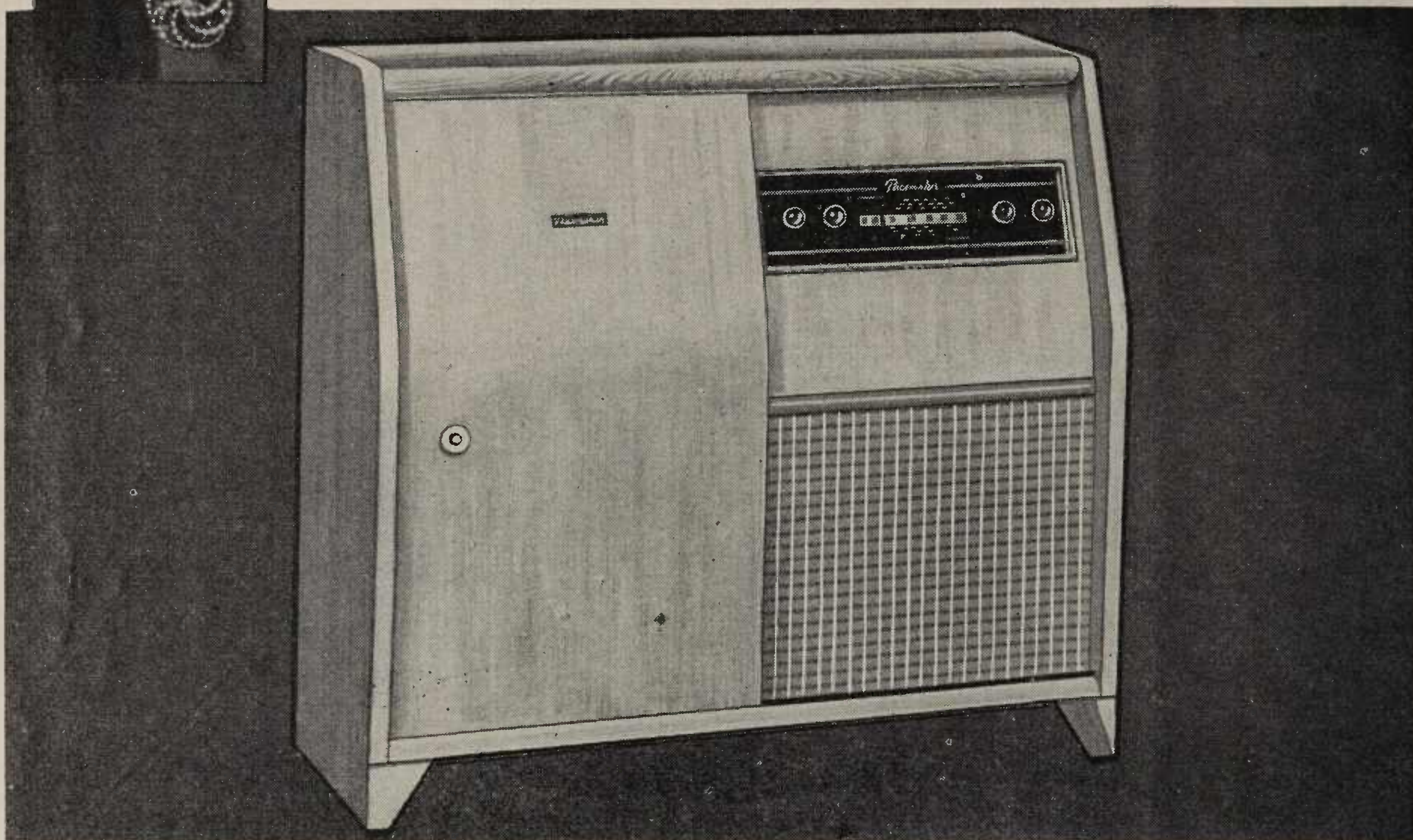
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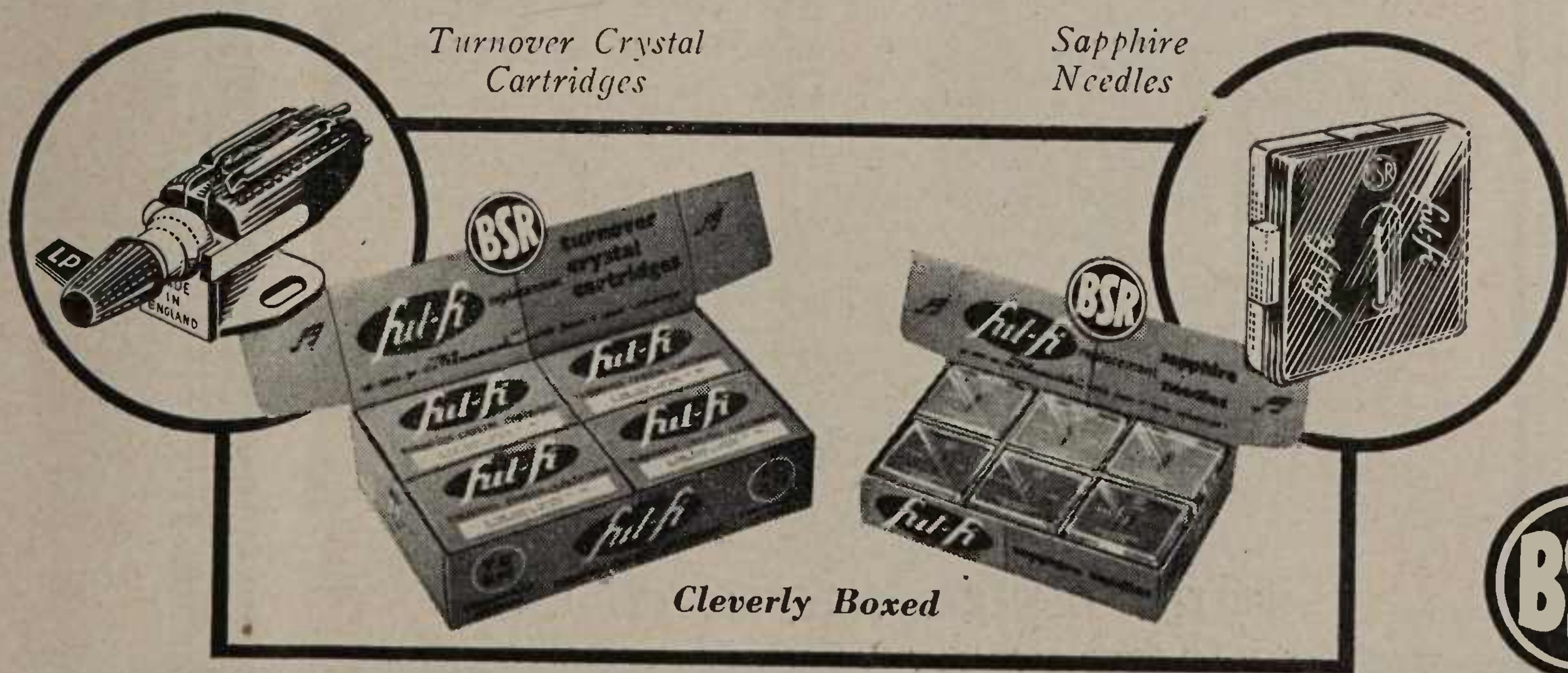


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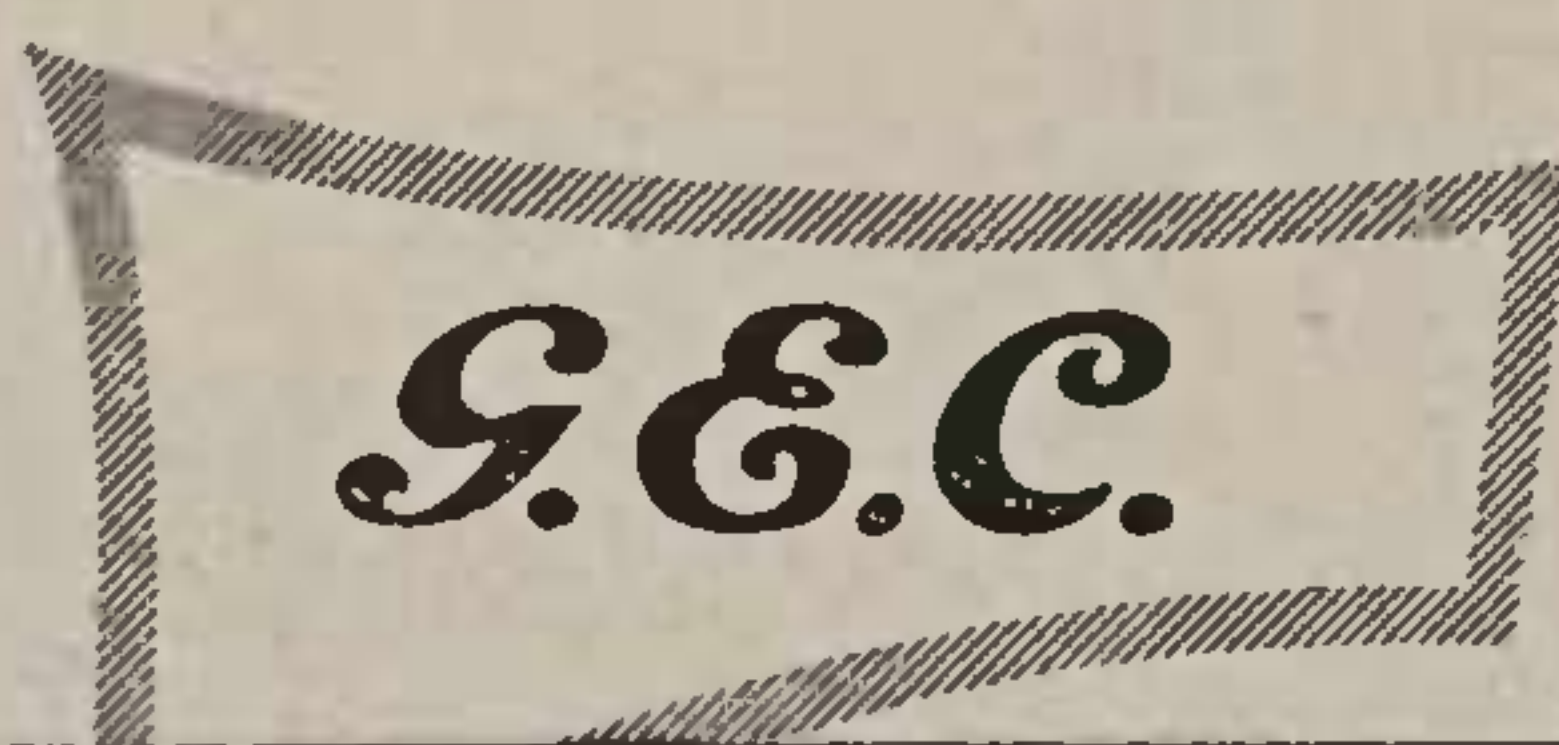
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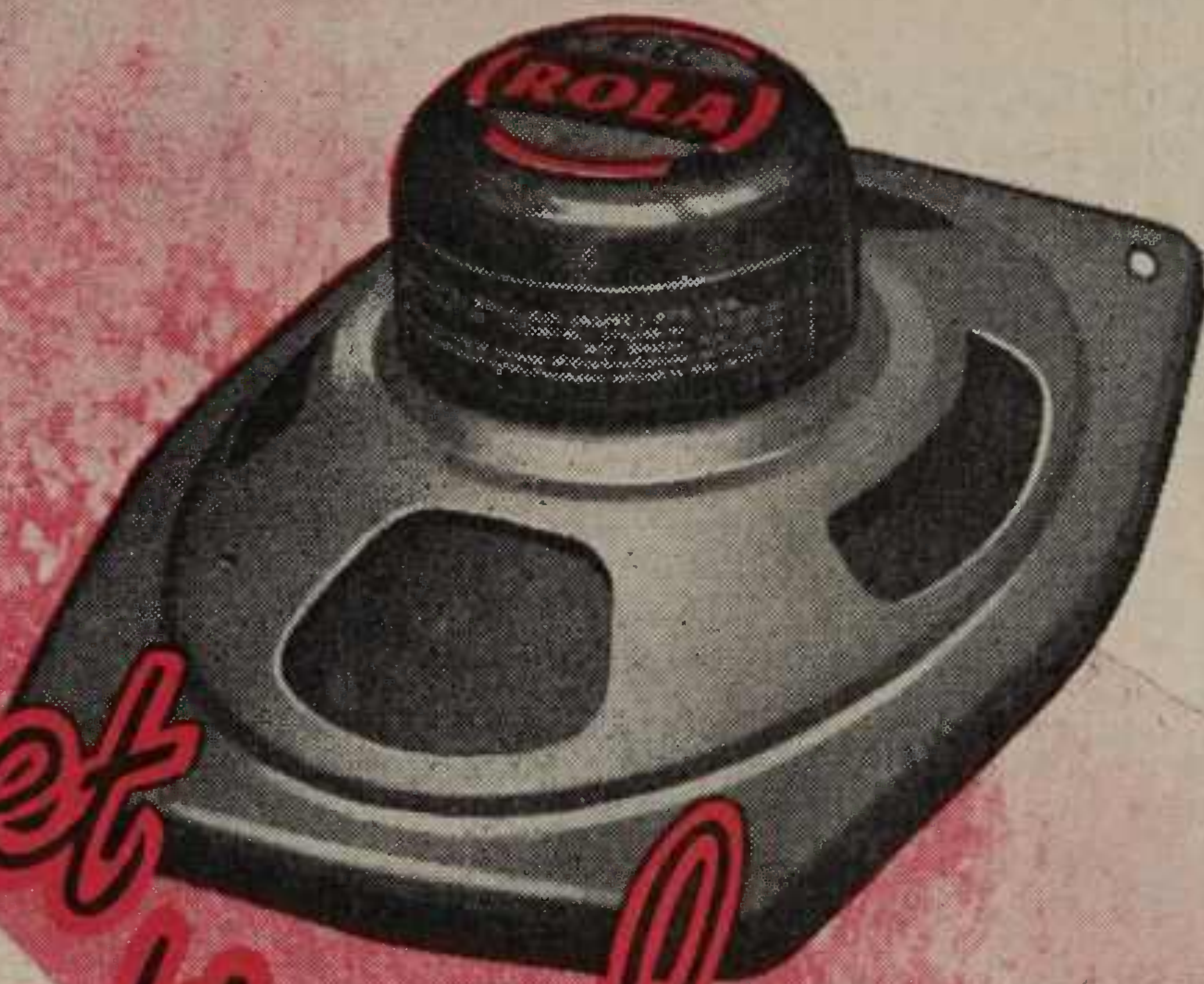
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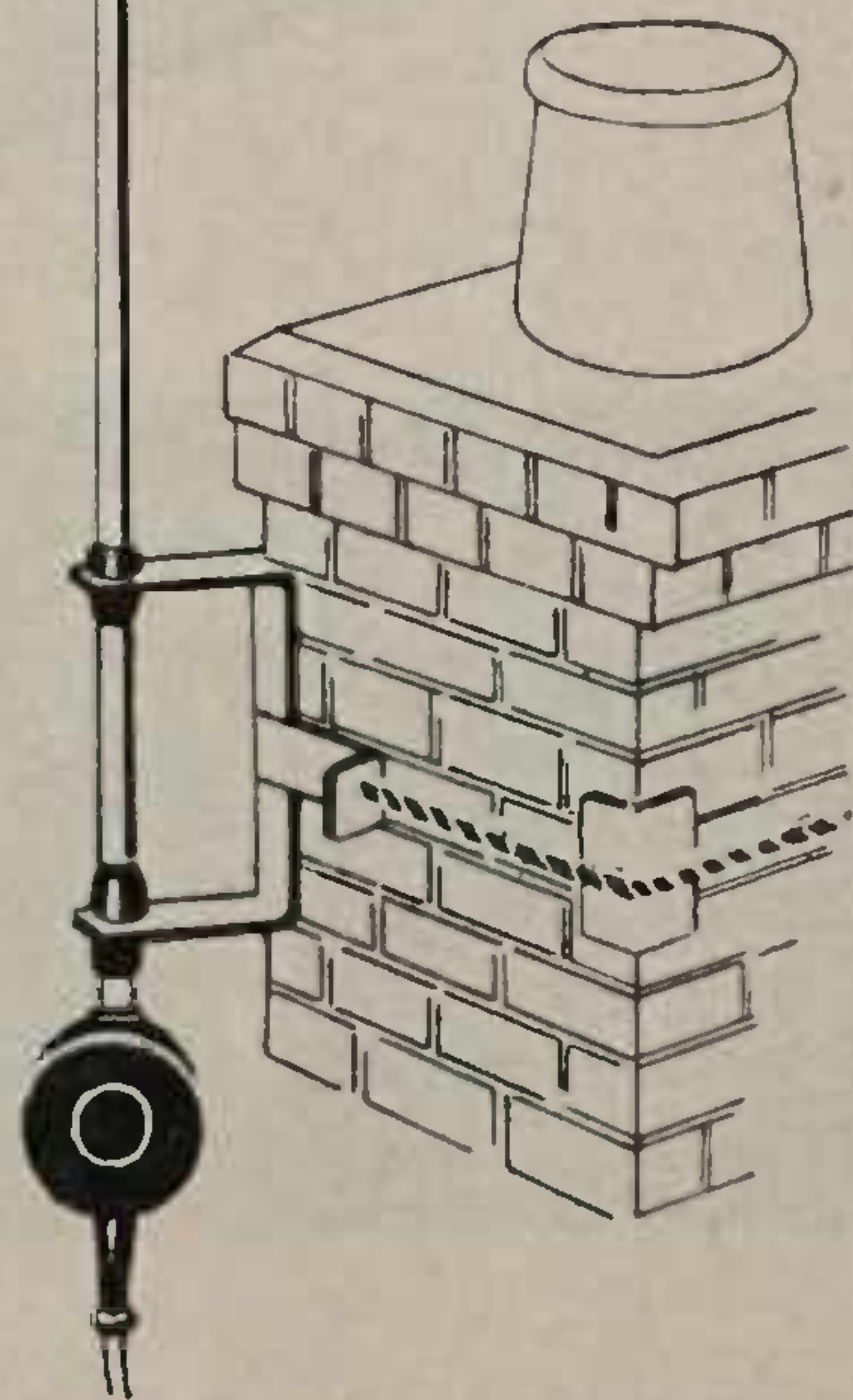
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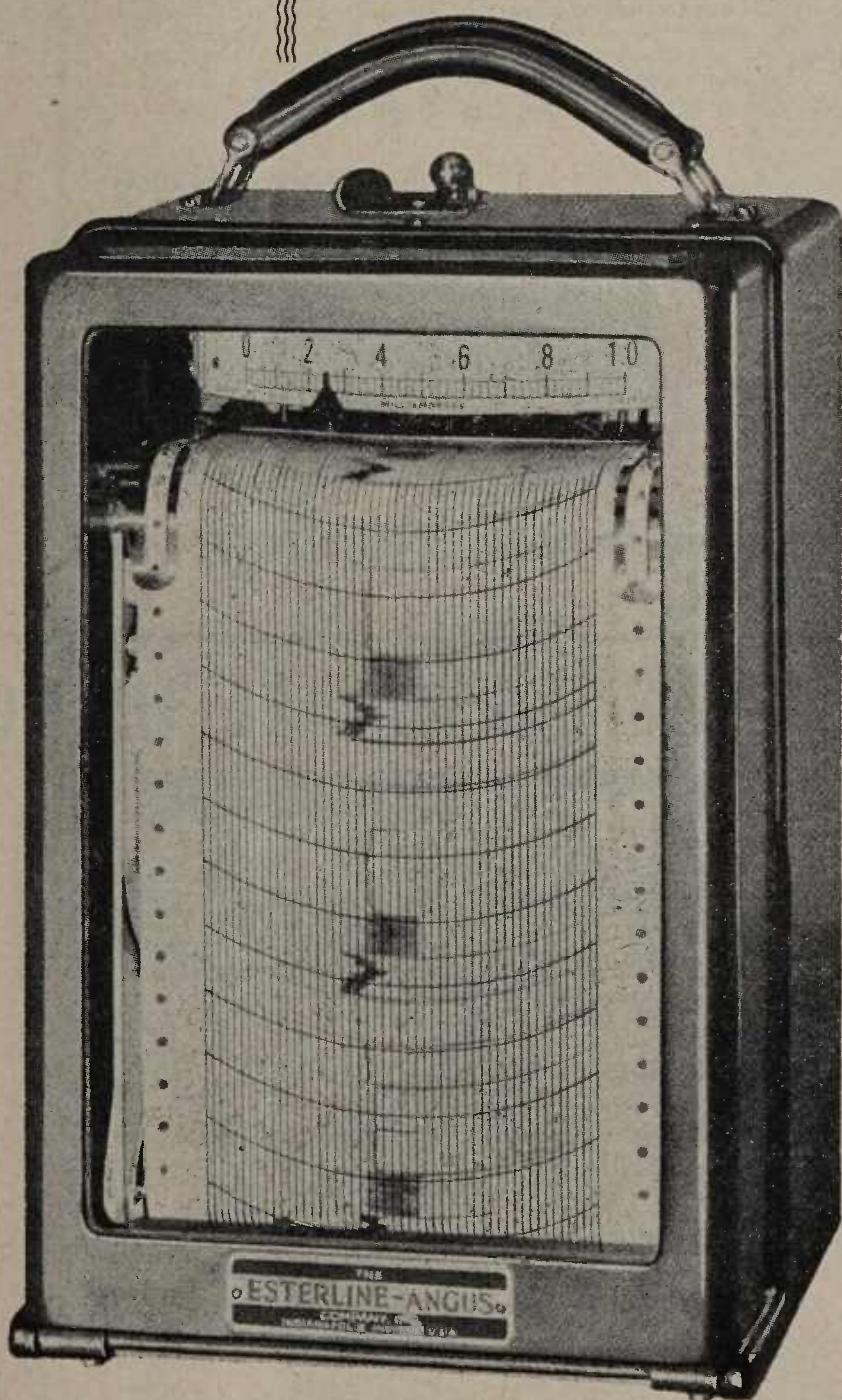


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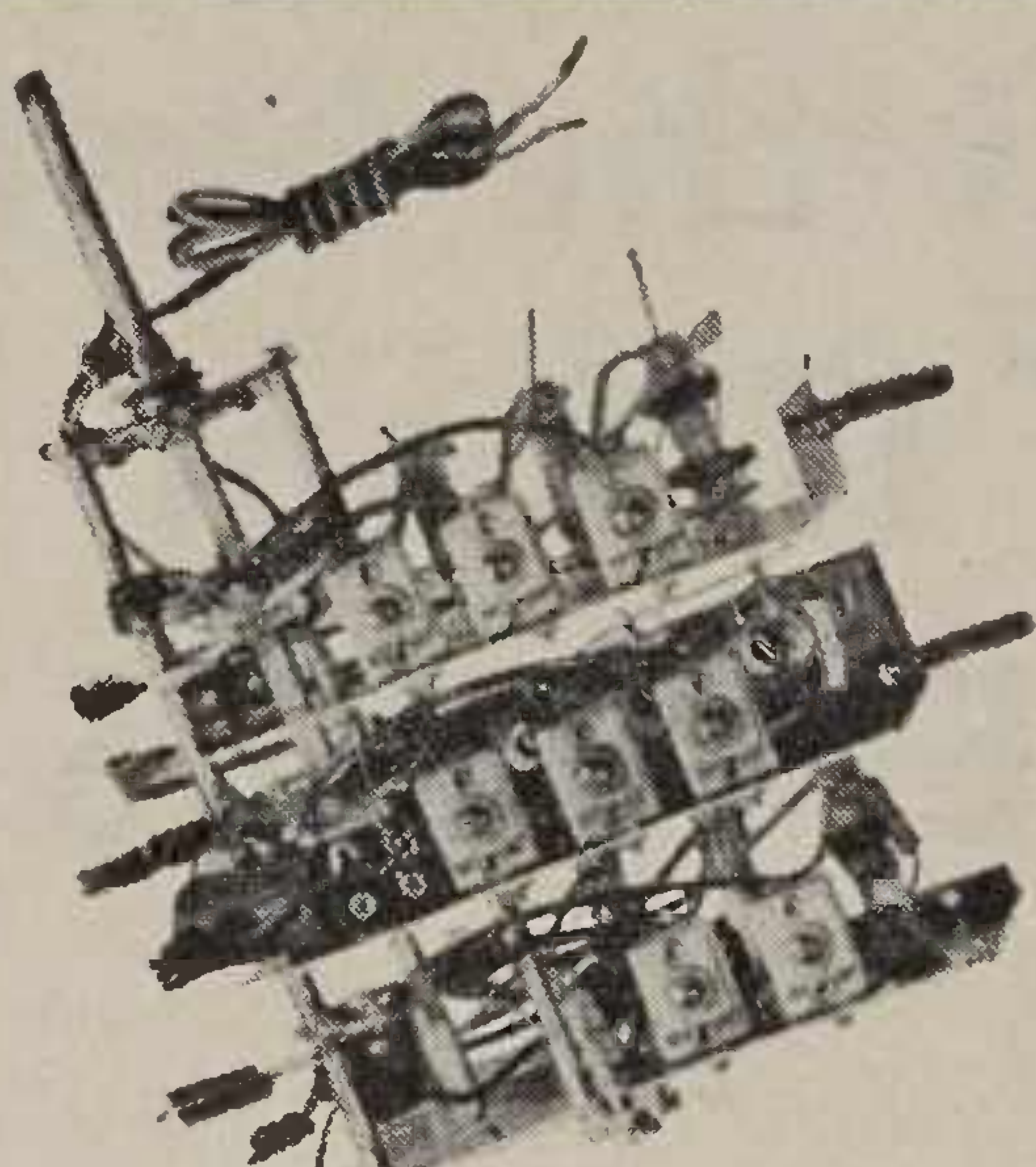
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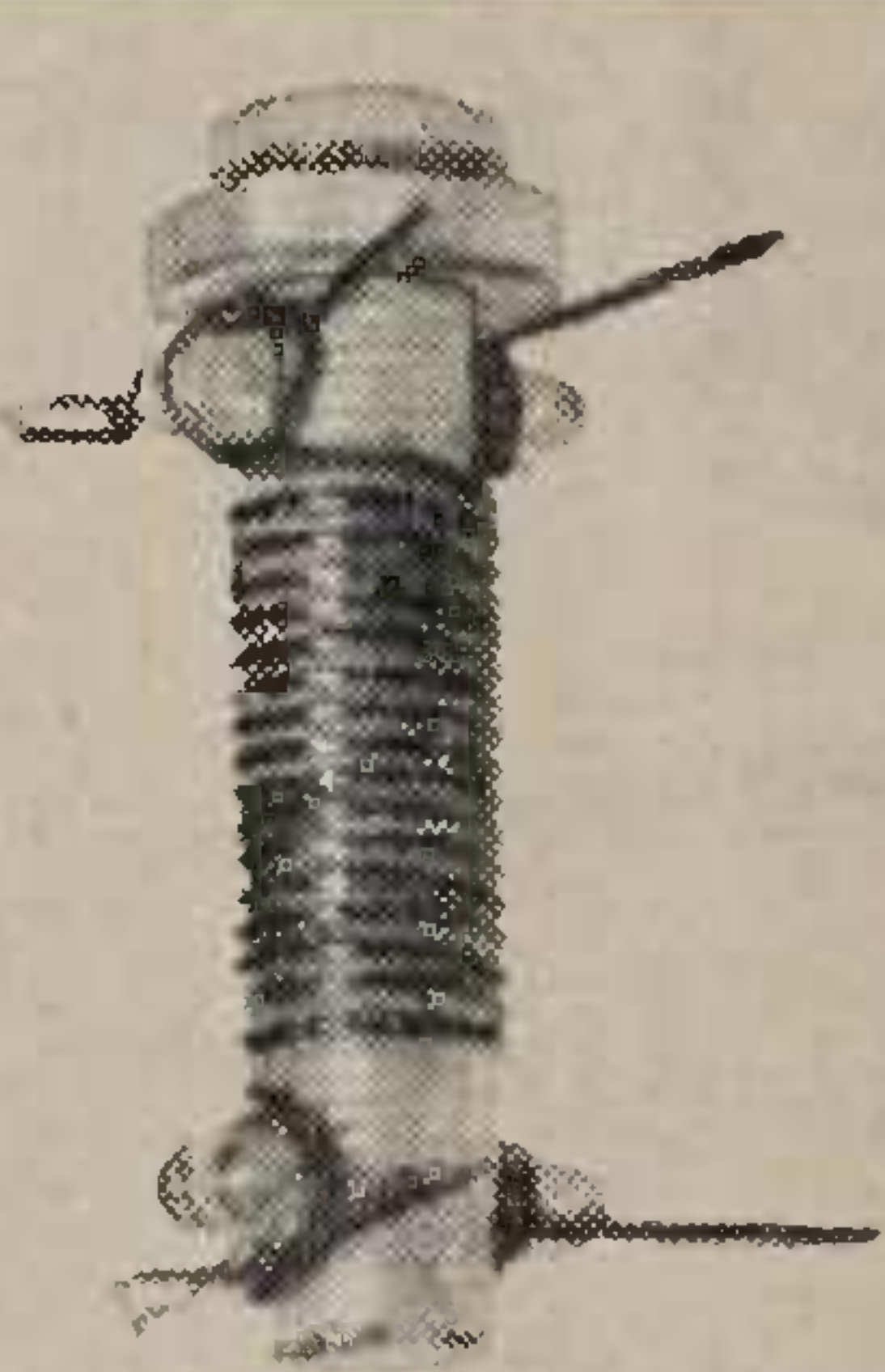
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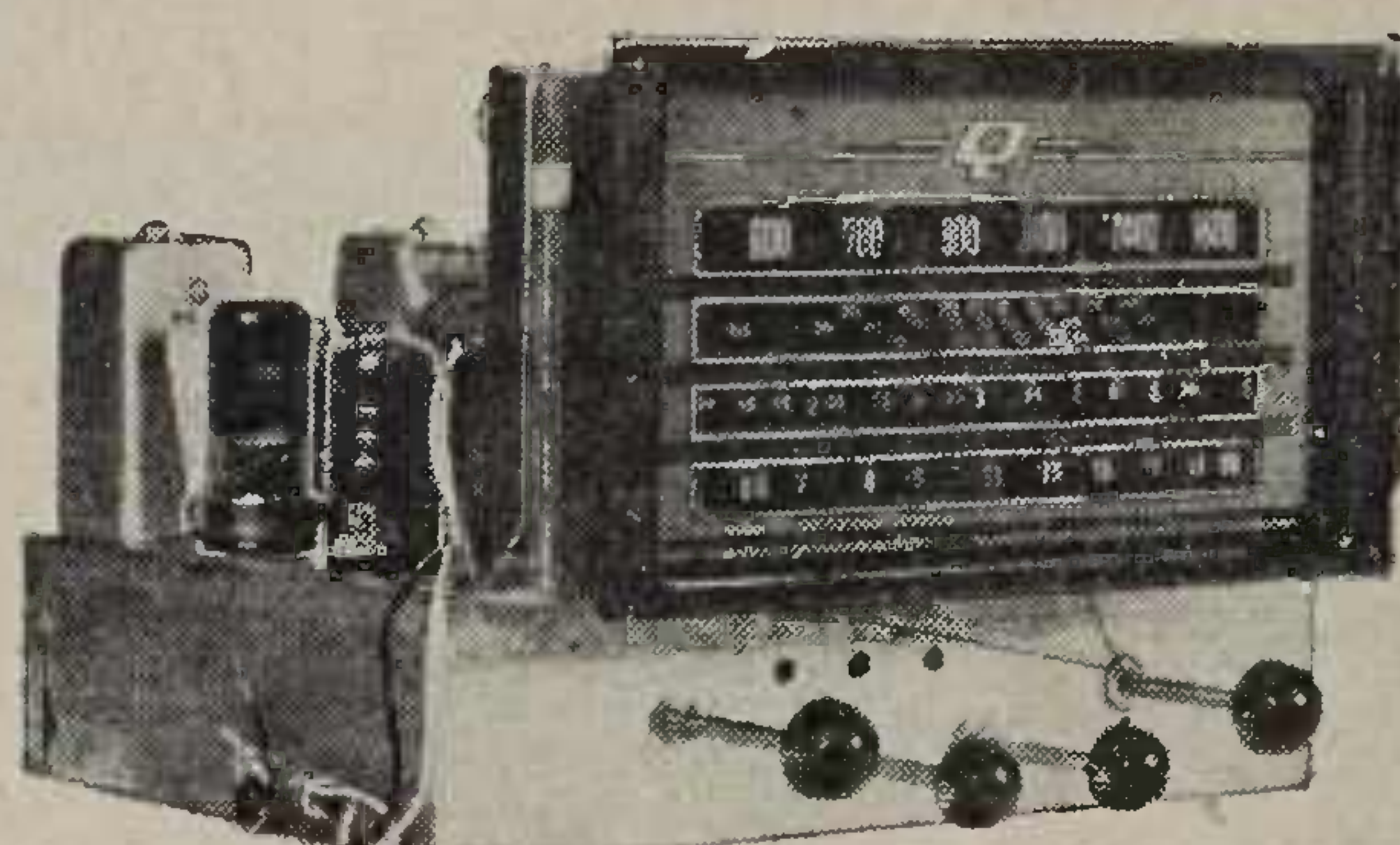
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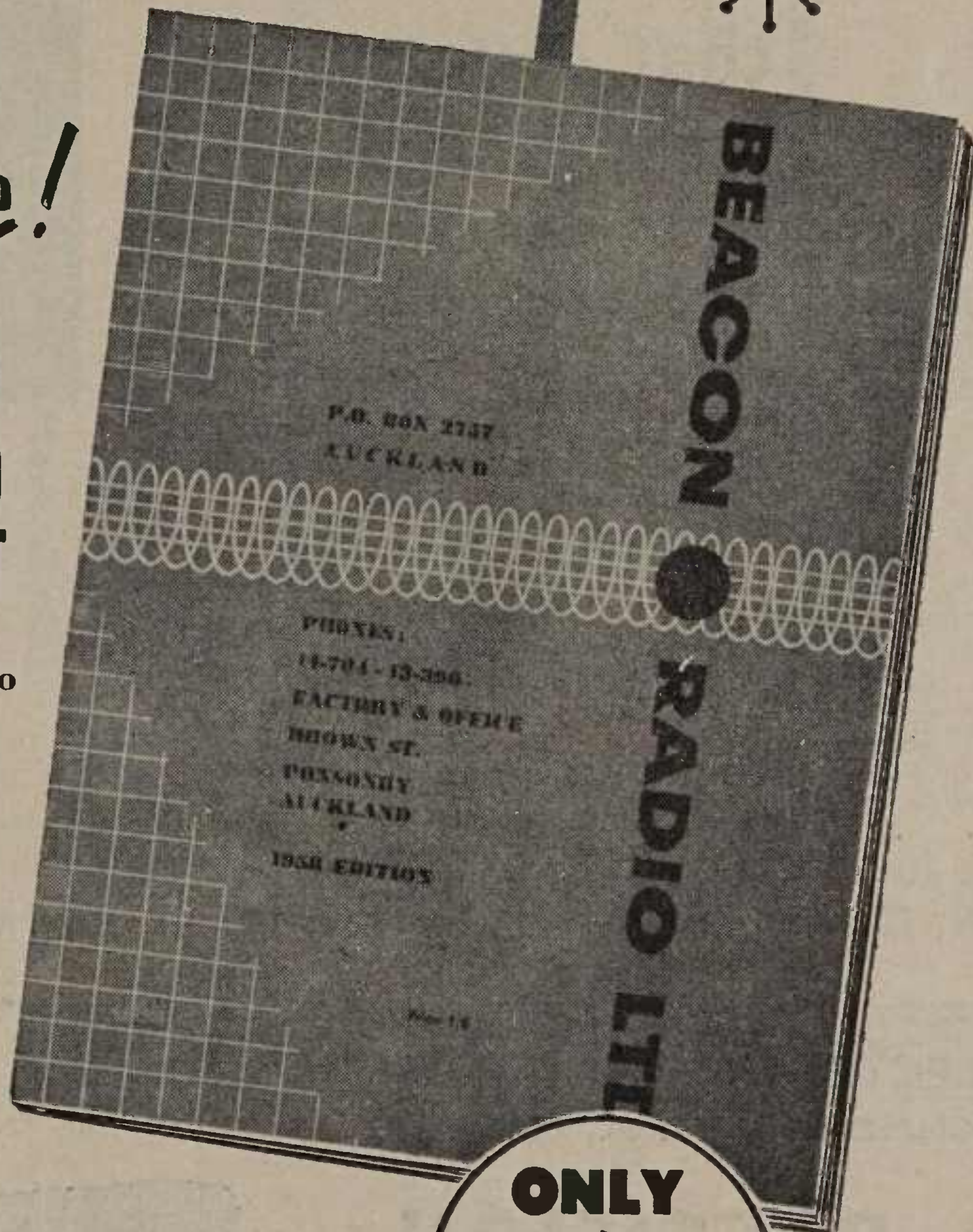
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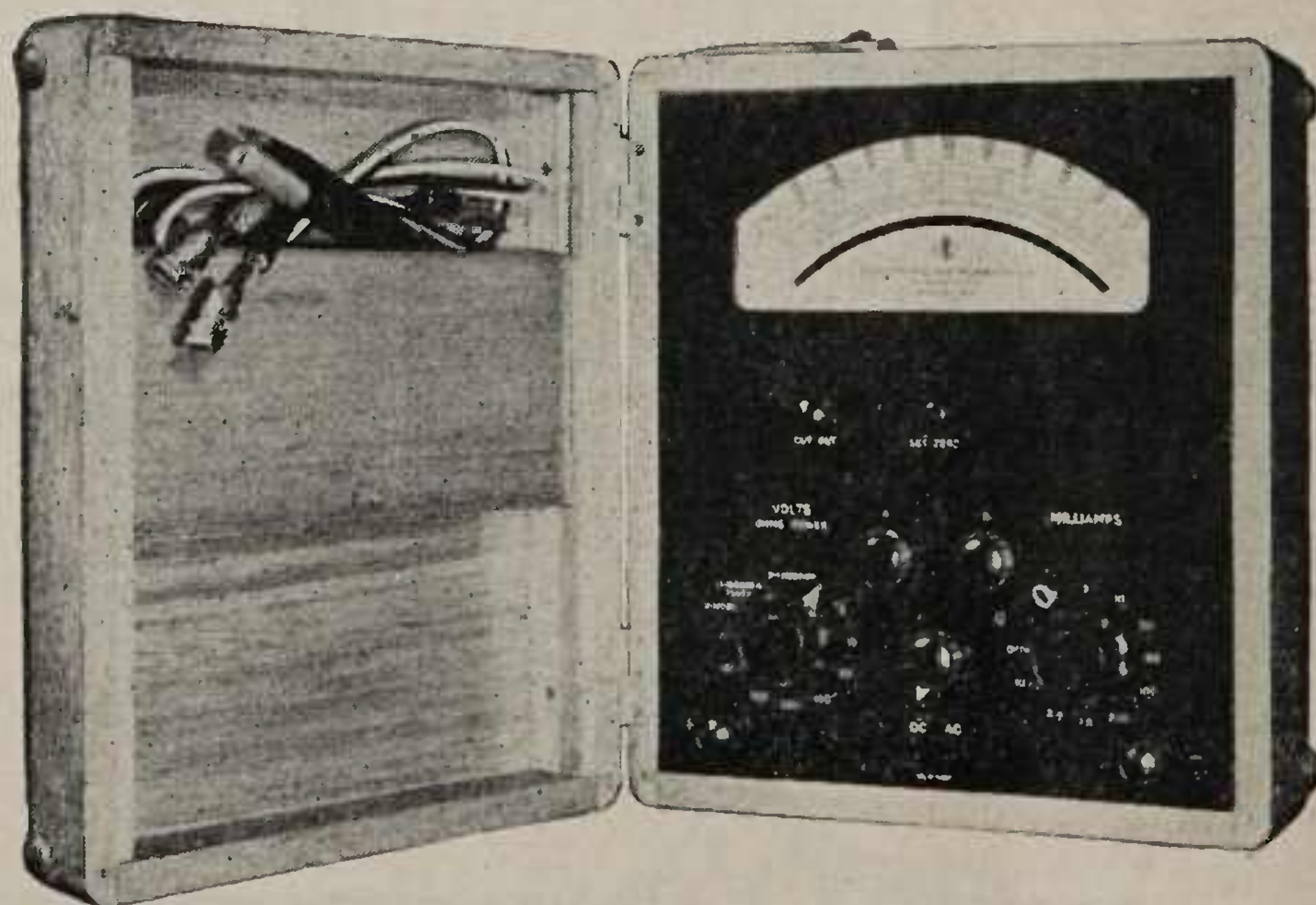
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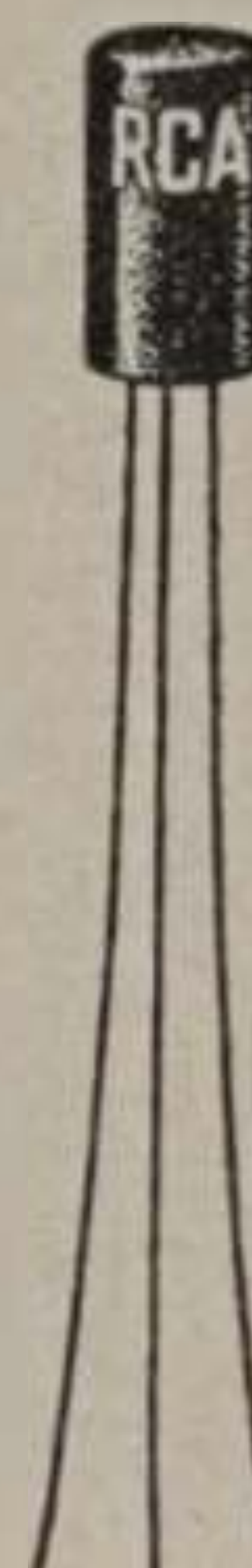
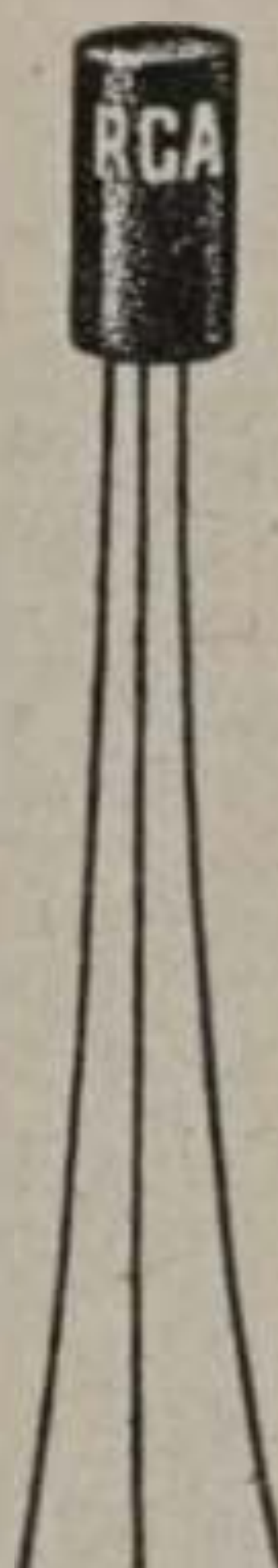
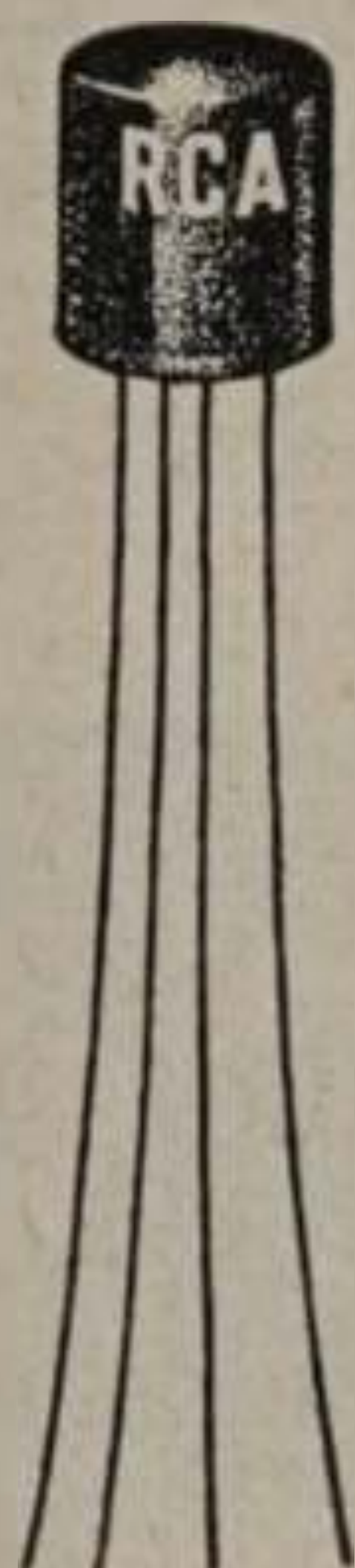
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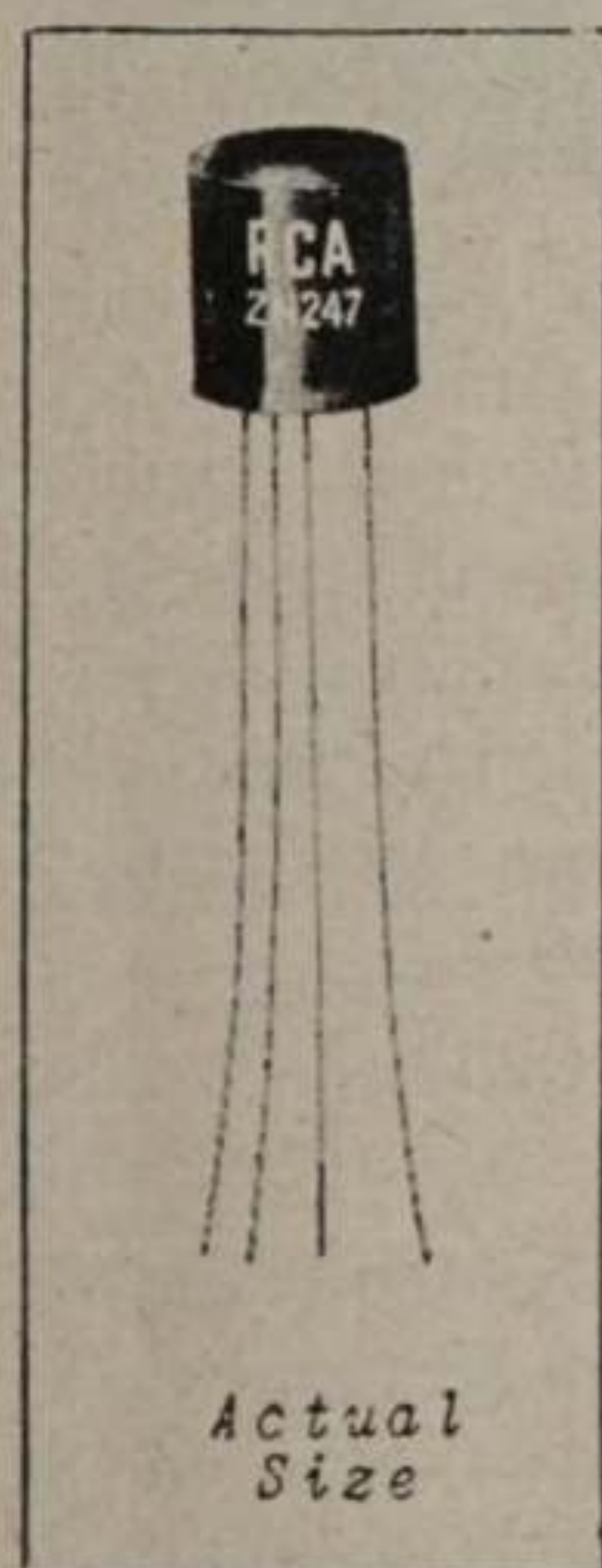


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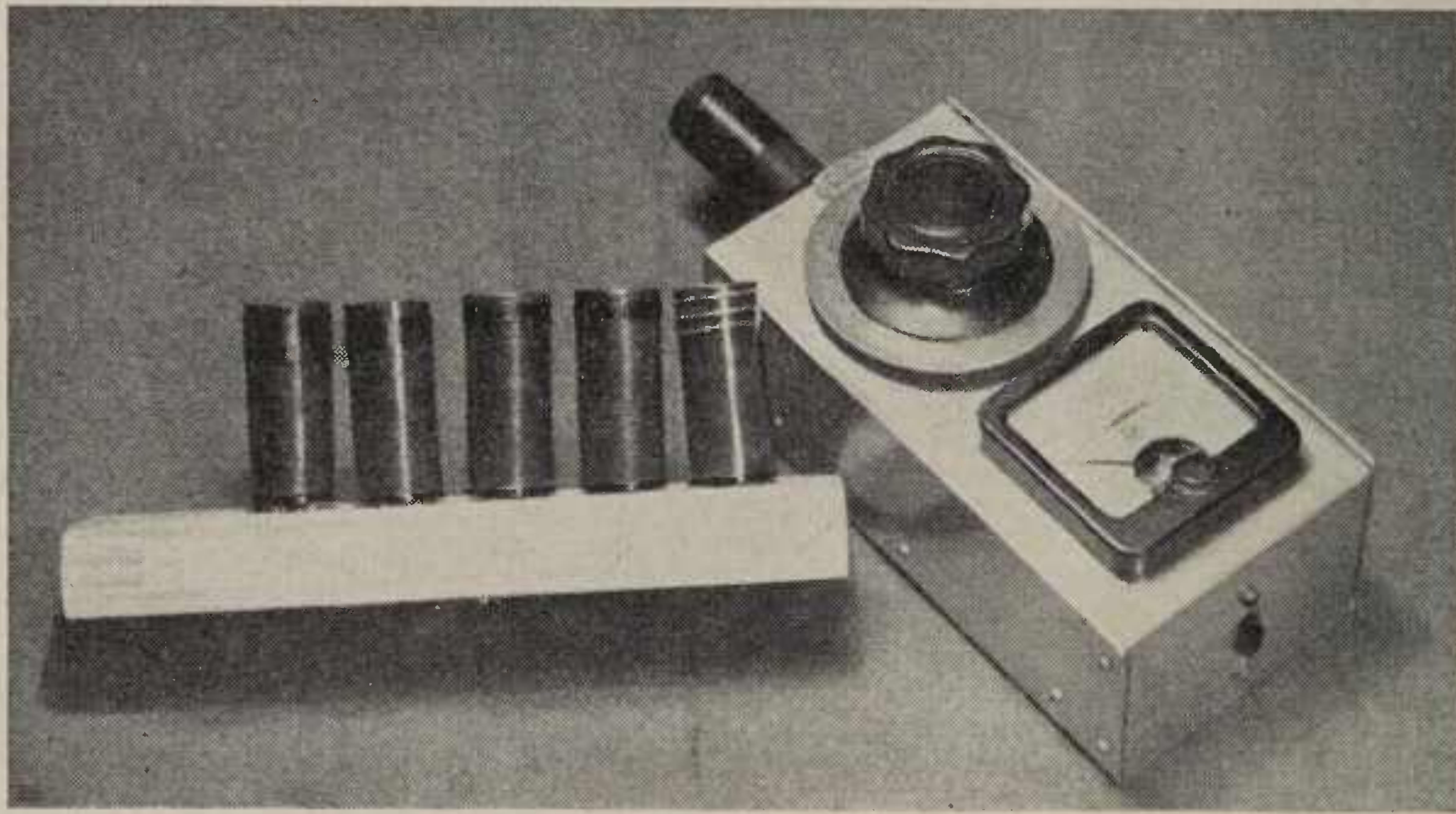
Here is an application for transistors which the Americans would describe as a "natural". Transistors make it possible to build a dip meter of good sensitivity using a 0-1ma. meter movement, and completely self-contained, with a pair of 4½-volt flat torch batteries as the sole source of power. For all the use such an instrument gets, the batteries should last almost for their shelf-life, as the total drain when the meter is in use is only a very few milliamperes.

Introduction

For a very long time, the grid-dip meter has been a familiar piece of test equipment in the ham shack, for its usefulness is out of all proportion to its cost, and it is simple and easy to build. Its great virtue is that it can act as an indicator of resonance in tuned circuits which are not excited by their own source of R.F. power. That is to say, transmitter tuned circuits can be set to frequency without the transmitter's H.T. supply having been turned on, and likewise, receiver circuits, which hardly ever contain enough R.F. power to operate an absorption type of wavemeter, can also be checked as to frequency with the grid-dip meter.

Basically, it consists of a low-powered R.F. oscillator, preferably with a series of coils giving continuous coverage of a wide range of frequencies, and capable of being tuned with an ordinary condenser over a range of, say, two to one in frequency. In addition to the oscillator, there is a visual indicator whose job is to show when power is being absorbed from the oscillator. Since this can occur only when the oscillator is coupled to a circuit that is tuned to its own frequency, the system of oscillator-plus-indicator is able to show when a tuned circuit has the same frequency as the oscillator. Since the dial of the latter can be calibrated, it is then possible to read off the frequency of the circuit being investigated. From description, it is clear that the working of the grid-dip meter in no way depends on the presence of R.F. in the circuit under test, other than that coupled to it from the meter's own oscillator.

Now, because of the way in which the grid-dip meter works, measurements with it are not restricted to tuned circuits made up of conventional coils and condensers. Aerials and feeder lines can also be tuned circuits, so that provided it is possible to couple the



The completed grid-dip meter together with the full set of coils, which cover 3.2 to 53.0mc/sec.

aerial to the grid-dip meter, the latter will indicate the frequency to which the aerial tunes. The instrument can therefore be used to check on aerial systems without their having to be loaded by the transmitter, and thus without the emission of radiation.

How it Got its Name

The grid-dip meter was invented long before transistors were thought of, and so until their advent always employed a valve as the R.F. oscillator. Now, in a valve oscillator, the D.C. grid current is a convenient measure of the amount of R.F. in the tank circuit, or, if you prefer it, of the strength of oscillation. Thus, if for any reason at all, the R.F. voltage across the oscillator's tuned circuit decreases, this will show up as a decrease in the direct grid current. It is a very simple matter to measure this, by placing a 0-1ma. meter in series with the grid leak resistor of the oscillator, so that if this is done, the simple R.F. oscillator becomes a grid-dip meter. Of course, as the oscillator is tuned from one end of its frequency range to the other there will always be a slow variation in the grid current, because it is usual for an oscillator to work more strongly the higher the ratio of inductance to capacity in its tuned circuit; but if

we have coupled to the meter a circuit tuned to some point within its frequency range, there will be a sudden dip in the reading of the grid-current meter as the oscillator passes through the frequency to which the test circuit is tuned. This sudden dip is the desired indication, and it is readily distinguished from the slow change that occurs, and upon which it is superimposed.

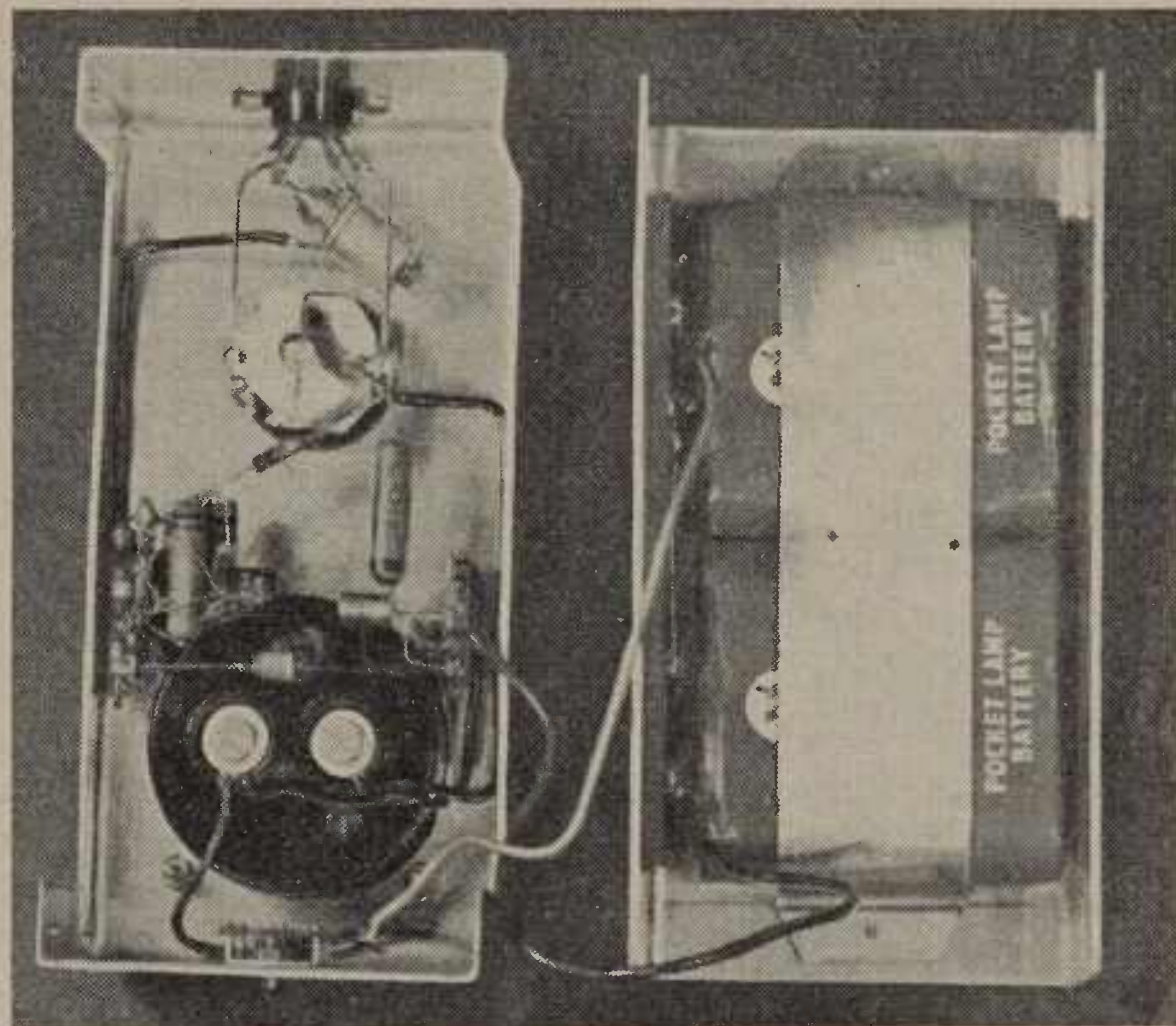
From the above description it is obvious how the grid-dip meter acquired its name, but it is equally obvious that if we make a similar device from a transistor, the name no longer applies, because the transistor has no grid. However, the instrument can be made to work in exactly the same way, and do just the same job, to the extent that no one could tell, without taking off the cover, whether the gadget had valves inside, or transistors. And since the name is one of long standing, we make no apology for retaining it, even if, as Gillie Potter once said, it is a "terminological inexactitude".

Transistorization

In transistorizing the grid-dip meter, the first and obvious thing to do is to substitute for the valve oscillator one using a transistor instead. Provided that suitable transistors are available, this presents no undue difficulty, and for the oscillator we have chosen the R.C.A. type 2N371. This is a recently released type designed specially for oscillator circuits, which has the added advantage of being available in New Zealand. As a result, intending builders of this circuit should have little difficulty in obtaining the necessary components.

Unfortunately, with a transistor oscillator it is not possible to connect a milliammeter directly into the circuit to indicate the oscillation amplitude in the same way as a grid-current meter will do with a valve oscillator. This difficulty can be overcome, however, by rectifying the output of the oscillator with a crystal diode, and in principle it is possible to pass the rectified current through a meter which then acts as the dip indicator. If this were done, though, it would be necessary to use a fairly sensitive movement, such as a 0-100 μ amp., and these are rather expensive, as well as being delicate. From both angles, it is preferable to use a 0-1ma. movement, obtaining the additional sensitivity by operating the meter from a second transistor, used as a D.C. amplifier, amplifying the direct current produced by the crystal rectifier.

This scheme allows the loading on the oscillator tuned circuit to be made quite light so that it remains more sensitive to external influences. By this, of course, is meant the effect of the tuned circuit to be measured, on the output of the oscillator, for the more heavily loaded the oscillator is, the less obvious is the effect of coupling to it a small load in the shape of a loosely-coupled tuned circuit.



Underneath view. The 2N371 oscillator transistor and its circuit mount on the left-hand tag strip in the photograph, while the 2N406 can be seen to the right of the meter.

The Circuit

As can be seen from the diagram, there is not much in the final circuit by way of parts. The oscillator transistor is operated in the grounded base connection, with the tuned circuit in series with the collector, and with feedback obtained by connecting a small capacity between collector and emitter.

It will be noted that from the D.C. point of view, base bias for the oscillator transistor is obtained in exactly the same way as for most transistor audio stages. That is, there is a small resistor in series with the emitter, and a potential divider across the battery, to the tap on which the base electrode is connected. This might be a little confusing to some readers, since the arrangement is no different from that used with audio stages in the grounded emitter connection. How, then, can one tell which connection is being used, and how is it that a transistor can be used in grounded base or grounded emitter, with identical D.C. biasing arrangements?

The answer is really quite simple; it is that the name given to the transistor connection refers only to the alternating signal, and not to the D.C. biasing arrangement. With the one biasing system, the transistor can still be operated in any of the three possible connections as far as the signal is concerned. To illustrate this we have drawn Fig. 2. At (a) and (b) we obviously have identical biasing arrangements, but (a) shows the transistor used in a grounded-base circuit, while (b) shows it in the grounded-emitter connection. From these diagrams, it can be seen that the difference between them is solely that in one case the base electrode is common to both input and out-

put circuits, while in the other, the emitter is common to both. In fact, another, and perhaps better name for these connections are common base, and common emitter, respectively.

In the common-base circuit, the resistor from the positive side of the battery to the base is bypassed by a condenser, and the positive battery terminal forms the "cold" side of both input and output circuits. The input is applied in this case to the emitter. In the common emitter arrangement, the emitter resistor is bypassed, and the positive battery terminal is still the common terminal for input and output circuits. In this case, the input is applied to the base, and the resistor between base and battery positive forms a shunt on the input voltage.

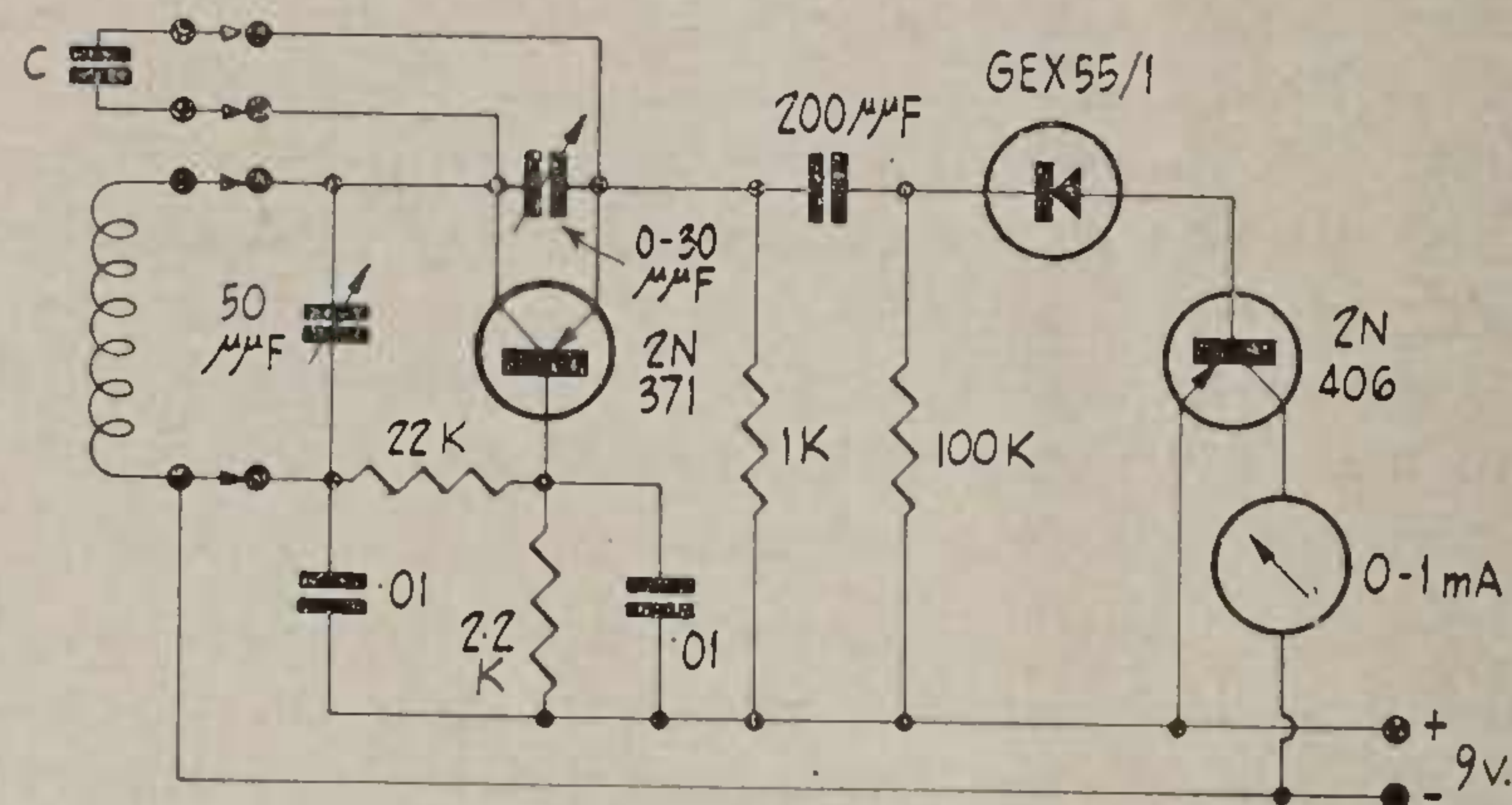
In an oscillator, we simply have an amplifier in which steps are taken to feed some of the output back into the input terminal, so that the circuit supplies its own input. Thus, it is possible to have oscillators wired as common-base or common-emitter circuits, just as it is with amplifiers.

With transistor amplifiers, as with valves, some types of connection produce a phase reversal of the signal, while others do not. The common emitter connection, almost universal in audio amplifiers, does give a reversal in the phase of the signal, while the common base does not. Thus, if we have a common base oscillator circuit, there is no necessity to produce a phase reversal in the signal that is fed back from the output circuit to the input in order to give the fed-back voltage the correct phase to produce oscillation. The feedback can thus be secured by the simple expedient of connecting a small condenser between emitter and collector, as already described. It will be noted that this has been made pre-set, by using a 3-30 μ fd. Philips trimmer, thus enabling the strength of oscillation to be controlled to some extent. This control is set once and for all, and it is helpful to have it there in order to take care of differences between transistors of the same type. There is still much more variation between the characteristics of transistors of the same type number than is usually found between valves.

The Meter Circuit

Since the emitter circuit of the transistor is of very low impedance, it is preferable to rectify and use the R.F. voltage appearing at the emitter than to use the voltage at the collector, even though the latter is by far the greater. For one thing, the diode circuit produces very little effect on the oscillation frequency when it is connected in the emitter circuit, while in the collector circuit, it would be directly across the tuning circuit, and would thus have a correspondingly larger effect.

The rectifier circuit is a perfectly ordinary shunt circuit, in which the D.C. path is completed by means



Circuit of the meter. The arrows represent the connections to the pins of the coil former, while the dots represent the connections on the socket. The condenser C is used only on one coil range, and is described in the text.

of a shunt resistor—in this case, 100k. The diode current is quite small—only a few tens of microamperes—so that a D.C. amplifier is essential if a 0-1ma. meter is to be used. The D.C. amplifier transistor is another R.C.A. type, a 2N406, which is one of the less expensive audio amplifier types, and very suitable also as a D.C. amplifier. It is connected in the grounded-emitter arrangement, which gives a large amount of D.C. current amplification. The meter is in the collector circuit, and there is no D.C. bias network as in the oscillator circuit. This is because we want the D.C. amplifier to be normally cut off, and to pass current only when it is supplied with input by the oscillator-rectifier combination. Because of this, the polarity of the diode is important. Crystal diodes are usually marked with a coloured band to indicate the electrode corresponding to the plate of a thermionic diode. It is this electrode which acquires a negative potential when the diode conducts, and the transistor circuit requires that the base of the 2N406 should become negative with respect to the emitter. When the oscillator is functioning, the meter reads anything between full-scale, and about one-third of this reading, depending on which coil is in use, and on what frequency it is tuned to. If the oscillator is stopped, as it can be by removing the plug-in coil from its socket, the meter reads only a few microamperes.

The battery has been fixed at 9 volts, mostly for the benefit of the oscillator. The performance of the latter at the high-frequency end of the scale would be better, if the transistor were operated from a higher voltage still, up to say, 15 volts. In America this would cause no difficulty, and it would thus be advantageous to operate the circuit in this way, because small 15-volt batteries are available, designed specially for sunning transistorized apparatus. Here, however, the available batteries would be rather too bulky if 15 volts were made up. The best compromise, therefore, was to use 9 volts, and to find room for a pair of 4½-volt flat torch batteries, even though these take up a fair amount of the total space occupied by the case of the finished instrument.

Construction

The photographs and diagrams of the chassis work give a fairly comprehensive idea of how the original dip meter was put together. The chassis is in two main pieces, with the whole of the "works" mounted on one of them, and the other forming the bottom and sides of the case, and containing the batteries, strapped internally to the bottom. The case measures only six inches by three by two and a quarter deep, and is large enough to hold a 3 in. diameter dial, and a 2½ in. meter. These components really determine the size of the whole thing, and although it would have been possible to make them smaller, doing so would not really have made the instrument any easier to use.

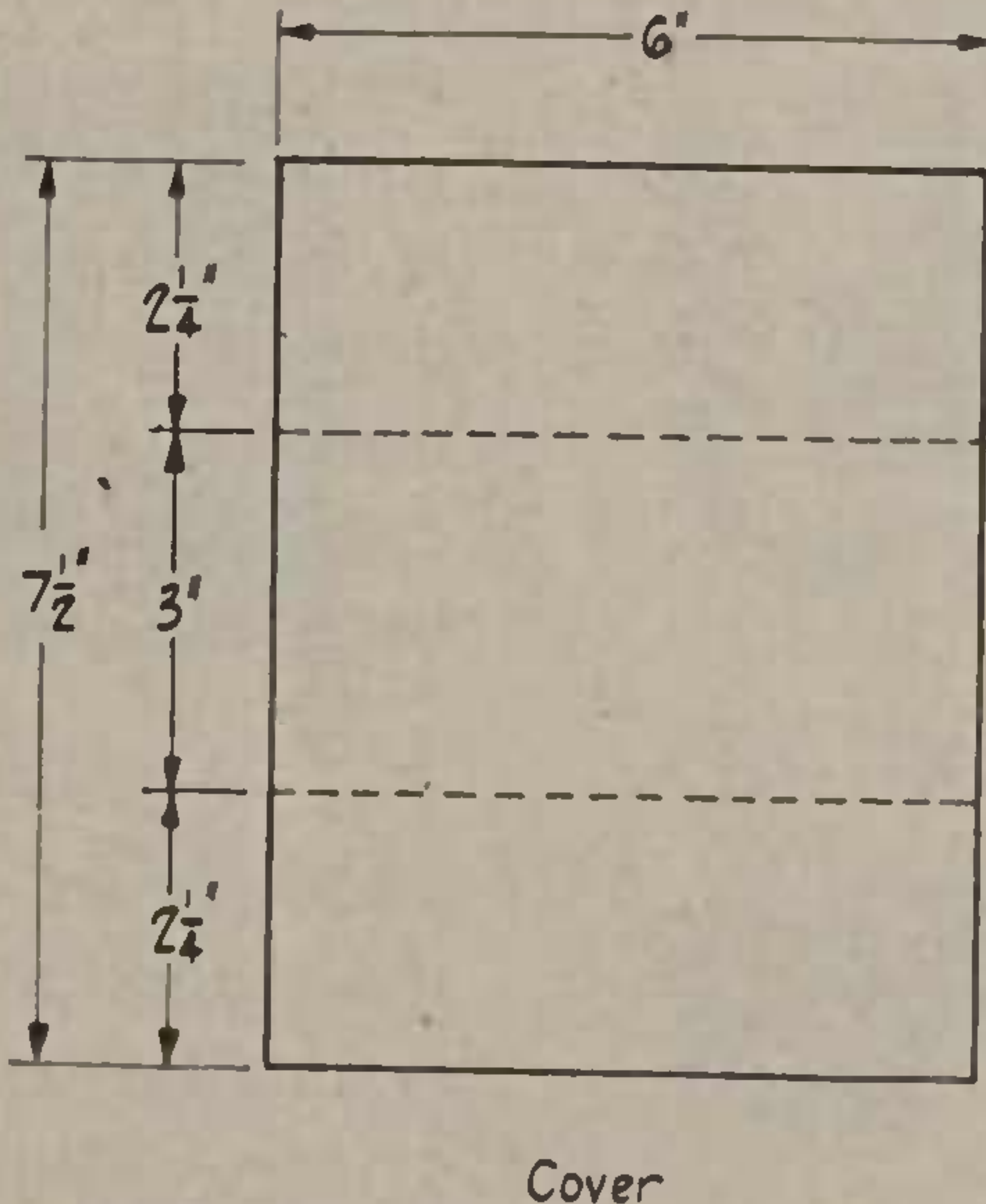
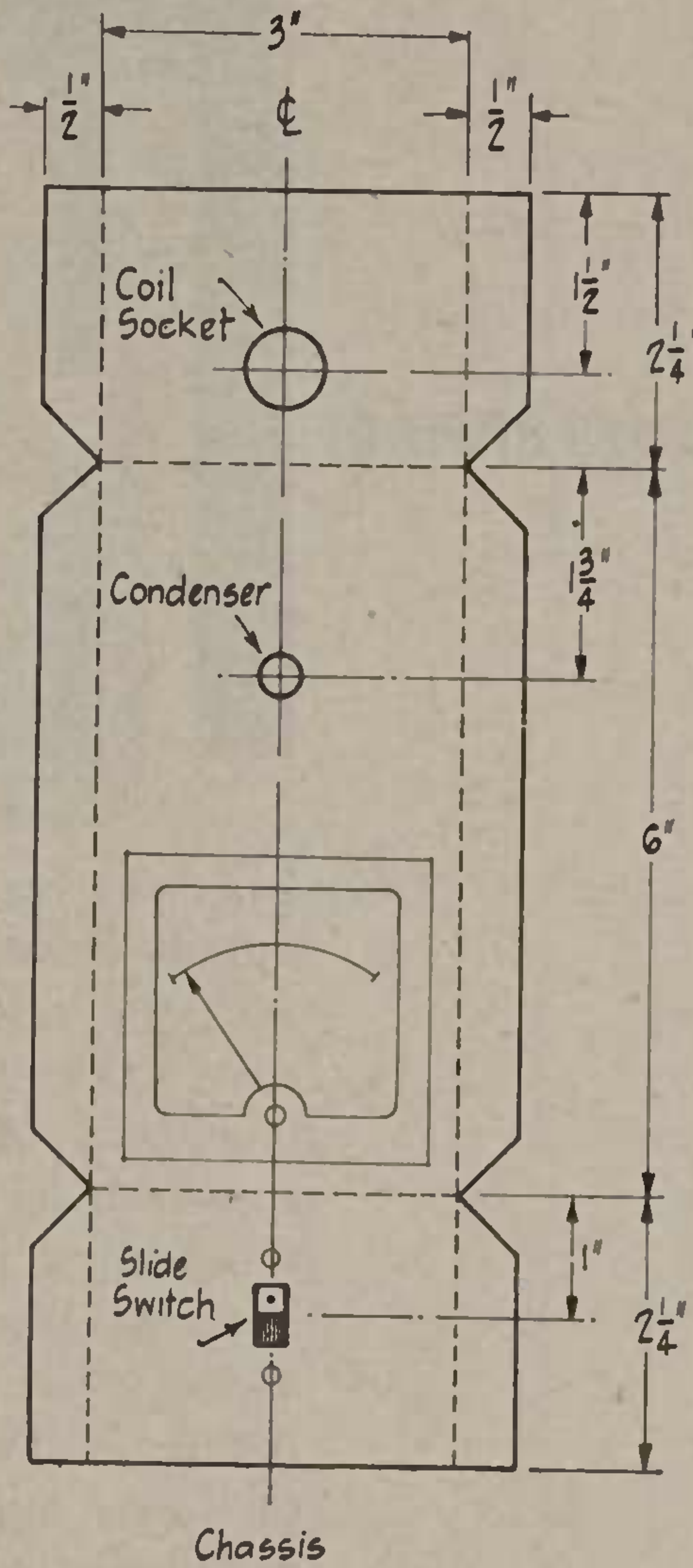
With the meter, tuning condenser, coil socket, and switch mounted, it is only necessary to add two small strips of insulated solder tags, as can be seen in the photograph, after which the wiring can easily be completed in an hour or so. In our case, the whole circuit was insulated from the chassis, by dint of making a paxolin washer on which to mount the tuning condenser. However, there is no reason why this should not be avoided by connecting the case to the negative battery terminal. As long as the circuit is earthed to the case at only one point, and as long as that point is not a "hot" one for R.F., it does not matter which point is chosen, and the easiest one to pick is obviously the one to which the rotor of the tuning condenser is connected, thereby avoiding the need to insulate this. It can make no difference to the functioning of the circuit which side of the battery is earthed, provided that only *one* side is!

Frequency Ranges

The exact frequency range attainable with the dip meter will depend largely on the sample of transistor which one obtains, owing to the differences between individual transistors, mentioned earlier. However, it should be possible to secure satisfactory operation up to at least 30mc/sec. with any 2N371, while the livelier samples will probably function in this circuit as high as 50 to 60mc/sec. Because of this, we have constructed coils covering the range 3.2 to 53mc/sec., and in the prototype, the ranges covered by individual coils were as follows:

Coil No.	Freq. Range				
1					3.2- 5.4mc/sec.
2					5.1- 8.4mc/sec.
3					8.0-13.2mc/sec.
4					12.8-22.8mc/sec.
5					21.5-40.0mc/sec.
6					38.6-53.0mc/sec.

It will be noted that in the circuit diagram provision has been made for artificially increasing the



Working drawing for the metal work of the meter.

size of the feedback condenser when a coil is plugged in. This can be done because the coils require only two pins of the four-pin sockets and plugs that are used. Where necessary, herefore, it is possible to use the remaining two pins to add extra feedback capacity simply by connecting a small fixed condenser to the unused pins in the coil former in the manner shown on the circuit. This has had to be done only on the lowest frequency range. The reason for it is, of course, that as the frequency becomes lower, a larger feedback condenser is required to give the same degree of feedback.

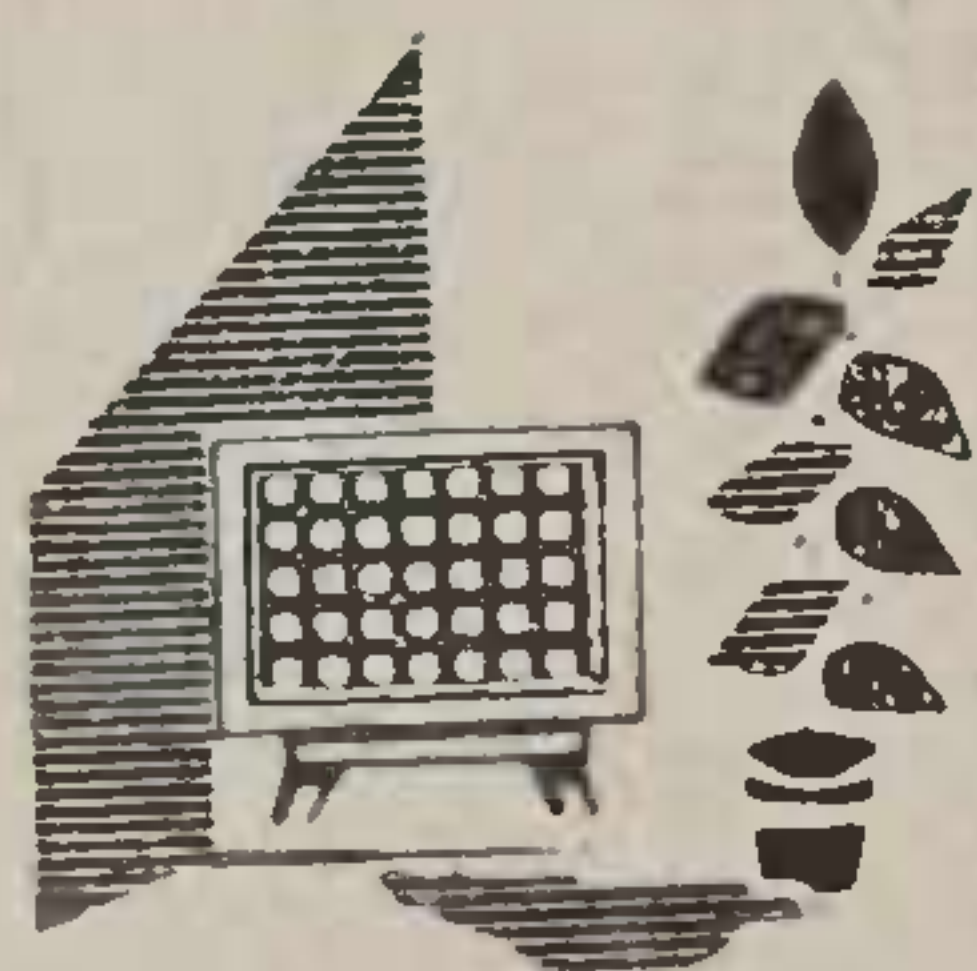
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THE SUCCESS STORY OF

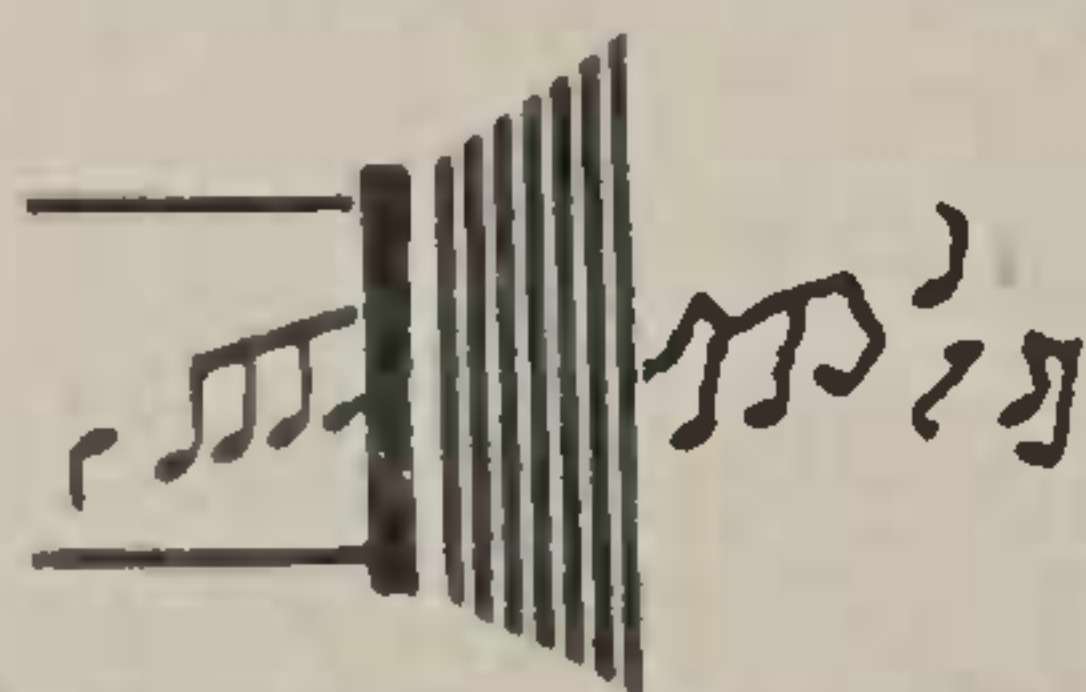


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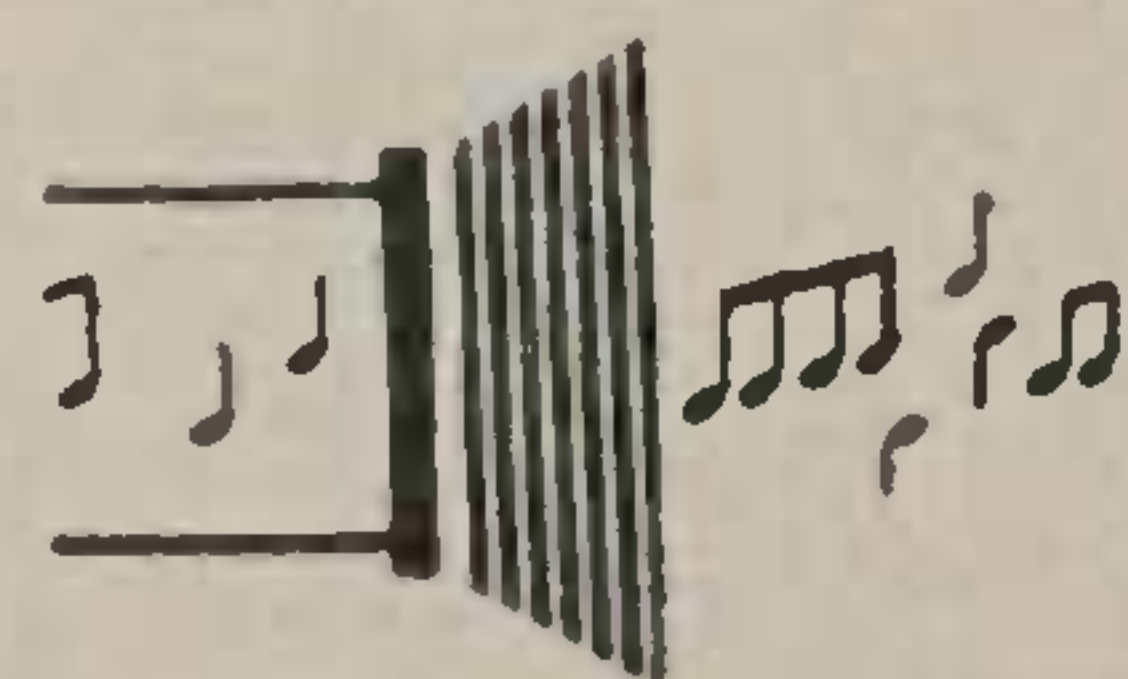
For many years conventional radio receivers have used a loudspeaker output transformer to match the low impedance of the speaker with the rest of the circuit. The loudspeaker transformer has always been a weak link in the chain which converts tiny electrical impulses into the vibrations in the air we hear as music and speech from the loudspeaker. No matter how carefully the transformer has been designed—even with the expensive manufacturing extras—it has always had many imperfections which have added to or subtracted from the true sounds before they reached the ear. Two of the major drawbacks of the transformer are that very high notes and very low notes are lost, and that intermodulation distortion takes place, merging various notes together. Now, after years of research, Philips engineers and scientists have perfected the extremely difficult technique of making loudspeaker coils with almost microscopic wire, to give a voice coil impedance of 800 ohms in the average loudspeaker. Highly accurate wire-drawing methods, developed by Philips technicians from the manufacture of electric lamps, have been applied. These speaker coils, coupled direct to the output valves, have removed a major barrier in the path of perfect listening.



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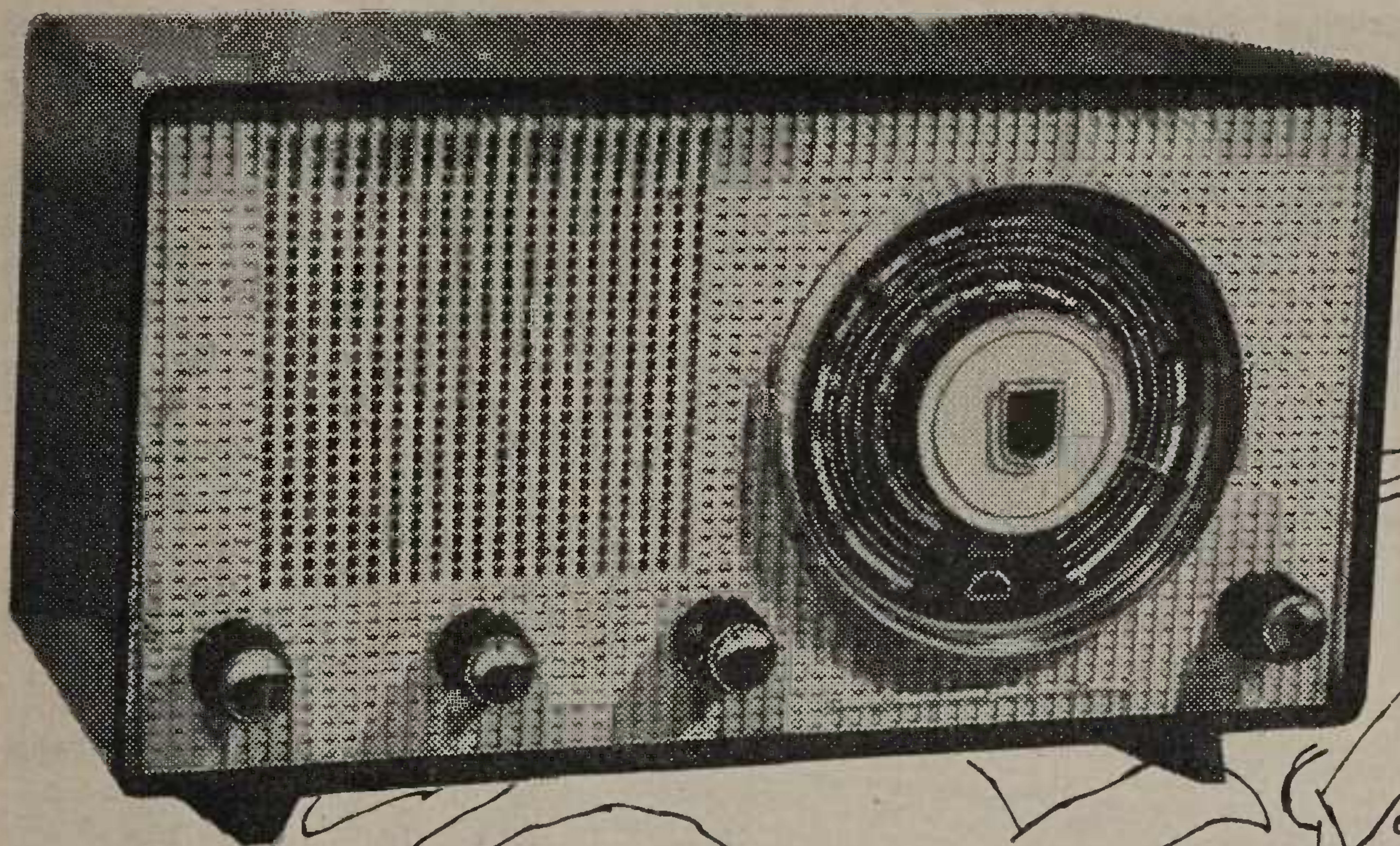
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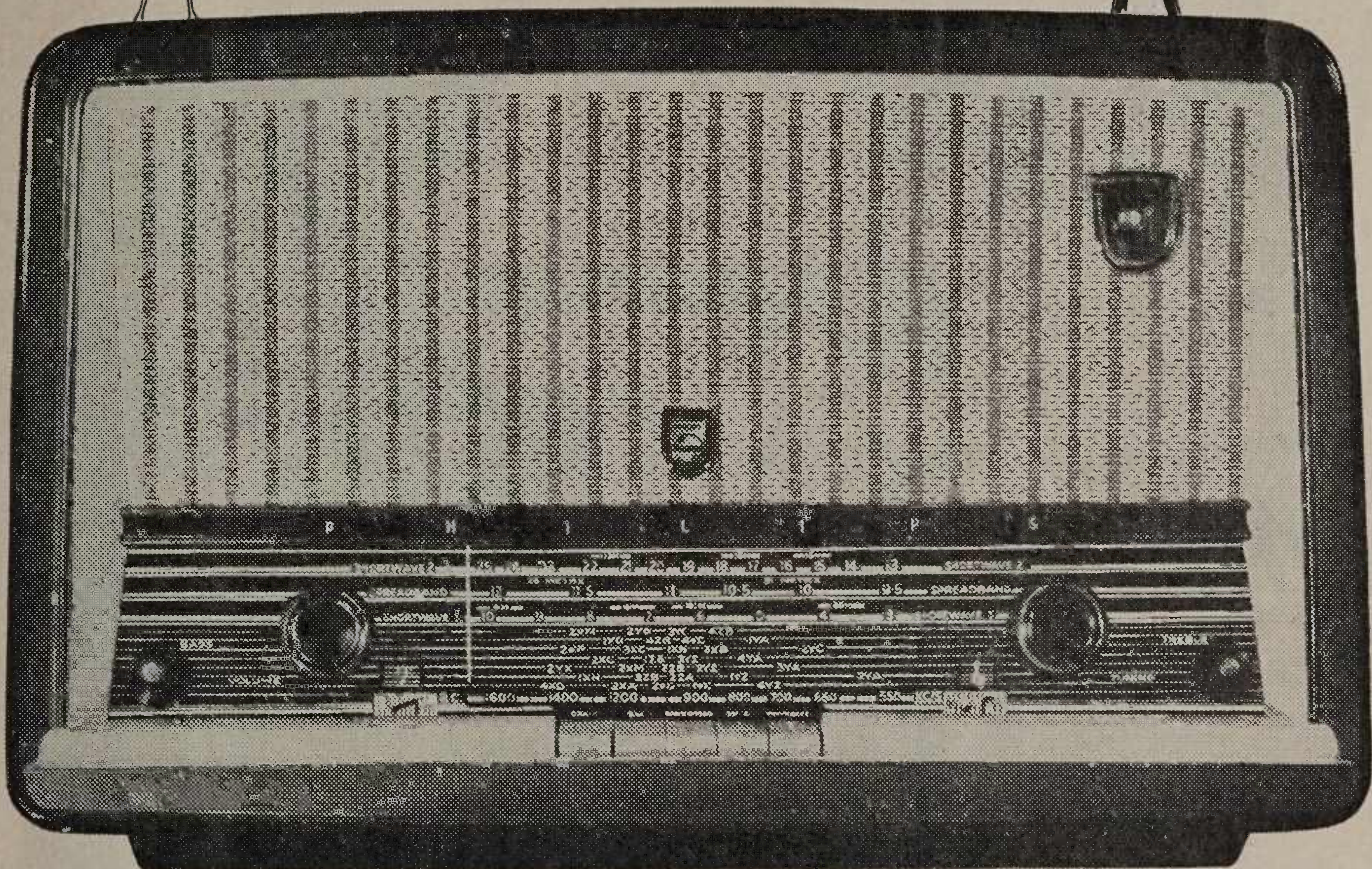
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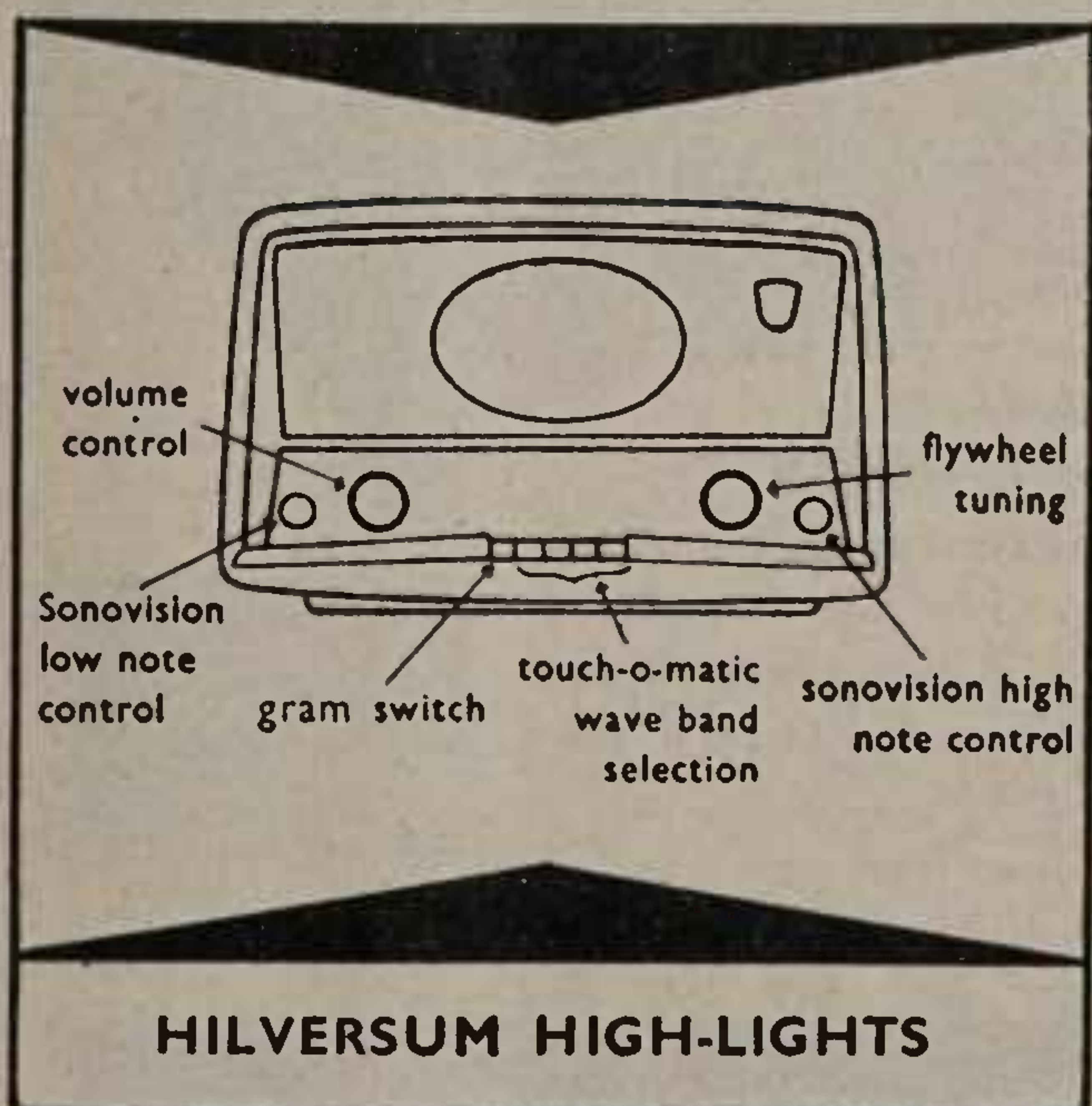
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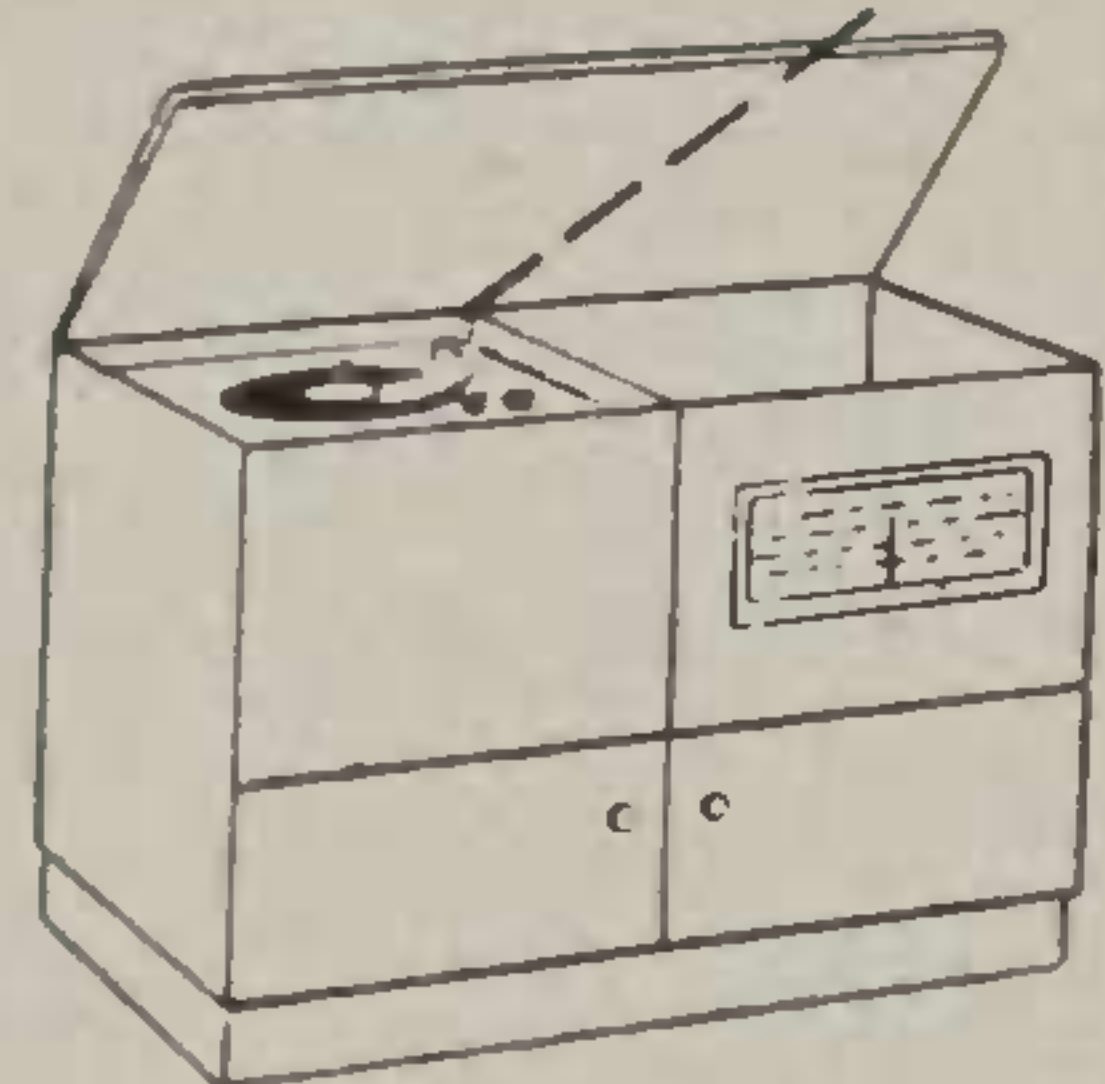
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- ★ Flywheel assisted spin tuning for rapid dial traverse
- ★ Separate Sonovision tone controls for bass and treble with "vanishing note" indicators
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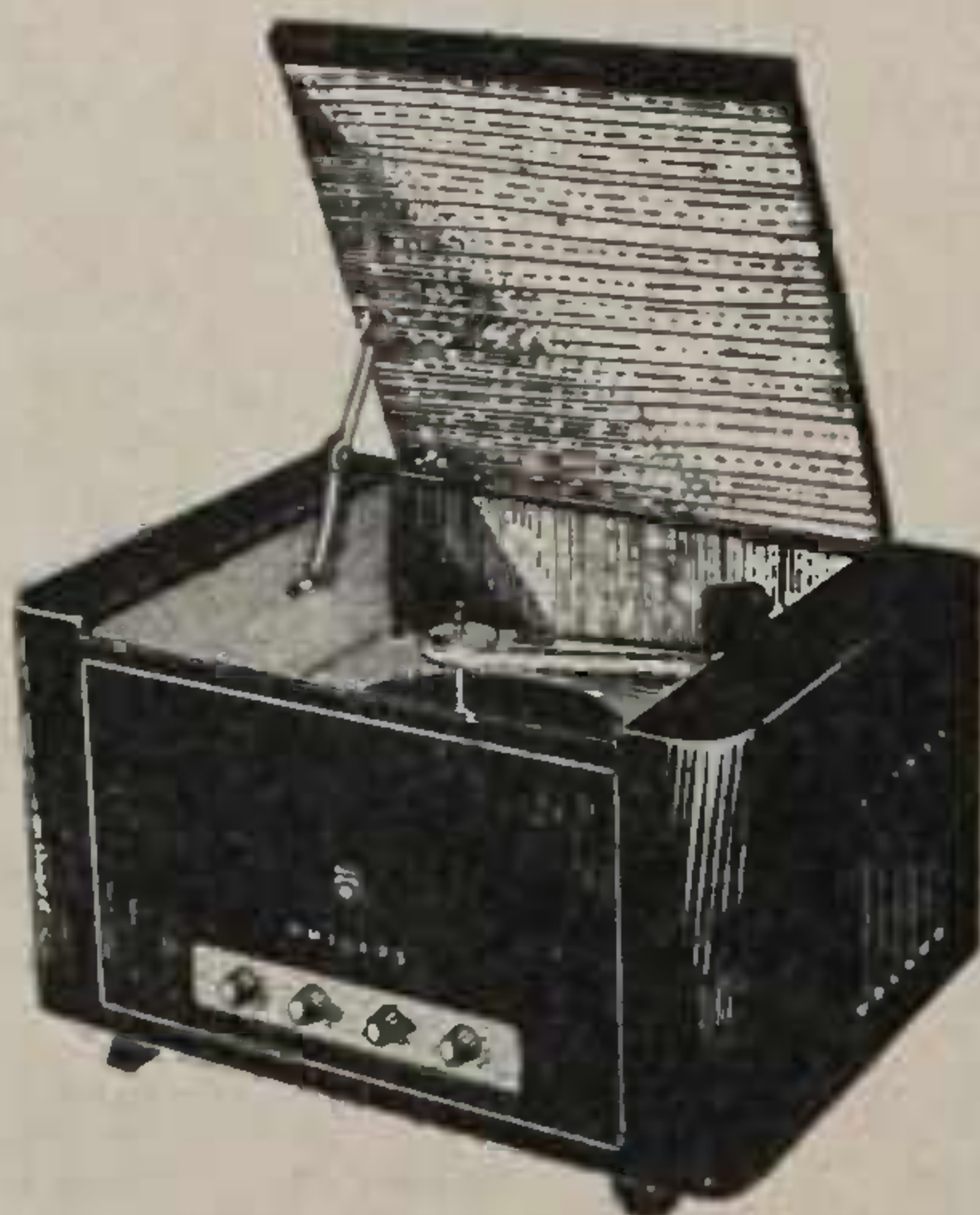
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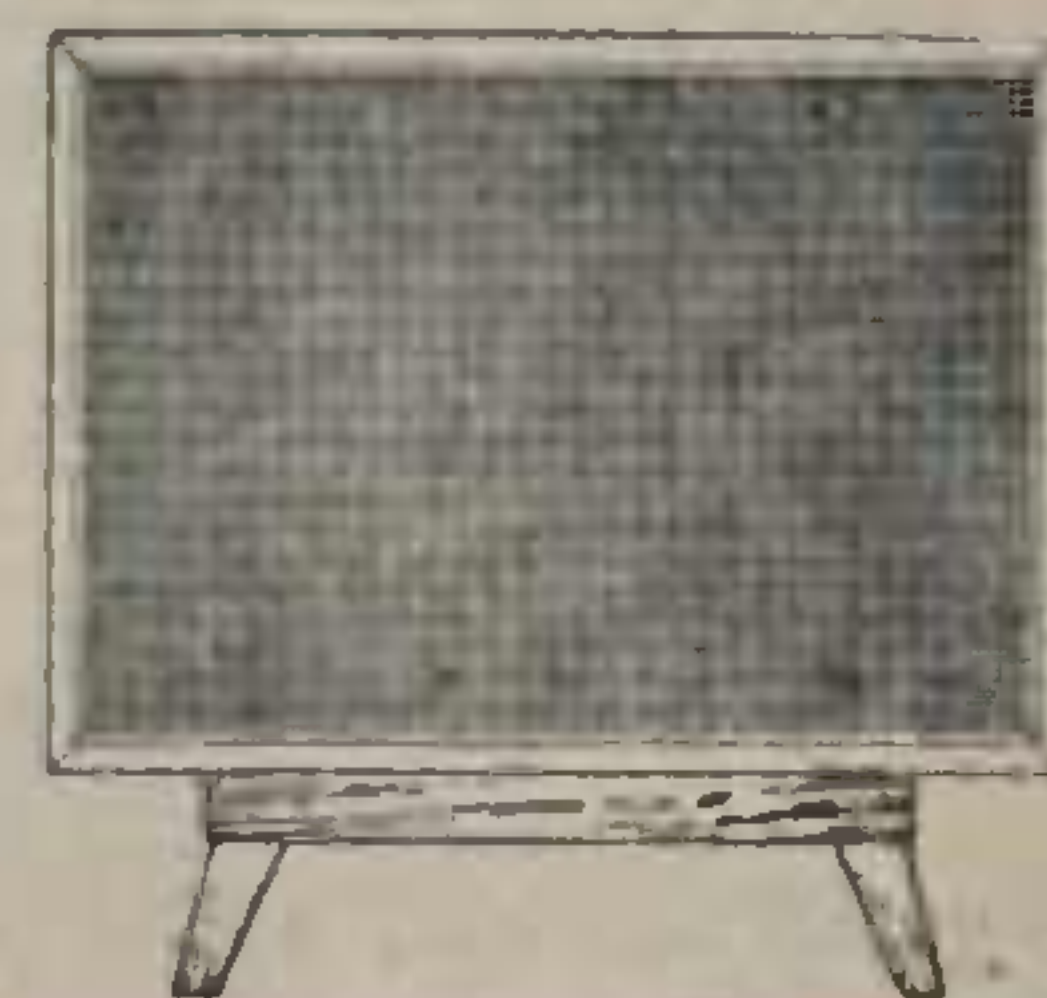
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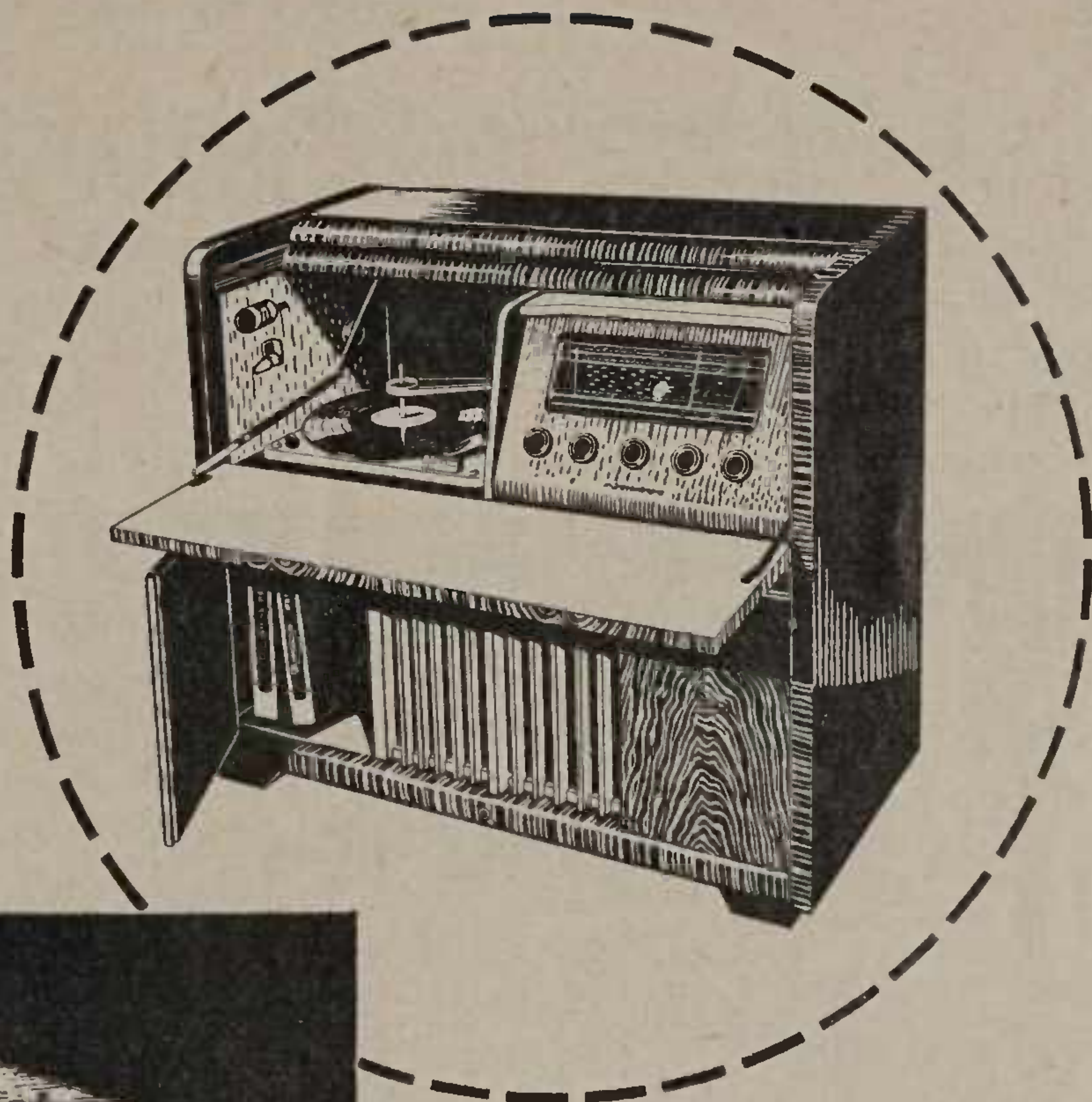
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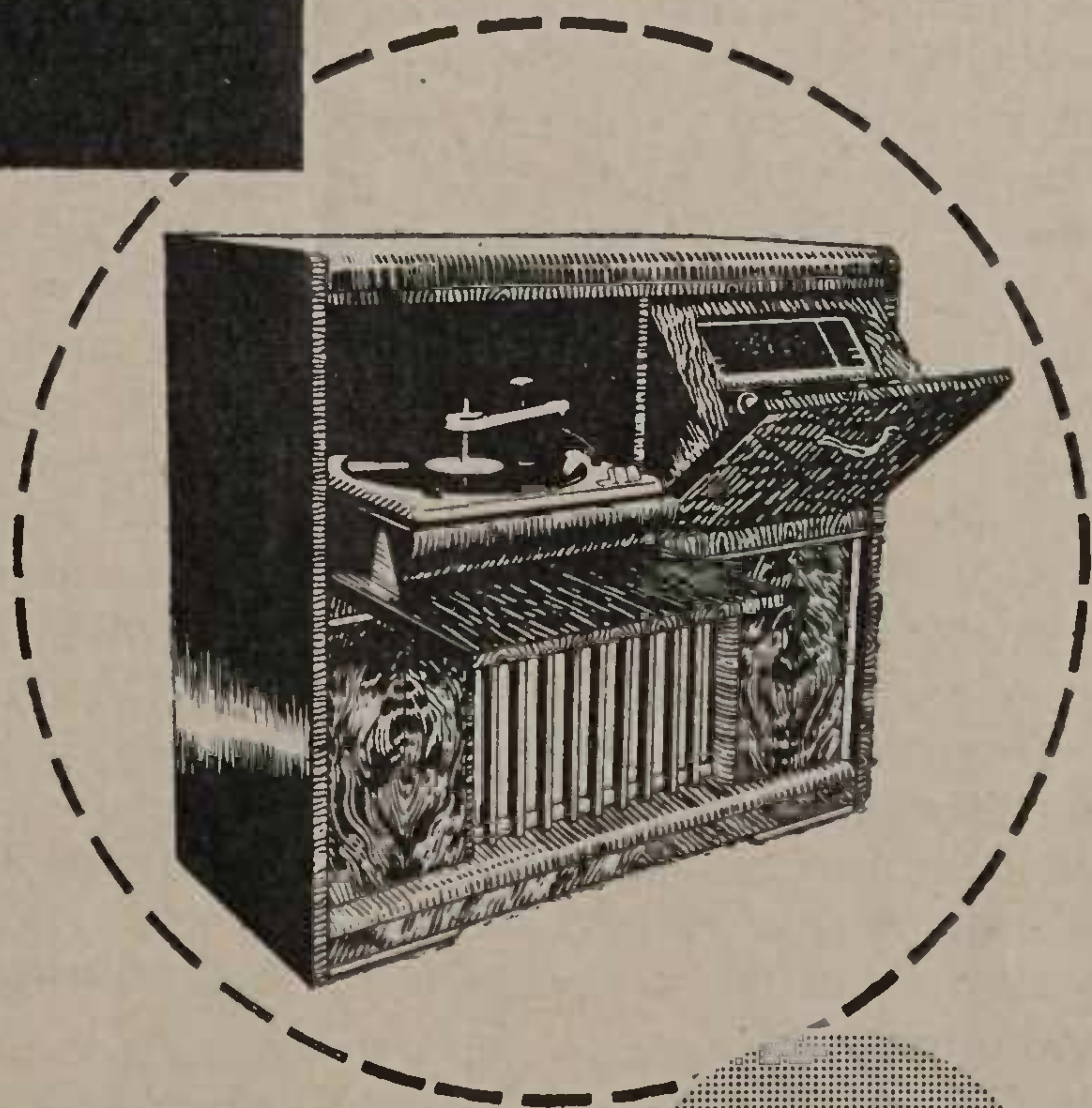
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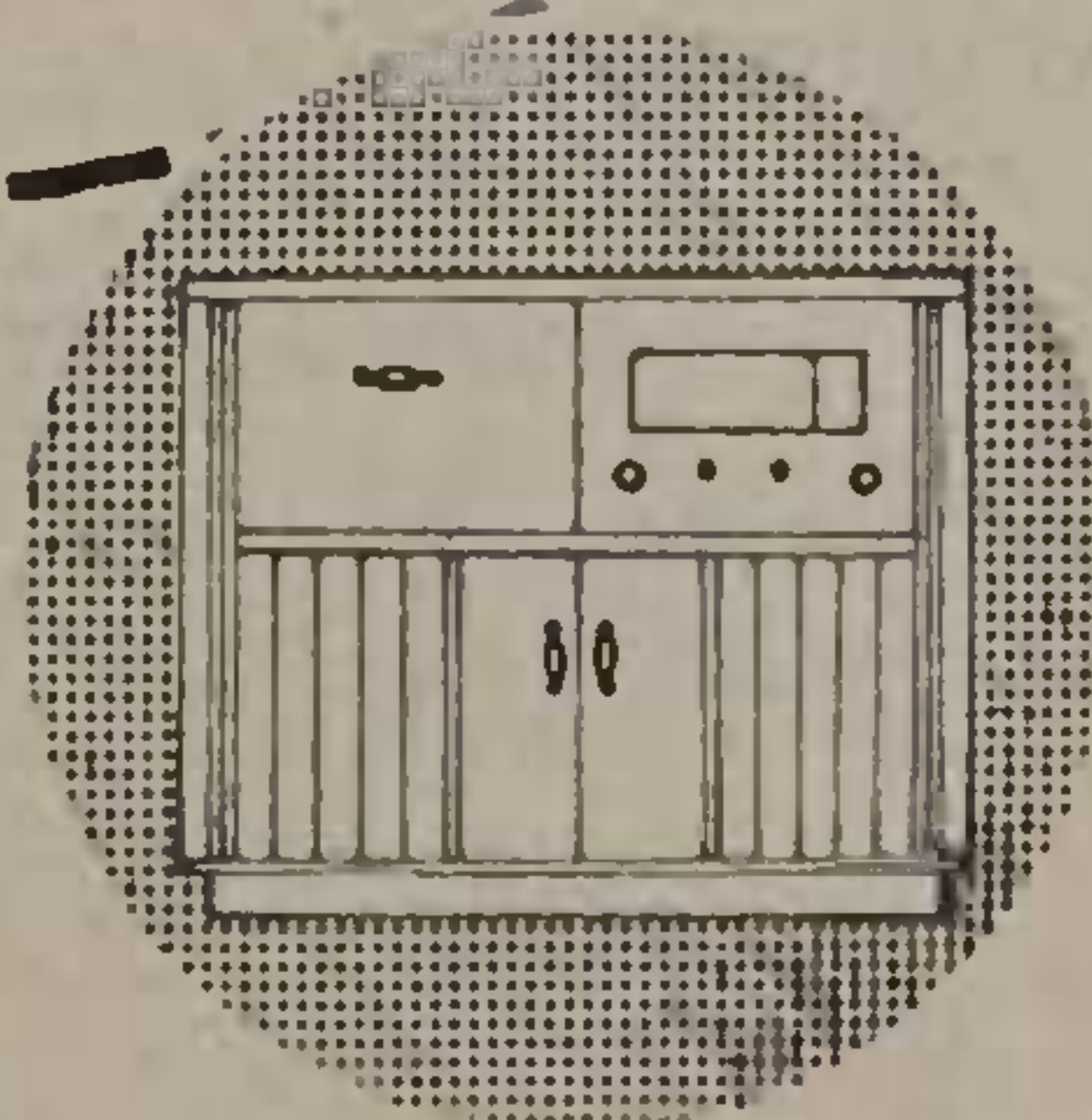
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Making the Coils

The plug-in coil formers are home-made ones, using bakelized paper tubing for the former proper, and part of small four-pin bakelite speaker plugs as the bases. The tubing is a nominal $\frac{3}{4}$ in. diameter, with a wall thickness of about a sixteenth of an inch. It was found that the coarse thread on the bakelite plug, which is normally used for screwing on the cap, was just right to thread into the tubing, and to hold there without any fixative of any sort. The tubes used were cut to a length of two inches, and, as can be seen in the photo, the coils were wound at the outer ends of the tubes. All except the last, No. 6, were wound with 28 S.W.G. enamelled wire. Turns for the various coils are as follows:

Coil No.	No. of Turns
1	58
2	28
3	15
4	$8\frac{1}{2}$
5	$4\frac{1}{2}$
6	$2\frac{1}{2}$

Note: No. 1 has a $15\mu\text{fd.}$ condenser wired to the spare pins so as to add to the feedback condenser when the coil is plugged in.

The numbers of turns given in the above table should not be taken as fixed and immutable, for various things can happen to alter the actual number needed. For example, some transistors may need slightly more feedback capacity than others in order that they can oscillate satisfactorily at the higher frequencies. This in turn adds slightly to the minimum capacity across the tuning coil, and thus affects the tuning range on the higher frequencies. Because of this, the best procedure is to wind a test coil according to, say, No. 4 or 5, and to settle on the best setting of the Philips trimmer. This will generally be about at half capacity or a little more. Once the setting has been decided upon, the condenser should be waxed in position and not touched thereafter. At this stage, the exact frequency range given by the test coil is measured, and the coils on either side of it are wound to give a suitable degree of overlap between ranges. Variations from the numbers of turns given in the table will not be great, but it will be found as well to put on a few extra turns for a start, and then prune the coil until the desired overlap with the adjacent coil is obtained. Incidentally, the turn spacing on coil No. 6 is approximately $\frac{1}{8}$ in., and on this coil, spacing of the turns can be used to get the final adjustment of inductance.

Adjustments to Circuit Values

When all the coils have been built, it may be found that owing to differences in transistors, the meter

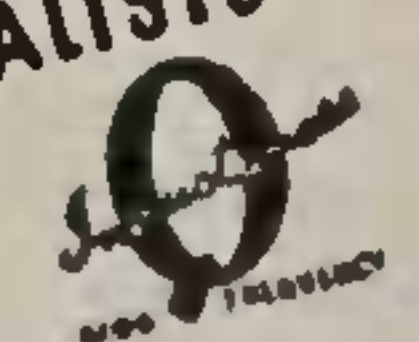
reads over full scale on one range, or on part of it. If this should happen, the best way of fixing the trouble is to make a slight increase in the 100k. shunt resistor in the diode circuit. This will decrease the diode current, and hence the current in the 2N406.

Using the Dip Meter

There are two things to look out for when using a grid dip meter of any sort. In the first instance, the meter should be coupled as closely as possible to the circuit under test, as this will make the approximate frequency easy to identify. Having obtained a dip, which will be quite deep if the meter is closely coupled to the test circuit, it will be noted that as the dial of the meter is rotated, the dip occurs relatively gradually, but that the pointer suddenly snaps back when a certain point is reached. This happens because with close coupling, the circuit under test is able to pull the frequency of the oscillator quite strongly, and the snap back in the reading occurs when the oscillator suddenly returns to its own natural frequency. Under conditions such as these, it is not possible to get an accurate reading of the frequency, because of the pulling effect on the oscillator, so that the next step is to reduce the coupling, and try again. As the coupling is reduced, a point will be found where the snap effect is no longer visible, but it will also be noticed that the dip obtained is much smaller than before. Thus, to obtain the most accurate reading of frequency, the coupling must be as loose as possible, consistent with being able to see any effect at all. Then, the reading to be taken is the position where the maximum dip has occurred. Still, for searching purposes, and for rough identification of a frequency, the coupling should be tight, so that the dip will not be missed as the meter is tuned through the frequency of the test circuit.

Of course, where it is desired to adjust the test circuit to a given frequency, this can be done by leaving the meter set to that frequency and tuning the test circuit until the dip is a maximum. Once more, for final and most accurate adjustment, the coupling should be kept as loose as possible.

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TRANSISTOR AMPLIFIER STAGES OPERATING FROM 6, 9, AND 12V.

This article describes some low-level OC71 transistor amplifier stages. They can be used as a basis for building simple RC-coupled amplifiers operating up to 45° C ambient temperature.

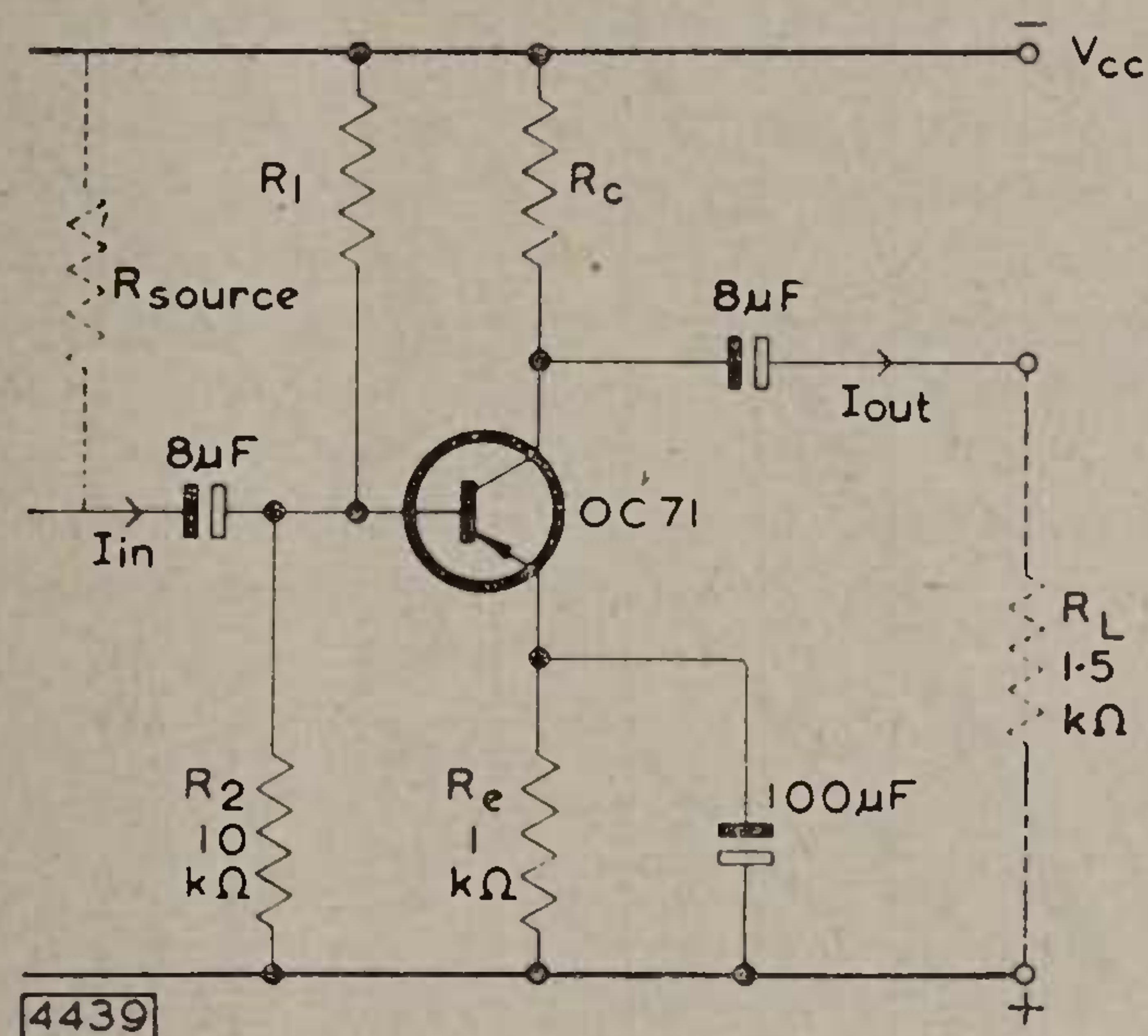


FIG. 1—A TYPICAL OC71 AMPLIFIER STAGE

The transistor amplifier stages described are suitable for RC-coupled amplifiers using identical stages in cascade. It is not possible to design a universally-applicable amplifier stage because the signal level, supply voltage, and maximum ambient temperature will differ with each application. However, the amplifier stages described will cover many low-level applications. The circuits operate at collector currents of 1.0 and 1.5mA with a 6, 9, or 12V supply.

Curves are given to show the amount of current (for any given distortion up to 5%), available for the second of two similar stages when connected in cascade.

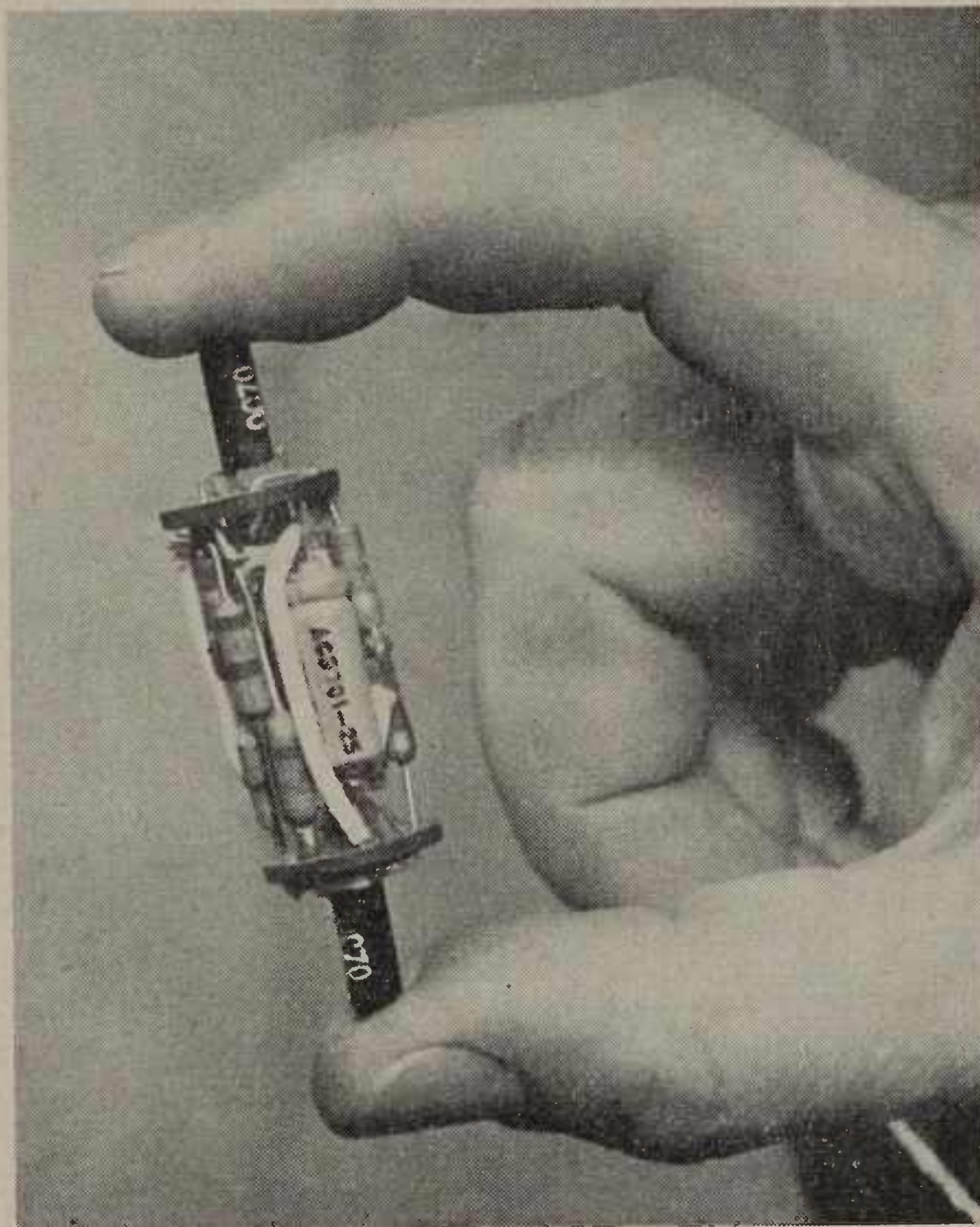
Battery drain, stage gain, signal handling capacity, and distortion have all been considered in the design of these stages.

Circuit

The type of circuit employed is that shown in Fig. 1. The potential divider R_1 , R_2 , and emitter resistor R_e provide good d.c. stabilization which ensures satisfactory operation up to 45° C.

The collector currents are chosen to be 1.0 and 1.5mA, so that the stages operate in the region where the transistor gain is near maximum, and where the non-linearity of the transistor characteristics is low. The circuit values which lead to these operating conditions, are given in the table.

The distortion and gain measurements were made on a typical transistor under the conditions expected in practice. The source resistance was equal to the collector impedance R_c of an identical stage preceding it. A resistor R_L of 1.5k Ω equivalent to the input im-



The data in this article enable resistance-capacity-coupled transistor amplifiers such as this one to be built, having a desired number of stages. The amplifier in the illustration was built in our laboratory in such a way as to make it and its power supply (consisting of penlite cells) fit into a bakelite tube with connectors at each end. It can be inserted directly in the output line from a low-level microphone, as a pre-amplifier.

pedance of an identical stage following it, was used to shunt the collector resistance R_c .

The current flowing in this 1.5k Ω resistance is the output current considered in the distortion and gain measurements tabulated below.

From the values given in the table and from the curves in Fig. 2, it can be seen that, for a given collector current, the stage gain and the amount of current available at the output for a given distortion increase with increased supply voltage.

For a fixed supply voltage it can also be seen that if the collector current is increased from 1.0 to 1.5mA, more output current for a given distortion will be available. This is obtained at the expense of slightly decreased stage gain.

V_{cc}	-6		-9		-12		V
I_c	1.0	1.5	1.0	1.5	1.0	1.5	mA
R_1	39	22	62	39	82	56	k Ω
R_c	2.2	1.5	3.9	2.7	5.6	4.7	k Ω
I_{out}/I_{in}	23	18.5	28	24	31	30	times
I_{out}^*	200	290	260	430	270	535	μA

*for 5% total distortion.

Fig. 2.

The following notes will prove useful when the designer wishes to concentrate on one characteristic to the exclusion of others.

Stage Gain

This can be increased if the ratio of the collector load resistance to input impedance of the following stage, R_c/R_1 , is increased. For operation up to a lower ambient temperature than 45°C the value of R_c can be increased. However, for satisfactory operation up to a maximum ambient temperature of 45°C this ratio R_c/R_1 can be increased if the collector current is reduced. For instance, in the 6V circuit if $I_c = 0.5mA$, R_c can be 2.2k Ω , which improves the stabilization, so that R_c can be 3.9k Ω , increasing the gain 20%. In the 12V circuit the small increase in gain does not justify the change involved.

The limit to which the collector current can be reduced is set by two factors:

- The rapid rise of input impedance of the transistors for currents less than 1mA, the effect of which is greater the smaller the source impedance R_1 source.
- The serious fall in current gain a' at collector currents below 0.3mA.

Maximum stage gain is usually obtained at a collector current between 0.3 and 1mA, the exact value depends on the supply voltage and source impedance. The maximum obtainable value of stage gain is unlikely to exceed that given by the operating conditions in the table by more than 30%.

The stage gain may also be increased by following the OC71 stage with one of lower input impedance, e.g., OC72. The ratio R_c/R_1 , will be increased and a larger proportion of the signal current will be available for the following stages.

Increased Output

This is obtained by increasing the collector current. An indication of the effect is shown in the table, where I_c is increased to 1.5mA. In the higher voltage cases the increase in I_{out} at 5% distortion is more than proportional to the increase in I_c .

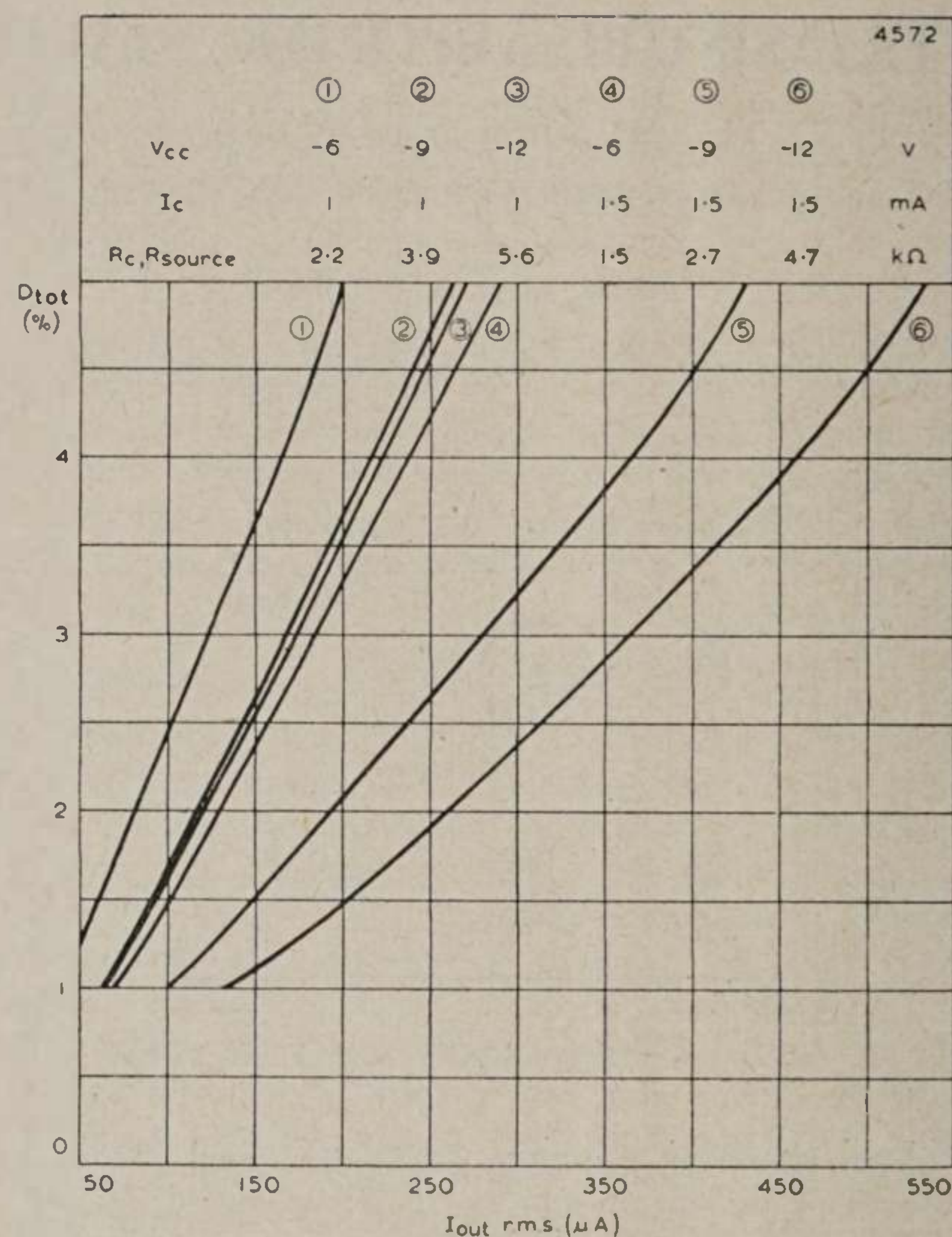


Fig. 3.

This is because the distortion requirement does not allow operation in the highly non-linear regions, 0.3mA down to zero, which forms a lower percentage of the increased collector current.

Minimum Distortion

The source impedance, which is mainly determined by the collector load resistance of the previous stage, should be as high as possible to overcome the effect of non-linear input impedance. The extent of a' variation with collector current, which also causes distortion, depends on the operating current. It is least in the region from 1 to 2mA. The signal excursion should be such that the instantaneous collector current is never less than 0.3mA.

Where two RC-coupled stages in cascade are used the distortion of the output will be less than that shown in Fig. 2, because there will be some cancellation of the second harmonics which predominate.

Reduction of Current Drain

Here, the above remarks on stage gain are also applicable. Care should be taken to ensure the stability of the circuit right up to the designed maximum ambient temperature, if the bleeder currents through the potential divider are reduced.

(Concluded on page 38.)

TENTH ANNIVERSARY OF RADIO NEW ZEALAND

This journal has pleasure in printing this message from Radio New Zealand, the overseas service of the New Zealand Broadcasting Service, which this year celebrates its tenth anniversary.

"In September of this year, Radio New Zealand will celebrate its 10th anniversary in the field of shortwave broadcasting. For the occasion many special programmes have been planned and we are anxious to ensure that regular listeners who have reported reception of our transmissions to date should be fully informed about the programmes which are to be transmitted during Radio New Zealand's 10th anniversary week from September 20 to September 26, 1958 (New Zealand dates).

Although transmissions from Radio New Zealand are designed for coverage only of Australia and the Pacific Islands, we are always interested in reports from other countries, and in acknowledgement of the interest of listeners generally, we are issuing a Special QSL Diploma to be awarded to all listeners who log any of the programmes presented during anniversary week. In addition, a Special Souvenir Award will be made to the listener in each country who supplies us with the most informative technical report combined with the best identification of programme content during the period of the week's transmission within the hours of 0600 to 0700 G.M.T. and 0930 to 1030 G.M.T. It is pointed out that the award is for the most comprehensive report (with particular emphasis on programme identification) covering the full period of the anniversary week within the hours specified, but the Special Souvenir Diploma is issued to all listeners who adequately report reception of Radio New Zealand at any time during anniversary week.

The frequencies to be used during anniversary week have not been decided upon fully but either of the frequencies 6.08 megacycles or 9.54 megacycles will definitely be one of the frequencies used. Actual full details of frequencies and summaries of anniversary programmes will be broadcast prior to anniversary week from Monday, 15th September to Friday, 19th September (New Zealand dates) at the following times:

0700, 0840, 0900, and 1040 G.M.T.

"R. & E." prototypes are frequently available for sale at attractive prices. If you are interested, please write to "Radio and Electrical Review," P.O. Box 6361, Wellington. Telephone 50-660.

Concerning our reference above to the Special Souvenir Award, the reporting form shown below should be adopted.

The code is as follows:

<i>Signal Strength</i>	<i>Interference</i>	<i>Overall Merit</i>
0 Inaudible	0 Very strong	0 Nil
1 Very weak	1 Strong	1 Very poor
2 Weak	2 Fairly strong	2 Poor
3 Fairly strong	3 Weak	3 Fair
4 Strong	4 Very weak	4 Good
5 Very strong	5 None	5 Excellent

Example: 534 means a very strong signal with weak interference reducing the overall reception merit to good.

As explained, of course, the actual reception report needs to be supported with programme identification.

The anniversary programmes will include special sessions of particular interest to many of the countries from which we receive a great number of reception reports.

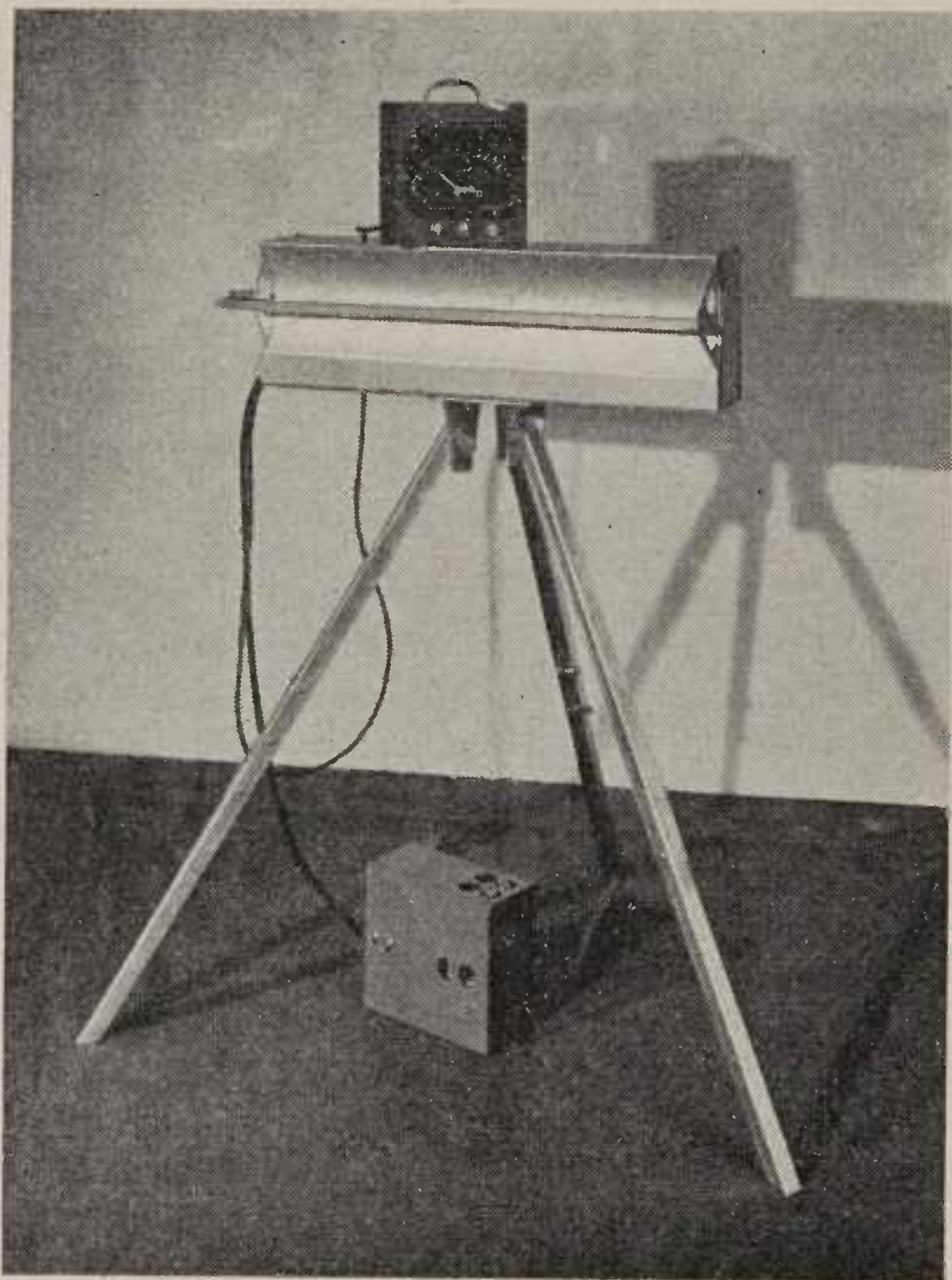
A special feature of the week's programmes will, of course, be that presented on the actual date of Radio New Zealand's 10th anniversary, that is September 26. This is also New Zealand's National Day—"Dominion Day" and on this night a highlight of the broadcast will be a documentary programme tracing the developments and broadcasting highlights of the shortwave service over the past ten years. Also during anniversary week will be featured contributions to our programmes kindly prepared by other shortwave services. It is possible you may hear a programme contributed by the shortwave service in your own country. The details of the times of these overseas contributions will be heard during the summaries of programmes and frequencies to be used, the times of which are referred to above.

We do hope that you can join us for what we are sure will be an interesting week for all shortwave listeners and radio enthusiasts.

As this early advice is receiving a very wide distribution, we would ask you to understand that we are not able to enter into any communication affecting the general plans outlined above."

THEY HAVE THEM IN ENGLAND, TOO!

New Radar Speed Check Can Select Individual Vehicles



Marconi's Wireless Telegraph Co. Ltd., announce the production of the first radar speed check equipment to be designed and manufactured in Great Britain. The device is known as "PETA" (Portable Electronic Traffic Analyser).

"PETA" removes one of the major objections to the use of radar as a means of checking the speed of road vehicles in that it can discriminate between individual vehicles even under conditions of dense traffic. It will provide separate readings on vehicles which are only 8 ft. apart and will automatically "lock on" to any individual reading if so desired. The speed range of the equipment is from 2 m.p.h. to 80 m.p.h. but this can be extended if required. The accuracy of speed assessment is within 1 m.p.h.

"PETA" employs the Doppler effect of frequency change which occurs when electromagnetic waves are reflected from moving objects. This principle, in conjunction with the extremely narrow horizontal beamwidth of the radiated signals (between 3° and 4°), provides simplicity of design, portability, and high accuracy of measurement, giving the user a device which calls for no technical skill in its operation. An

extensive use has been made of transistors and printed circuits in order to achieve compactness and light weight.

The complete equipment, which weighs only 21 lb., consists of a transmitter/receiver unit with its associated aerial, and a meter unit.

In practice, the aerial unit forms a baseplate for the transmitter/receiver unit. The equipment is placed in the open boot of a car with the aerial facing the on-coming traffic, or taken outside as convenient. The natural "squint angle" of the aerial is such that when the latter is physically at right-angles to the road the transmitted beam is directed at the required angle of 20° to the line of traffic.

The transmitted beam is reflected from the vehicle concerned and is picked up by the receiver, which measures the difference in frequency between the transmitted signal and the received one. This change is known as the Doppler Effect and is occasioned by the movement of the vehicle; the frequency difference is proportional to the speed at which the latter is travelling. A voltage signal, proportional to the change, is transmitted over a convenient length of cable to a meter which is directly calibrated in m.p.h. or k.p.h. and thus provides instantaneous information upon the speed of the vehicle.

The potential uses of "PETA" are by no means confined to the operation of speed checks. By the use of a 35 mm camera attachment and an analyser unit which is in the course of development, a record can be provided of the speed and frequency of traffic at any particular road point.

The standard version of the equipment incorporates a single-channel system; if discrimination between near- and far-lane traffic is required a double-channel system is available for fitting as an optional extra.

The cost of "PETA" is likely to be under £500.

Technical Appendix

Summary of Features

The equipment operates in the "X" Band and gives an FM/CW output of 4-10mW from a klystron feeding into a slotted waveguide aerial with flare. This provides a working range between 8 ft. and 150 ft.

The horizontal beamwidth of the aerial is between 3° and 4° and is directed at 20° from the line of traffic. Vehicles of more than 8 ft. apart will give separate readings on the meter and the needle will also automatically hold the reading if required.

The speed range covered by the equipment is normally 2-80 m.p.h., but these features may be extended as required to suit the speed bracket to be used. A calibrating signal at 30 m.p.h. or any other datum figure is provided and readings on the meter are accurate to better than 1 m.p.h.

The standard version of the equipment incorporates a single-channel waveguide system and if discrimination between near- and far-lane traffic is required, a double-channel waveguide system can be fitted at extra cost in place of the single channel.

The fullest use has been made of transistors and printed circuit techniques in order to achieve compactness and light weight.

Data Summary

Power output: 4-10 milliwatts FM/CW.

Aerial: Linear slotted waveguide array with flare. Horizontal beamwidth, Between 3° and 4°.

Range: 8-150 ft.

Speed range: 2-80 m.p.h. (or as required).

Discrimination: Vehicles more than 8 ft. apart will give separate readings.

Meter: Rectangular (4 in.)

White figures on black background.

Linear response.

Accuracy: Better than 1 m.p.h.

Directivity: Near -or far-lane reading facility is incorporated as optional fitting (switchable).

Power supplies: 9v D.C. Stabilised from a 10-16v supply.

Consumption: Power consumption is 2A from a standard 12v car battery.

Dimensions and Weights

	Size (approx.)	Weight (approx.)
Transmitter/receiver unit	26 in. x 8 in. x 7 in.	15½ lbs.
Rejection filter	8 in. x 6 in. x 3 in.	3½ lbs.
Meter Unit	6 in. x 5 in. x 2½ in.	2 lbs.
		21 lbs.

* * *

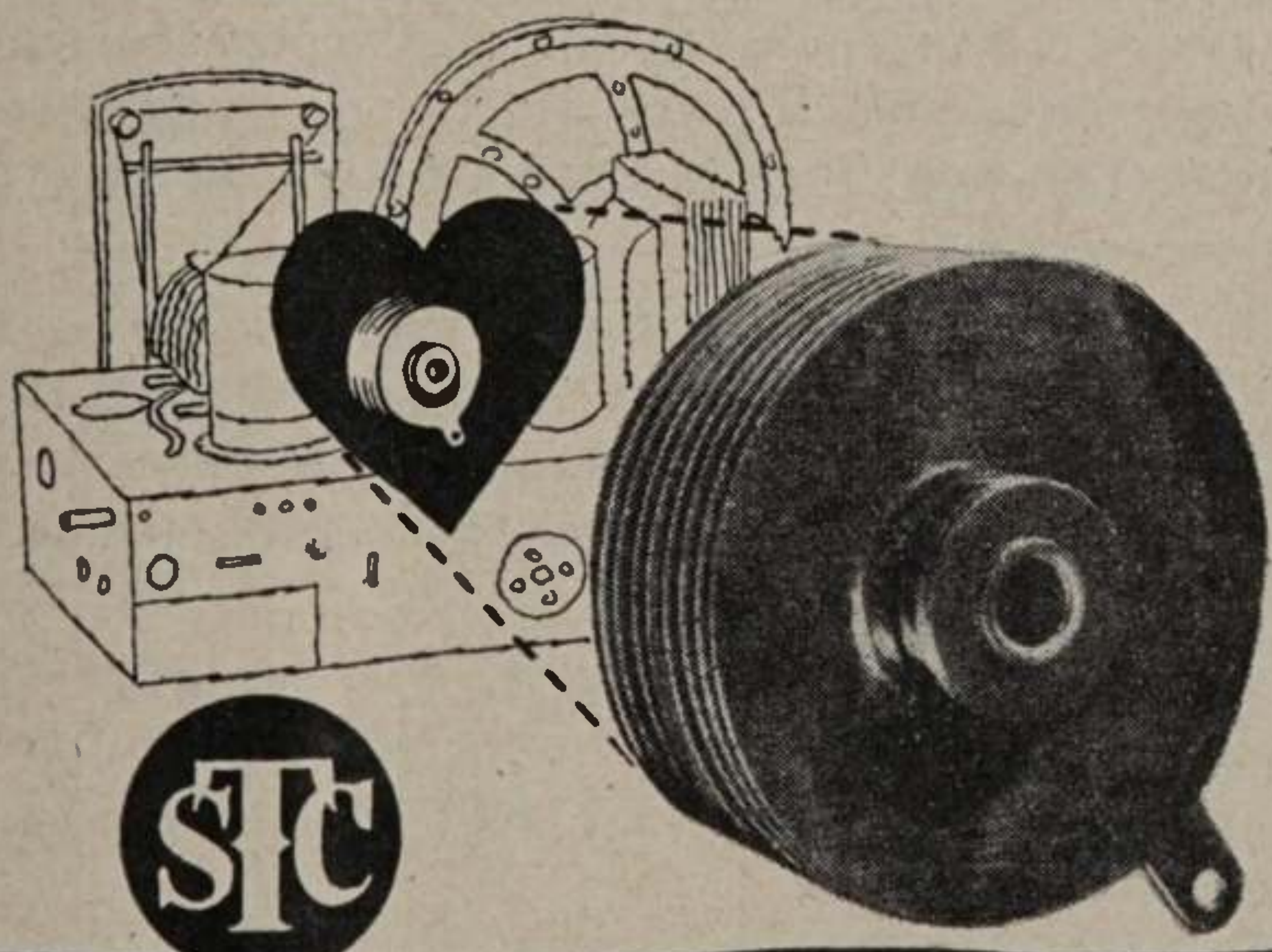
Why Do Amplifiers Sound Different?

One of the (to many) minor mysteries of audio reproduction is that definite differences can be observed between the sounds of various amplifiers which, in all important respects may have, and live up to, identical technical specifications. When the amplifiers concerned are found to have minutely small amounts of distortion, as measured by conventional methods, and when they all exhibit a flat response over the audio frequency range and well beyond, in both directions, how can such things be?

A recent article by N. H. Crowhurst propounds the very likely theory that the observed differences are due to the behaviour of the amplifiers in those very frequency bands that should have no effect on the audible output, but which in practice do, because of effects that are seldom recognized. The main one of these is the effect on the amplifier valves when there is so much feedback round the amplifier that the latter is near to the point of low-frequency instability. It might be thought that as long as the amplifier does not actually motor-boat there would be no trouble, but such is not the case. If the amplifier is close to the point of oscillation, there will be a large response peak in the vicinity of 1 to 2 cycles per second. Thus, when a transient disturbance comes along, the grid voltages and plate currents of all the tubes in the amplifier will fluctuate more or less violently, and will often execute a damped oscillation at this extremely low frequency. This will not be heard directly in the speaker, nor will it necessarily be noticeable, even with meters, at the amplifier's output terminals. How it will make its presence felt, though, is by causing distortion to the higher-frequency signals that

(Continued on page 36.)

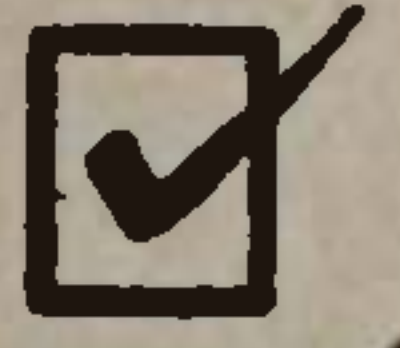
The HEART of the Portable



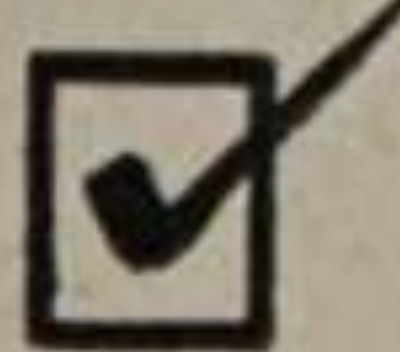
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★ Peak performance



★ Practically unbreakable

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ELECTRICAL AND TRADE SECTION

For the Serviceman

GARRARD MOVING COIL PICK-UP—TYPE GMC-5

Installation and Operation

Mounting

The cartridge bracket should be secured in the pick-up case with two screws provided and the bracket moved into position before tightening them up. In the case of the Garrard Model TPA10 Transcription Pick-up Arm, the stylus should be in line with the two notches on the underside of the case and the arm adjusted as instructed. With pick-up arms of other manufacture the stylus should normally lie $\frac{3}{8}$ in. in advance of the line joining the two fixing screws unless specifically stated otherwise by the makers of the arm.

Stylus Pressure

The Garrard GMC-5 pick-up has an extremely high compliance and theoretically can track correctly at less than 2 grammes on a microgroove record. For this reason the record wear with the cartridge properly installed will be very low indeed. In common with all high-quality pick-ups other factors such as the design of arm and stability of floor, etc., largely determine the correct stylus pressure, and we therefore recommend this pressure be set at 5 grammes.

Input to Amplifier

The output of the pick-up is some 3 db higher than most variable reluctance pick-ups and any amplifier having sufficient sensitivity for such pick-ups will work satisfactorily with the Garrard GMC-5 pick-up. The pick-up is not intended to be used without its special coupling transformer type T.P.I. and the required input impedance of the amplifier should be 1 Megohm, but this may be reduced to 0.5 Megohm without noticeable loss of high frequencies. The frequency response of the pick-up may be taken to be substantially flat from 20 to 16,000 cps. on microgroove records and any departure from this condition is negligible so that no additional equalization is required to that normally provided in the amplifier itself.

The input impedance of most amplifiers is above 0.5 Megohm and is therefore suited to the Garrard GMC-5 pick-up, but in the event of it being less than this figure the manufacturer of the amplifier should

be approached as to the method of increasing this to the recommended value for the pick-up of 1.0 Megohm.

Should there be any doubt as to the suitability of any amplifier for use with this pick-up, an enquiry should be addressed to the amplifier manufacturer stating that the pick-up has an output of 8 millivolts into 1 Megohm and that the response is flat, constant velocity.

Circuit Connection

The pick-up requires a balanced feed to the primary of the transformer and this will be provided by a twin, twisted pick-up lead; this need not be screened if precautions against hum pick-up, mentioned below, are taken. Connections to the cartridges are made to the tag on the switch plate and to one of the two red-spotted tags on the cartridge body. Polarity need not be observed.

The secondary of the transformer is centre-tapped and can be used to provide a push-pull output if so required, otherwise most amplifiers require a single-ended input. The connections for both requirements are given in Figs 1 and 2.

The notes overleaf are generally applicable to all moving coil and variable reluctance pick-ups with or without transformer and give general guidance in installation:

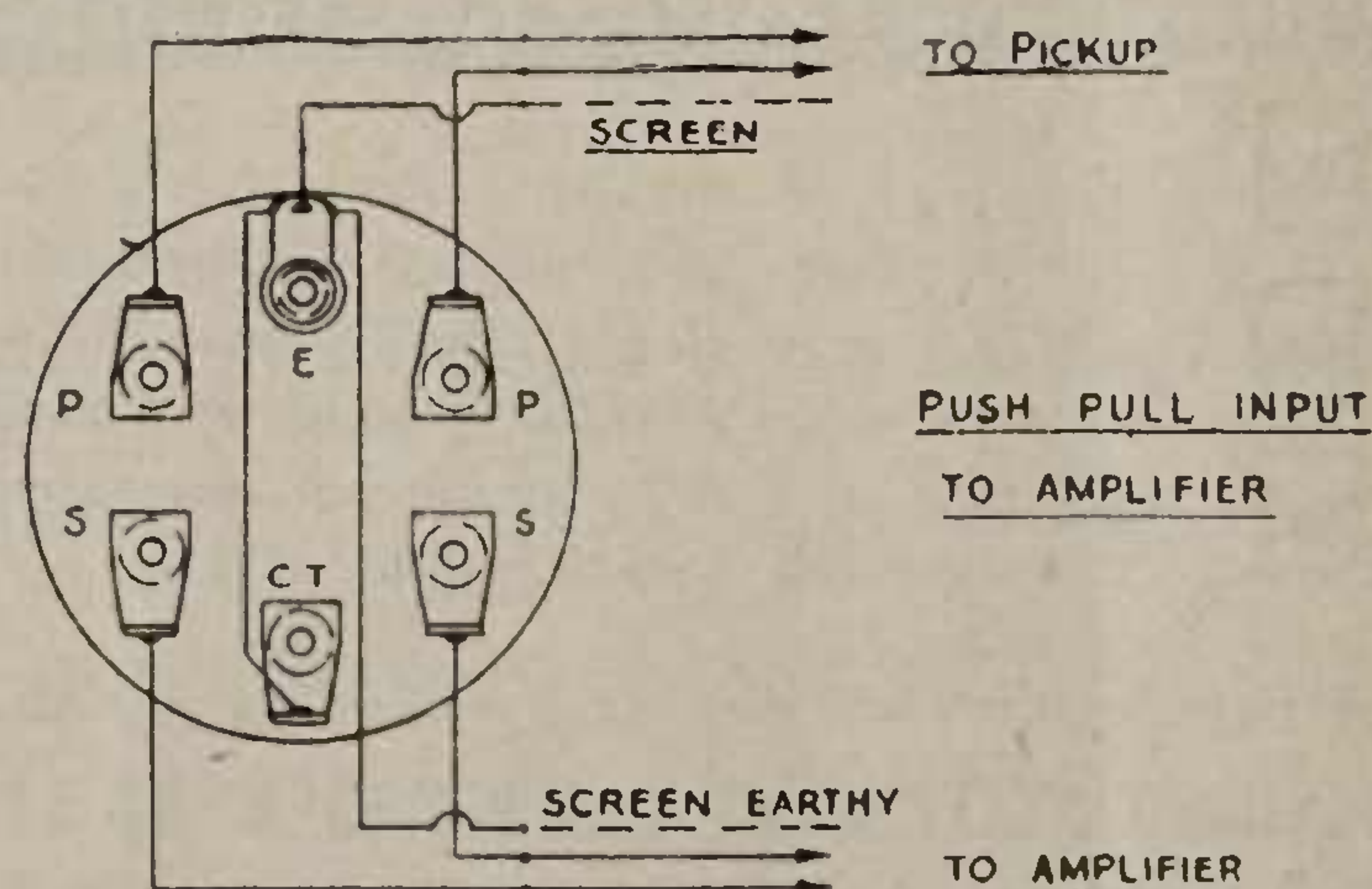


Fig. 1

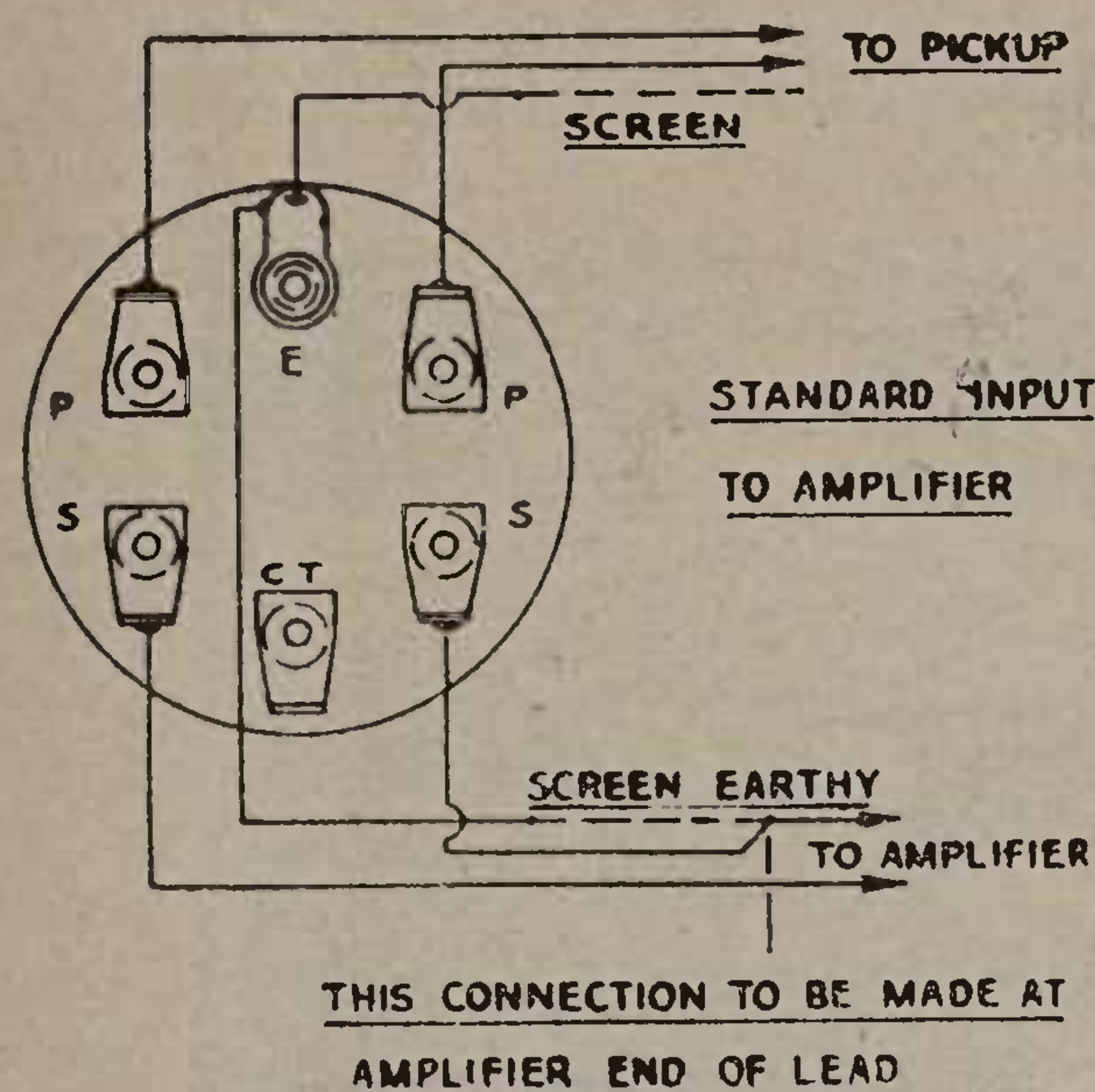


Fig. 2

The earth connection should be made exactly as shown. The hum component which always exists in the screen of the lead should be earthed as directly as possible and care be taken that it is not injected into the other leads. The connections we recommend avoid this.

The motor should not be earthed via these leads but connected separately to the main amplifier or directly to the mains plug if this has a third earth pin. See that no connection, accidental or otherwise, is made between the motor frame and the pick-up earth lead.

The transformer can is connected to the primary centre tap and is insulated at the factory from the fixing clip. This must not be altered. The transformer should be mounted in the position of least hum. Magnetic hum can be picked up from the mains transformer in the amplifier and from the gramophone motor. Two feet away from the former is usually effective and 8 to 10 in. from the latter is normally sufficient, but each installation will have to be set up individually. Electrostatic hum can also be picked up from the power supply lead, e.g., to the motor, but no difficulty should be experienced in spacing the transformer and leads sufficiently far away. A logical method of finding the best position for the transformer is to make the secondary and earth connections exactly as recommended but leave the three pick-up connections unmade. The two terminals marked P on the transformer should be joined together temporarily; it is then a simple matter to find the best position for the transformer by listening to the hum through the amplifier with the motor running.

Use with Auto Changers

The Garrard GMC-5 Moving Coil Pick-up can be used on automatic record changers and single record players. It has been so designed that it will operate at a stylus pressure of 8 grammes, which we recommend to be used with units having an automatic trip

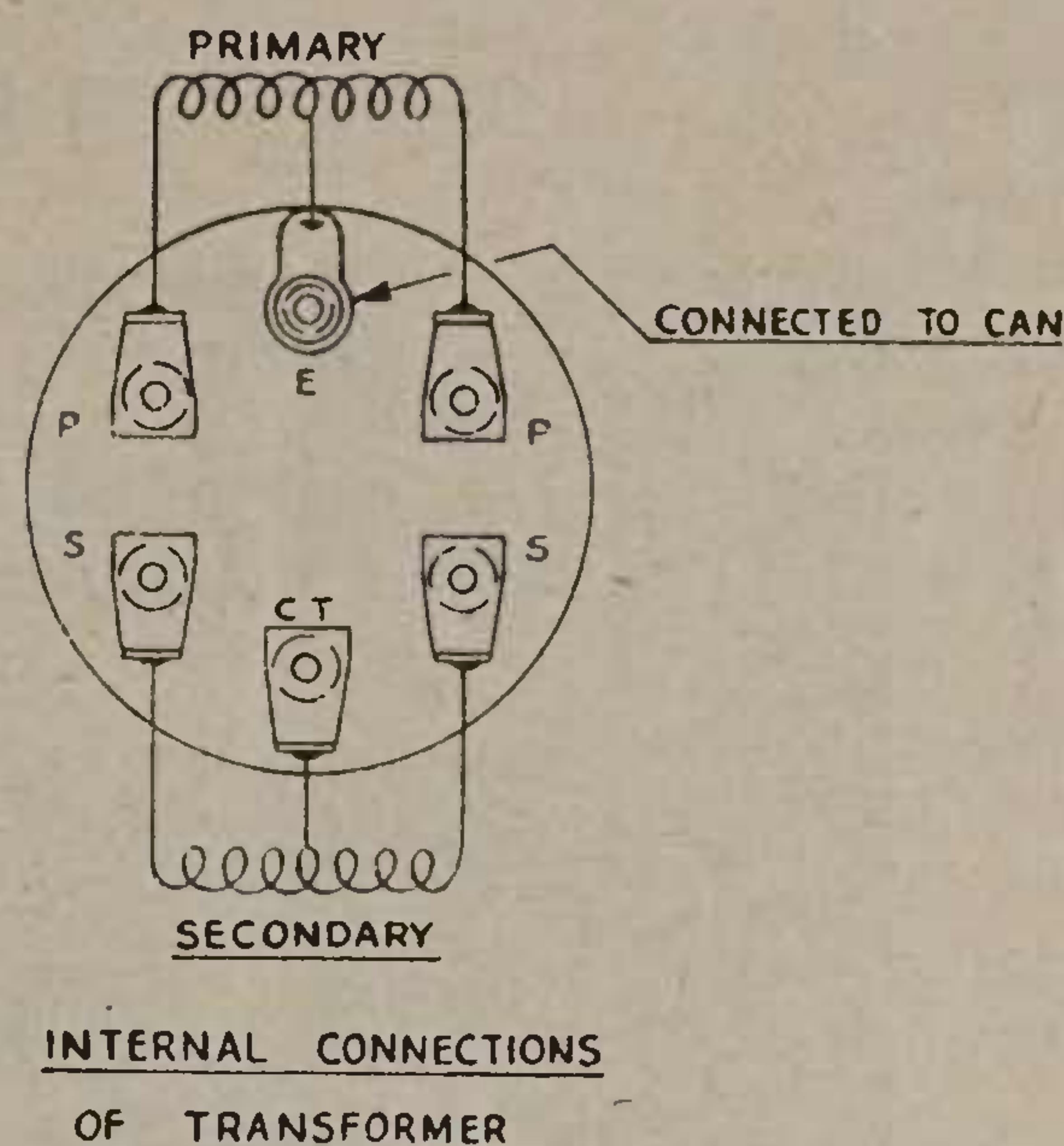


Fig. 3

or stop at the end of the record. On existing units it will be necessary to see that the single-screened pick-up lead, if fitted, is changed to a twin lead, which need not be screened, so that the balanced connection between pick-up and transformer is correctly made. The frame tag on the connecting plate should be earthed separately as described above. It will be necessary, of course, to make sure that the pick-up arm is suitable to accommodate standard turnover cartridges, which will be the case if it is fitted with our MPM1 or MPM2 mouldings.

Other Recommendations

The high power output of modern amplifiers sometimes gives rise to what is generally known as Acoustic Feedback, whereby vibrations from the loudspeaker, are transmitted to the pick-up. In extreme cases a continual howl will be set up, but in marginal cases the worst effect is to cause an apparent increase of the stylus impedance with consequent groove jumping and increased record wear, as well as impaired reproduction. This condition can be easily verified, for the trouble will disappear when the volume is reduced. The remedy lies in suitable placing of the loudspeaker and pick-up relative to each other, or resiliently mounting the motor and pick-up, or other means of preventing vibrations being transmitted from the loudspeaker to the pick-up.

The free weight at the needle point when the pick-up is positioned on the record can be set at any desired level between 6 and 9 grams. It is, of course, advisable to reduce this weight towards the 6 grams level providing the pick-up arm friction in the vertical and horizontal bearings is sufficiently low to allow the arm to track.

Channel separation at 1,000 c.p.s., 25 d.b.

Output difference between channels 1 and 2, 3 d.b. max.

Stylus tip radius, L.P. stereophonic, 0.00075 inches; standard, 0.0025 inches.

TRADE WINDS



An outstanding stand at a recent industrial fair in Invercargill.

* * * * *

Autocrat Appoints New Wellington Manager

Barry Holden, previously one of Autocrat's senior representatives in Auckland, has now taken over the Wellington Branch. Barry, a popular figure with retailers in the north, is a busy man at present making himself known to retailers in the Wellington area.

* * * * *

Post Office V.H.F. Mobile Radiotelephone Service

Post Office V.H.F. mobile radiotelephone services have now been operating for almost ten years, using in the main frequencies in the 100 to 108 Mc/s band, and the single-frequency simplex method of operation. Expansion during the decade has been considerable, particularly in Auckland, and it has been necessary to take action to ensure that there will be enough frequencies available for future needs.

Arrangements have therefore been made for the additional frequency band 94 to 100 Mc/s to be assigned to land mobile services, and for the two-frequency method of operation (i.e., using different transmit and receive frequencies) to be adopted. The two-frequency system allows more services to be operated in a given frequency band. Present plans

provide for the separation between adjacent channels to be reduced to 50 kc/s in the future.

In general, all new services will conform to the new arrangements, and existing services will be progressively converted to two-frequency working over an extended period.

* * * * *

BICC Submarine Power Cable for New Zealand

In March, 1956, the BICC Group were instructed to investigate the practicability of linking the rich electric power resources of New Zealand's South Island with the supply network of the industrial North Island. This investigation resulted in an announcement on Monday, April 28, 1958, by Mr H. Watt, the Minister in Charge of the New Zealand State Hydro Electric Department, that the BICC Group are to lay, test, and recover a trial length of cable in order to provide data for the ultimate installation of a submarine power cable across Cook Strait.

The trial cable, half a mile in length and with an overall diameter of five inches, was manufactured at the Trafford Park Works of British Insulated Cables (Submarine Cables) Limited; it is of the

single-core pre-impregnated high-pressure gas-filled type, and is to operate at 250,000 volts D.C. It has a hollow copper conductor, is paper insulated and lead sheathed, and is suitably reinforced with steel tapes and steel wire armouring to withstand the particular conditions of the sea bed under Cook Strait.

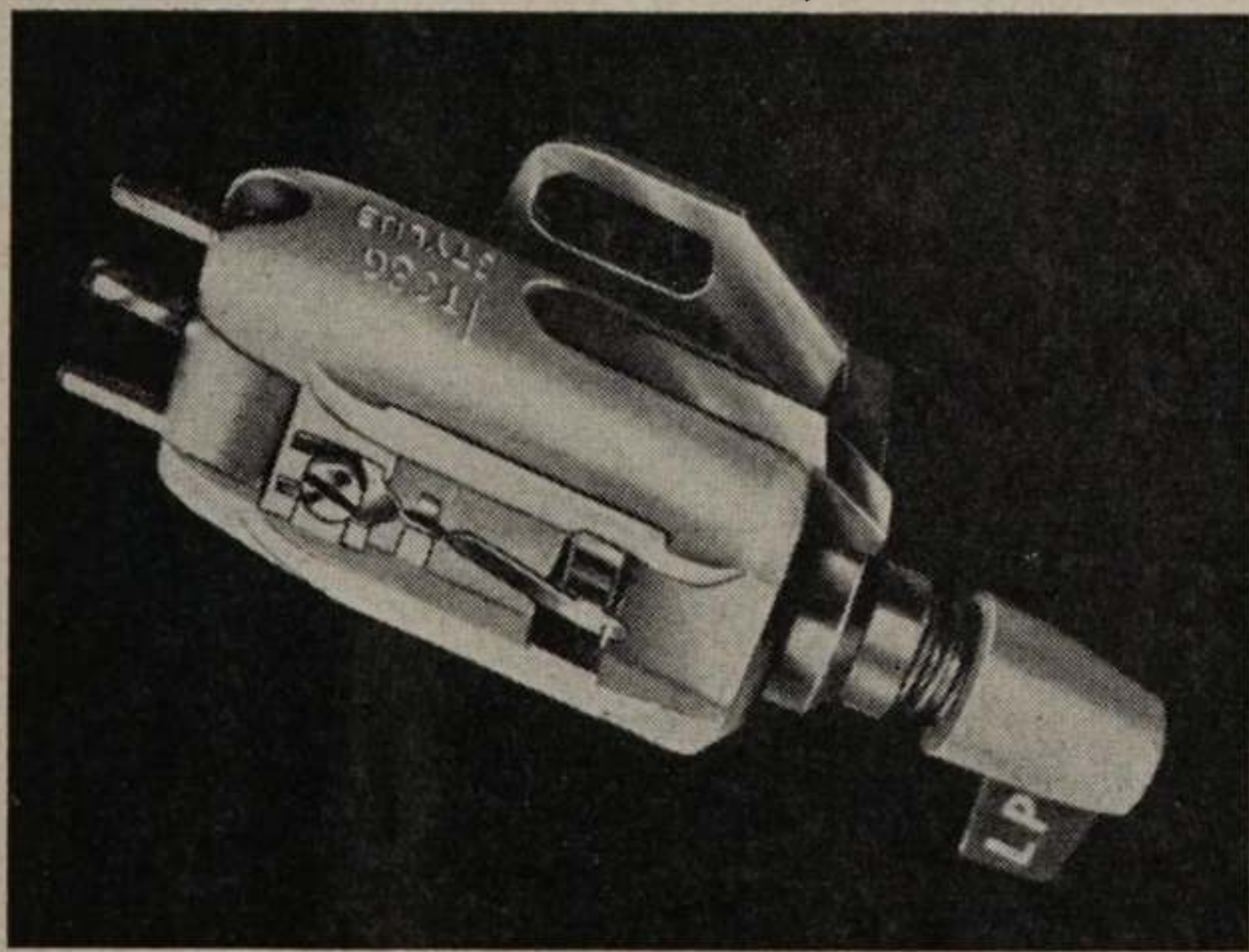
This trial cable was not of sufficient length to warrant transport by a cable-ship as would be the case for the continuous length required for the complete crossing. The cable was coiled on a giant drum, believed to be the largest ever produced. This drum was 15 feet 8 inches in diameter and 7 feet 6 inches across, and, with the cable, weighed about 45 tons. It left Trafford Park Works on 24th February, was loaded aboard the S.S. *Carronpark* at Liverpool, and arrived in Wellington, New Zealand, on 16th April.

Under the supervision of engineers from British Insulated Callender's Construction Company Limited, the trial length will be laid by the New Zealand Post and Telegraph Department's cable-ship H.M.T.S. *Matai* seawards from Oteranga Bay, which is on the North Island shore of Cook Strait south of Cape Terawhiti. After the ends have been sealed, the cable will be anchored and allowed to remain on the sea bed for as long as possible.

For the full-length cable the projected Cook Strait crossing route is a distance of some 25 miles, with a maximum depth of 150 fathoms.

* * *

"Ful-fi" Stereo Turnover Crystal Cartridge



The introduction of the world's first stereophonic turn-over crystal cartridge at last makes stereophonic reproduction a practical proposition in the home.

One of the major obstacles against the introduction of stereophonic sound has been the cumbersome adaptations and plug-ins of separate stereo cartridges.

B.S.R.'s new turn-over cartridge is not just a stereo cartridge but a universal cartridge, for in addition

it will play all standard microgroove records (45, 33 $\frac{1}{3}$, 16 $\frac{2}{3}$ r.p.m.) and at the flick of a finger, all standard 78 r.p.m. records. It has the same pleasant and streamlined lines of all "Ful-fi" cartridges. Snapfork housing facilitates easy servicing and cleaning.

The "Ful-fi" stereo turn-over crystal cartridge is available *only* in UA8 and UA12 "Monarch" record changes. This powerful combination represents the most practical contribution any manufacturer has made to stereophonic sound in this country.

It is now possible to play all stereophonic and monaural records with the truest fidelity, with the minimum of inconvenience, and at little extra cost. This is what the public have been waiting for and manufacturers can now go ahead with confidence in producing stereophonic equipment.

MISSING AND STOLEN RADIOS

Auckland:

Bell 6-transistor personal portable radio. Black bakelite case. Serial No. 62712. Value £27 10s.

Columbus 1942 Model 90. Six or seven valves. All-wave mantel model, dark wooden cabinet, new pick-up fitted at back of set. Value £30.

Electric radio, A.C./D.C. current; also battery wireless. Make thought to be Bell. White bakelite case. Value £10.

Portable radio, three transistors and three valves. Maroon plastic case. Value £22 10s.

Pye No. T.P.3069.C. portable radio. Suitcase model, dry battery, coloured grey and blue, four switches. Value £20.

Philite mantel radio. Model 167, light grey plastic case. Serial No. 8511. Value £15 15s.

La Gloria portable radio. Five valves dark blue bakelite case. Value £14.

Pye Model 121 B.Q. transistor record player. Grey plastic with blue edging, three-speed model with one needle for L.P. records and one for 78 r.p.m. records. Serial No. 796602. Value £29 19s. 6d.

Columbus transistor portable radio. Wild-rice colour with check pattern. Serial No. 80719. Value £35 10s.

Pye portable radiogram. Blue imitation grained leather case, white paint spots on case. Serial No. 46807.

Walter tape-recorder "Sound Cadet". Yellow grained leather case (stained), oval plastic plate on tape deck with "Wellington Sound" or "Wellington Recording" engraved in black.

Golden Knight radio. Battery/mains type, white plastic case. Serial No. 181843. Value £23.

Star Galaxy record changer. Value £9 6s.

Ultimate portable A.C. radio. White cabinet, cabinet new, but radio reconditioned, five valves. Value £14 5s.

Ultimate portable A.C. radio, maroon case. Serial No. 189262. Five valves. Value £16 18s. 5d.

Philips radio, Model 267. Brown case with clear plastic flutes on front. Serial No. 11220/19021. Five valves. Value £18.

Ultimate Venturer. Transistor 7 Model. White case with gold braid trimmings, no valves, 7 transistors. Serial No. 201175. Value £24 7s. 7d.

Pacemaker Buffalo radio. Grey plastic case, five valves. Serial No. 678874. Value £13 10s. 1d.

(Continued on page 36.)



John Gray

JOHN GRAY'S RECORD PAGE

RECORD OF THE MONTH

PAL JOEY (Rodgers and Hart). Vivienne Segal, Harold Lang, and members of Broadway cast with chorus and orchestra conducted by Lehmann Engel. Coronet KLL 545 (12-inch L.P.).

RECORD OF THE MONTH

"Pal Joey", never seen here on the stage, has arrived in the form of a film and will doubtless have a great deal of success, as will the Capitol soundtrack L.P. featuring Frank Sinatra and others of the film cast (W 912). So why choose to feature an out-of-the-way recording, dating back quite a few years, by a cast of principals hardly known in this country (though many will remember Vivienne Segal as the star of that early talkie musical, "Viennese Nights")? Simply because if you really want Rodgers and Harts' "Pal Joey", this is it. We all know how books suffer great changes when made into films, so do musical comedies; and the change undergone by "Pal Joey" in its transfer from stage to film is unusually drastic. Many of the best numbers have disappeared completely or are used only in instrumental form, and these have been replaced by such items as "Lady is a Tramp" and "There's a Small Hotel", which come from entirely different R. & H. shows. And some of the items surviving in the film have been considerably toned down, because in the first instance (1940) "Pal Joey" was a sophisticated play about people far removed from the wholesome types we met later in "Oklahoma". The upshot is that if you want the real "Pal Joey" you need this Coronet record. It sounds quite good—marred only by the too refined singing of Vivienne Segal who seems quite miscast—Harold Lang declaims his lines in gravel tones far more appropriate to the pungent nature of the piece.

One result of the current import situation is that distributors are now more likely to issue consolidated lists of what exactly they have in stock.

THE BEST OF WHAT'S LEFT

Those received from one or two leading organizations show that there is still, relatively speaking, a considerable amount of worthwhile material here. A few quite recent records seem to have slipped through somehow, but the general level of recording has been so high over the past five years or so that one need not regret, at least in the meantime, the absence of some of the very latest material. It has been interesting to read through stock lists put out by Delta Trading Company and by G. A. Wooller's for example. The Deutsche-Grammophon catalogue is well represented and is by no means confined only to the "safe" German composers; the Argo list is, of course, for a more specialized audience but contains much that is attractive. One record I found most enjoyable was Irmgard Seefried's recital of songs, including some Bartok and Moussorgsky in addition to the expected Schubert, on DGM 19050. The disc was made from actual public recitals and the singer was obviously in extremely good form at the time. Unfortunately,

the amount of applause which has been included is beyond all reason, and while it may have a convincing touch it will surely become only irritating in the long run, causing a mad rush for the volume control several times during the course of the record. Records taken from public performances are appearing in greater numbers than ever and it is a relief to have something which has not been assembled from innumerable pieces of tape, but surely we do not require enthusiastic clapping to convince us of this. Another singer who provides a particularly strong attraction in this German catalogue is the coloratura soprano Rita Streich. She bids fair to inherit the position once held by such as Erna Berger and Erna Sack, and seems to have more warmth in her voice than either of those ladies. Rita Streich can be heard to advantage in a curious medley record entitled "Curtain Up for Opera" (DGM 18169) on which a number of singers and orchestras combine to give us extracts from half a dozen works. She sings, for example, the rarely heard aria of the Page from Meyerbeer's "Les Huguenots", and follows this with a really sparkling rendition of the polonaise "I am Titania" from "Mignon". Other singers on this record are the soprano Annelies Kupper who gives a pleasing rendition of one of the Countess's arias from "Figaro", and Christel Goltz in a scene from "Aida". The male artists are less distinguished and the orchestral items include the good old "Coronation March" from Meyerbeer's "Prophete" and a rousing performance of the Grand March from "Aida".

H.M.V. are also active in the opera sphere, and have produced two extremely interesting L.P.s lifted from their Italian branch. A record by Gigli (MALP 6007) offers quite a mixture of his older and newer recordings. Some are from his

TWO ITALIAN VETERANS

palmy days, like the aria from "Faust" which he made in the early 30's with Goossens conducting, some from the immediate post-war period, like the exquisite song from Massenet's "Werther" made with the Covent Garden orchestra, and others, from the Italian catalogue, have never been available here at all up to now. The most interesting of these is the duet from Mascagni's light, pastoral opera "L'Amico Fritz", which Gigli made with his daughter Rina, who was no world-beater as a singer but who made some highly successful appearances in opera with her famous father at the end of the war. Their appearances in "La Boheme" were quite touching and surely provided the only instances, in the history of this famous opera, where Mimi was being made love to by her own father.

A record by Toti dal Monte from the same source (MBLP 6005) is even more interesting, because most of her records had long disappeared from view. Like Gigli she still sang up to the end of the war, but has since won new fame as an unusually fine teacher. She was one of the best Italian artists of her period, with a bright voice

"R. & E.'s" HIT PARADE LIST

We are indebted to the publishers of "Musical Express" for the lists below, which we hope will be of considerable assistance to dealers as a guide for their "pop" record buying.—Ed.

WEEK ENDED 19th JULY, 1958

Title	Artist	Position last week	Record make
1 Patricia	Perez Prado	4 ..	Victory 7245
2 Hard-headed Woman	Elvis Presley	1 ..	Victory 7280
3 Poor Little Fool	Ricky Nelson	6 ..	Imperial 5528
4 Yakety Yak	Coasters	2 ..	Atco 6116
5 Splish Splash	Bobby Darin	5 ..	Atco 6117
6 The Purple People Eater	Sheb Wooley	3 ..	MGM 12651
7 When	Kalin Twins	7 ..	Decca 30642
8 Secretly	Jimmie Rodgers	8 ..	Roulette 4070
9 Left Right Out of Your Heart	Patti Page	12 ..	Mercury 71331
10 Rebel-'Rouser	Duane Eddy	11 ..	Jamie 1104
11 Padre	Toni Arden	15 ..	Decca 30628
12 A Certain Smile	Johnny Mathis	14 ..	Columbia 41193
13 If Dreams Came True	Pat Boone	9 ..	Dot 15785
14 Return to Me	Dean Martin	13 ..	Capitol 3894
15 One Summer Night	Danleers'	— ..	Mercury 71322
16 All I Have to do is Dream	Everley Brothers	10 ..	Cadence 1348
17 Fever	Peggy Lee	23 ..	Capitol 3998
18 Endless Sleep	Jody Reynolds	17 ..	Demon 1507
19 Everybody Loves a Lover	Doris Day	— ..	Columbia 41195
20 Enchanted Island	Four Lads	18 ..	Columbia 41194

which people were inclined to call "Hard"—any singer who actually doesn't "wobble" risks such an accusation—and her complete "Butterfly" performance was one of the classics of recorded music. Two excerpts from that have found their way on to this new record, as have two previously unreleased Mozart duets with the bass Augusto Beuf and a touching aria from Mascagni's little-known opera "Lodoletta". H.M.V. have provided copious notes translated from the original Italian sleeve and the record is a most welcome oasis in the rather barren stretches of this company's classical releases at the present time. Another record from their international series is "The Music of Poland" on Parlophone PMCM 6004, though the performers are Polish emigres in Paris and one of their items turns out to be Gounod's "Ave Maria"! But there is a freshness to the singing and playing, and people interested in this comparatively little known corner of Europe might well try the disc.

Music for entertainment or frankly background purposes still has its appeal and there seems to be a steady demand for the lighter L.P. collections.

LIGHT AND BRIGHT George Feyer's piano series on Vox has long been popular. The latest release at the time of writing is a traversal of the main tunes from "Carousel" and "The King and I" (on a ten-inch disc, AVX 21300). A promised disc of "Echoes of Spain" (AVX 910) has failed to materialize but will be worth looking out for. Woollers, who control Vox releases, have pointed out that when a particular issue is exhausted it will remain unavailable until re-advised in a normal list. In all cases nowadays, it is a matter of "first come first served" and dealers will have to be more astute than ever in placing their orders. Some firms have already adopted a rationing

system, and the poor old public is apt to suffer more frustration.

Also from Woollers, this time on their Festival label, is an Al Jolson collection of items from the "Jolson Story" film. The great man is joined by the Mills Brothers and the Andrews Sisters in this medley (FR 12-1591) and those who gratefully hark back to items like "Is it True What They Say About Dixie" may well wonder what "Some Enchanted Evening" is doing there. From H.M.V. comes a toothsome collection of film themes on a 12-inch record (MELP 6052). This, which includes extracts from such films as "Anastasia", "Guys and Dolls", "Man With the Golden Arm", and "Pinocchio", is vaguely announced as being performed by "top notch radio and T.V. singers". Such a medley, if decently performed is surely preferable to the boring 12-inch L.P.s of soundtrack music from some non-musical film, and which have appeared in increasingly inexplicable numbers over the last year or so.

The "Very Merry Inacs" on Capitol T 850 makes a very welcome reappearance. In less familiar style is a Columbia record (33MSX 6009) by Nico Carstens and his Orchestra, which is described as "authentic South African Boeremusik". This is really a most attractive gathering mainly of traditional South African melodies, recorded in Johannesburg last year, and including the inevitable "Sarie Marais" and the jaunty little "Sugarbush" which made the hit parades some years back. From much nearer home is a record of "Hymns in Maori" recorded on H.M.V. by the Putiki Youth Choir conducted by the Rev. K. M. Ihaka (MDLP 6037), and from the other side of the Tasman comes a new release from organist Wilbur Kentwell (Columbia 33MS 7556). This is called "Under the Southern Cross" and is a grand medley of songs by Australian composers.

The battle of "South Pacific" is now beginning. In America the contenders have been R.C.A.'s brand-new soundtrack record from the film, featuring **PACIFIC SOUTH** Mitzi Gaynor and Giorgio Tozzi (the latter suppling the voice for the hero Rosanno Brazzi) and the ten-year-old vintage version with Mary Martin and Ezio Pinza. Coronet, who handle the latter here, have run out of stock. Local R.C.A. should have the new version on the market by the time these notes are published, and meanwhile Capitol have come up with a new Hi-Fi record of hits from the show, done by those old favourites, Fred Waring's Pennsylvanians (disc T 992). Diehards who have actually heard the new film recording are, of course determined that there is nothing like the original version!

PRINTS OF PHOTOGRAPHS

Prints of technical photographs appearing in this Magazine have in the past been available to readers, but it has now become necessary to make a revision of prices. The following are the current prices for prints, including postage.

8 x 10	8/-
8 x 6	6/-
6 x 4	4/6

WHY DO AMPLIFIERS SOUND DIFFERENT?

(Continued from page 29.)

we are listening to. The effect is very similar to that produced by rumble frequencies, and for the same reason.

It might be thought that it is unlikely, if not impossible, for the amplifier to be excited at frequencies as low as 1 or 2 cycles per second, but as Crowhurst points out, this can happen (and actually does happen) with certain musical waveforms, which, as many people have said many times, do not even approximately resemble a sine-wave. He cites the case of trumpets, and similar instruments, whose waveforms are highly unsymmetrical. They thus have an actual D.C. component, which, although not perfectly reproduced by the amplifier is able to make the grid voltages "flap about" in an unseemly manner. In an amplifier without feedback this component does not matter, because in general it will not then be amplified by more than the signal of which it is a portion only. In a feedback amplifier with a low-frequency peak, however, the D.C. component can be amplified many times more than the higher frequencies, causing the intermodulation effect complained of.

Other reasons for amplifiers sounding "different" are to be found at the high-frequency end of the audio spectrum. The amplifier may suffer from poor response shape to high-frequency transients, and this usually means overshoot and "ringing", which can certainly add coloration to the programme material.

STOLEN RADIOS

(Continued from page 33.)

H. M. V. Minisette portable radio. Blue plastic case, three valves and two transistors. Serial No. 1488. Value £12 12s.

Philco mantel radio. Five valves. Grey plastic cabinet. Serial No. 105851.

Mullard battery-electrical radio. Five valves, maroon plastic case with thin white stripe around face and back.

Bell transistorized portable radio. White colour, Model 34 P7. Serial No. 56269.

Two Bell "Personal" portable radios. Transistorized, ivory colour. Serial Nos. 60209 and 62748.

Walter portable tape recorder. Maroon colour, Model 202. Serial No. 54156.

Walter portable tape recorder. Maroon colour, Model 303. Serial No. 11168.

Portagram Babygram portable record player. Red rexine case. Serial No. 1984.

Regentone portable record player. Brown rexine case. Serial No. AG 2469.

Osram 912-plus high-fidelity amplifier. Light brown front panel. Value £39 15s.

Christchurch:

Pye 6-volt car radio. Model No. 404. black colour, complete with double-unit speaker painted grey. Serial No. 83187. Value £25 15s.

Ultimate "Personal" portable radio. White bakelite case, battery model. Serial No. 189086. Value £30.

Pye portable radio. Red plastic case, five valves. Value £32.

Bell "Personal" portable radio, four transistors, black plastic case. Serial No. 60246. Value £27 10s.

Hamilton:

Courier Venturer Transistor portable radio. Cream polythene case, red dial. Serial No. 201459. Value £32 10s.

Clipper bedside radio. Model No. 5W5. Blonde oak wooden cabinet. Serial No. 70148.

Marton:

Pye car radio Five valves Model No. P.Z. 404. Complete with aerial. Serial No. 101212.

Rotorua:

Ford transistorized car radio. Eight valves, 12-volt model, two-piece set of radio and speaker with grey painted metal cabinet. Serial No. 44624. Value £32 16s. 7d.

Clipper radio. Cream plastic case. Serial No. 107072.

Waiouru:

Autocrat transistor type car radio. Model T.P.1 push-button. Serial No. 43873.

Wellington:

Phillips portable radio. Model No 465. Cream and red plastic cabinet. Serial No. 3876. Value £37 16s.

Master-Radio portable record player. Pale grey and black checked leatherette case with red and black band around centre. Four-speed "Collaro" pick-up. Serial No. R.5472. Value £20.

Clipper four-valve radio. Model 4 CR7. Silver-grey colour. Serial No. 108808.

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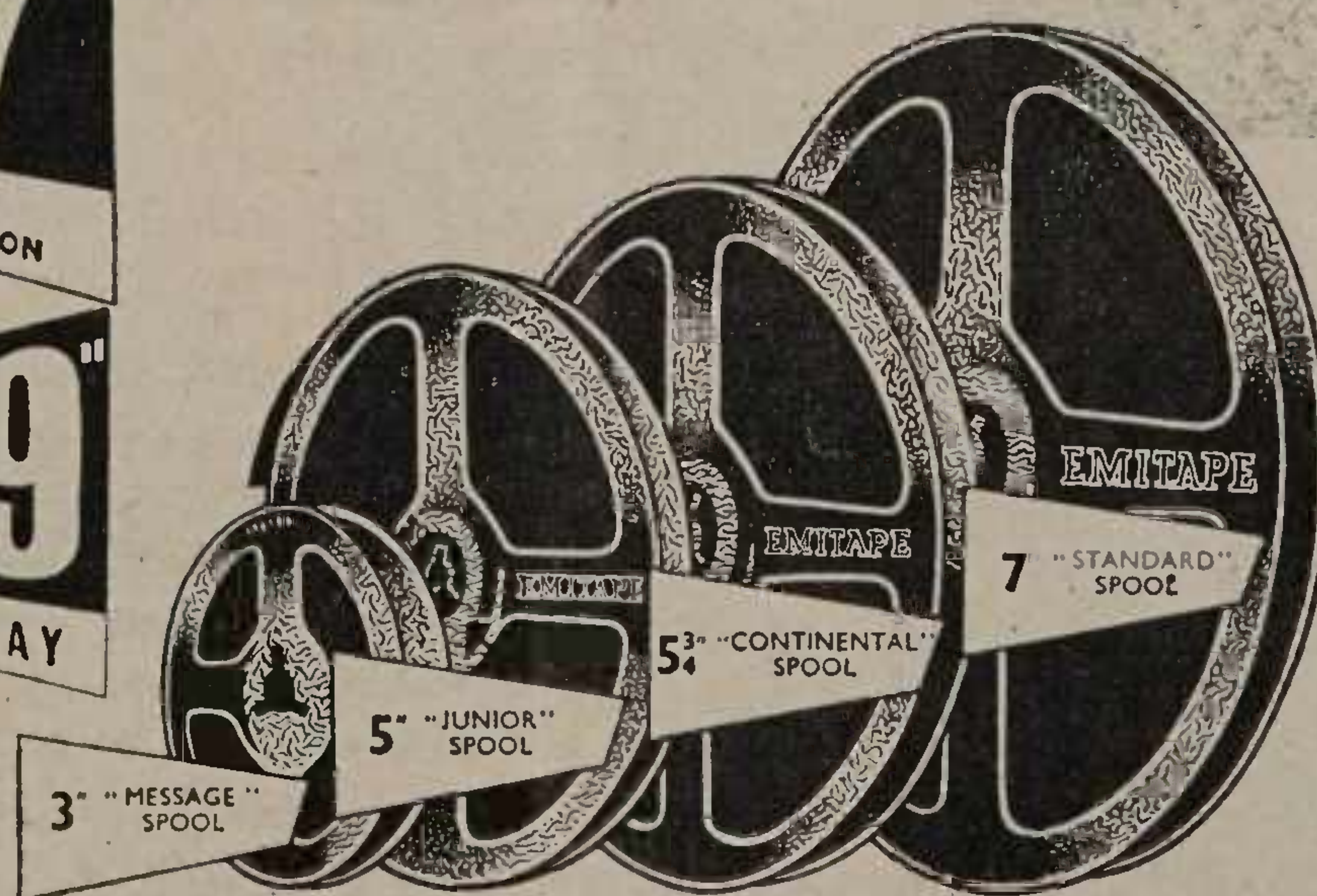
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TRANSISTOR AMPLIFIERS

(Continued from page 26.)

Maximum Ambient Temperature

For maximum ambient temperatures higher than 45°C the collector resistance must be reduced to avoid "bottoming" of the collector resulting from the increased collector current.

Noise

Provided the volume control is suitably sited, only the input transistor need be operated under minimum noise conditions. Operation with $I_c = 0.3\text{mA}$ and a source resistance of 500 to 2,000 Ω gives good results.

High stability resistors should be used in the first stage to prevent noise being generated in the resistors.

Decoupling

The stability of any multi-stage amplifier may be impaired by possible coupling between input and output

circuits by way of the supply feeders. Instability is avoided by decoupling the supplies to the earlier stages.

When dry batteries are near exhaustion, their internal impedance increases greatly. If dry batteries are used, the designer should bear in mind this effect, when considering the amount of decoupling necessary.

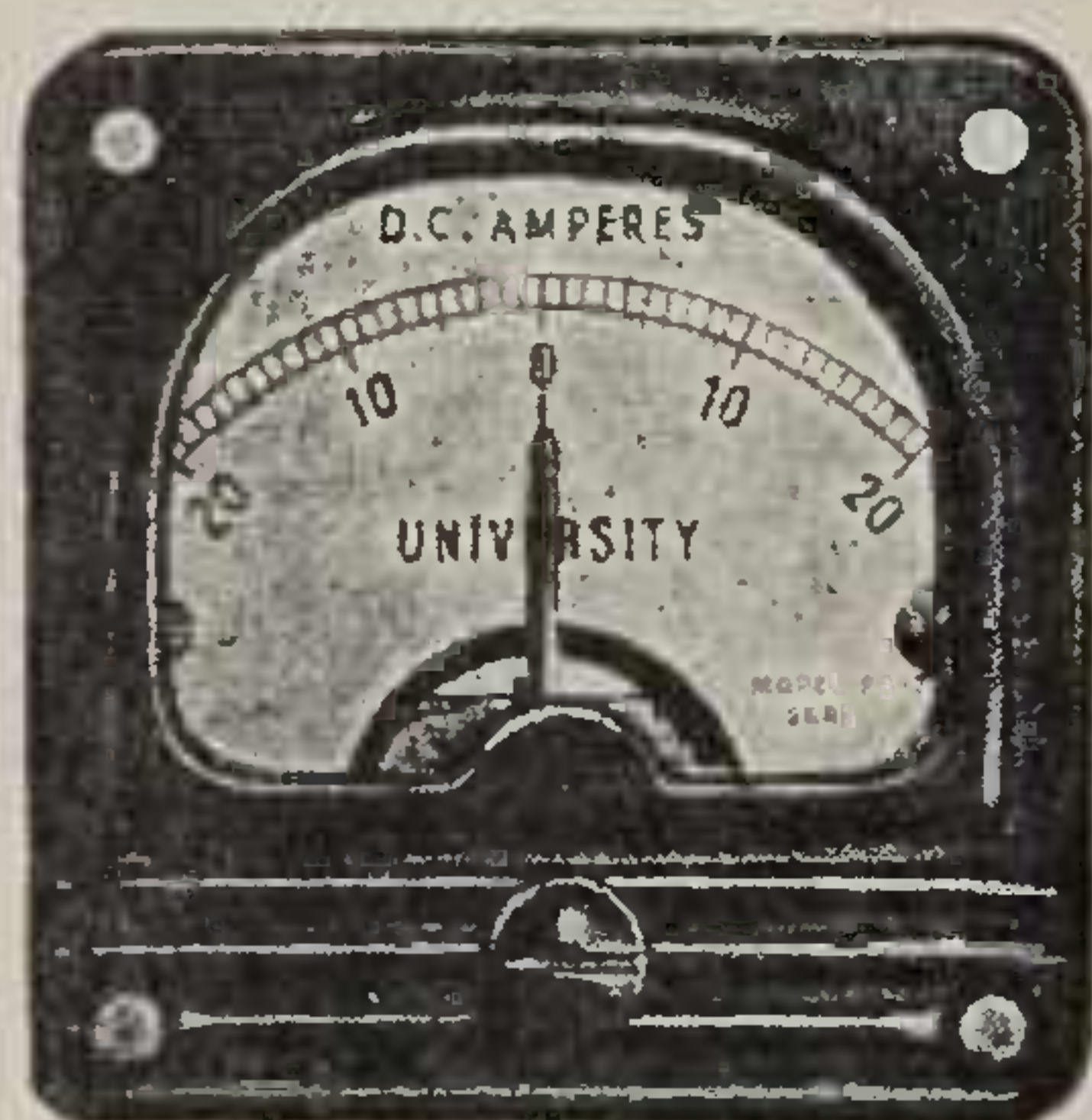
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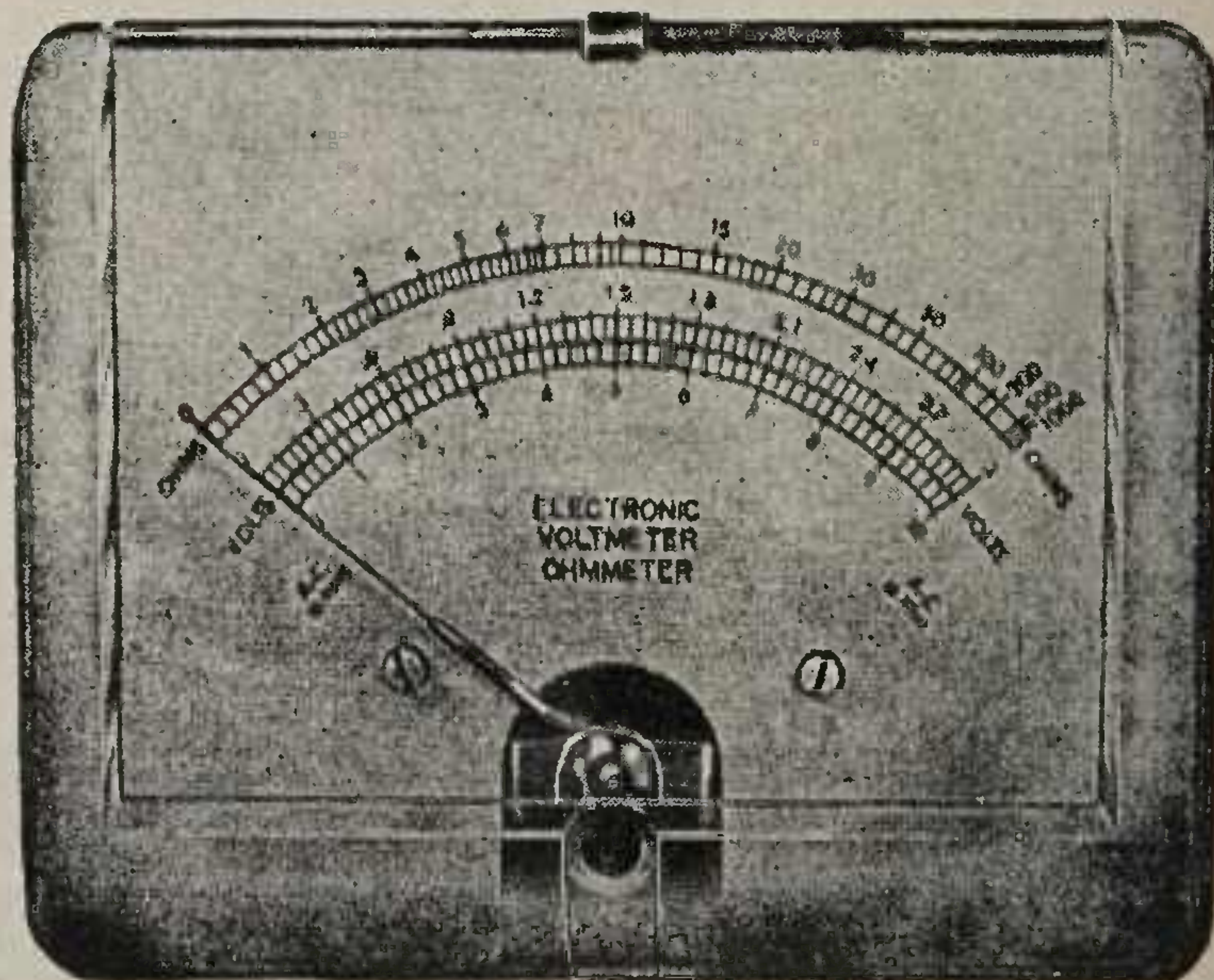


MODEL 52 Flush mounting moving coil instrument in bakelite case, with a square flange of $2\frac{1}{4}'' \times 2\frac{1}{4}''$. Scale length $1\frac{1}{2}''$ with 90° needle swing. Barrel diameter $2\frac{1}{16}''$. Self-contained up to 50 amperes D.C. or 1,000 volts D.C. Beyond these ranges external shunts and multipliers can be supplied.



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The meters illustrated follow the modern trend towards rectangular case flanges, but round types can also be supplied. The University range also includes multi-meters and a wide variety of test equipment for use in the radio and electrical trades.



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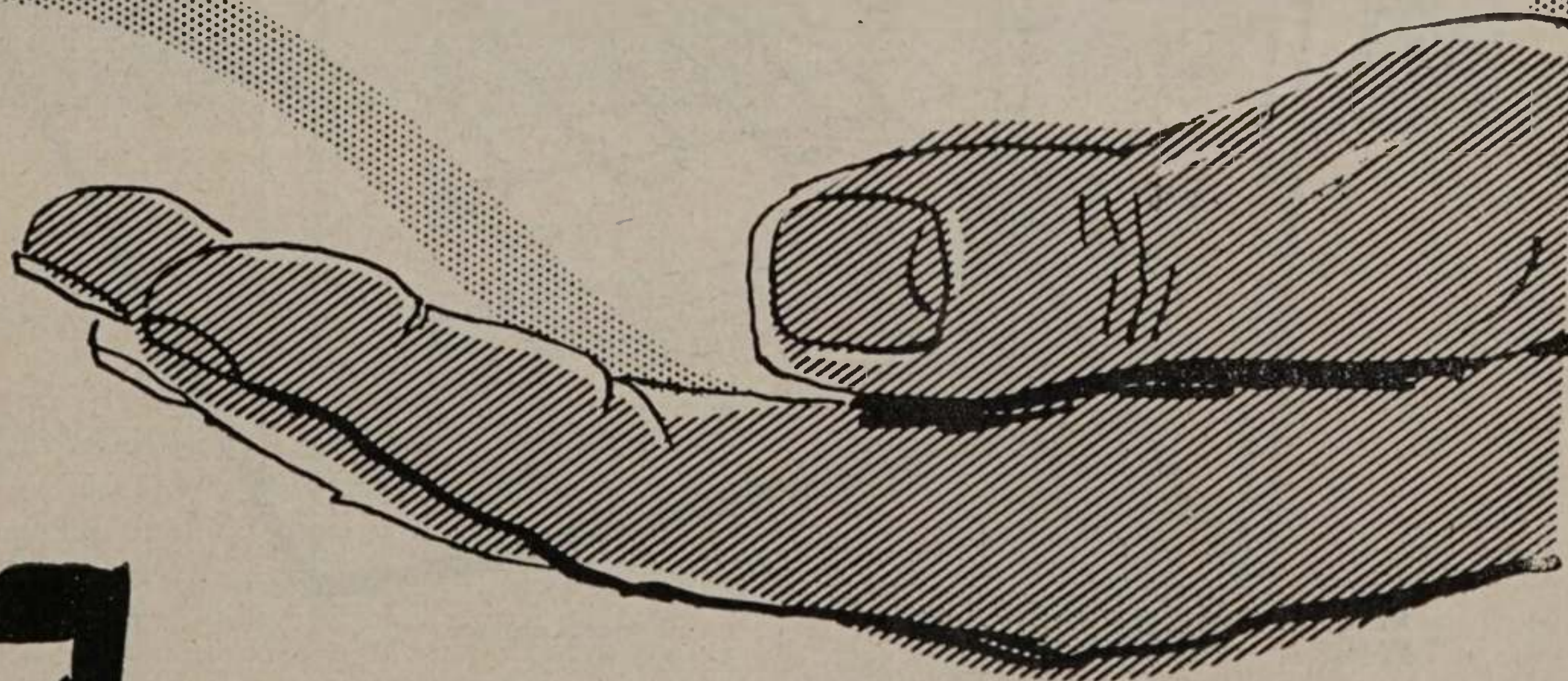


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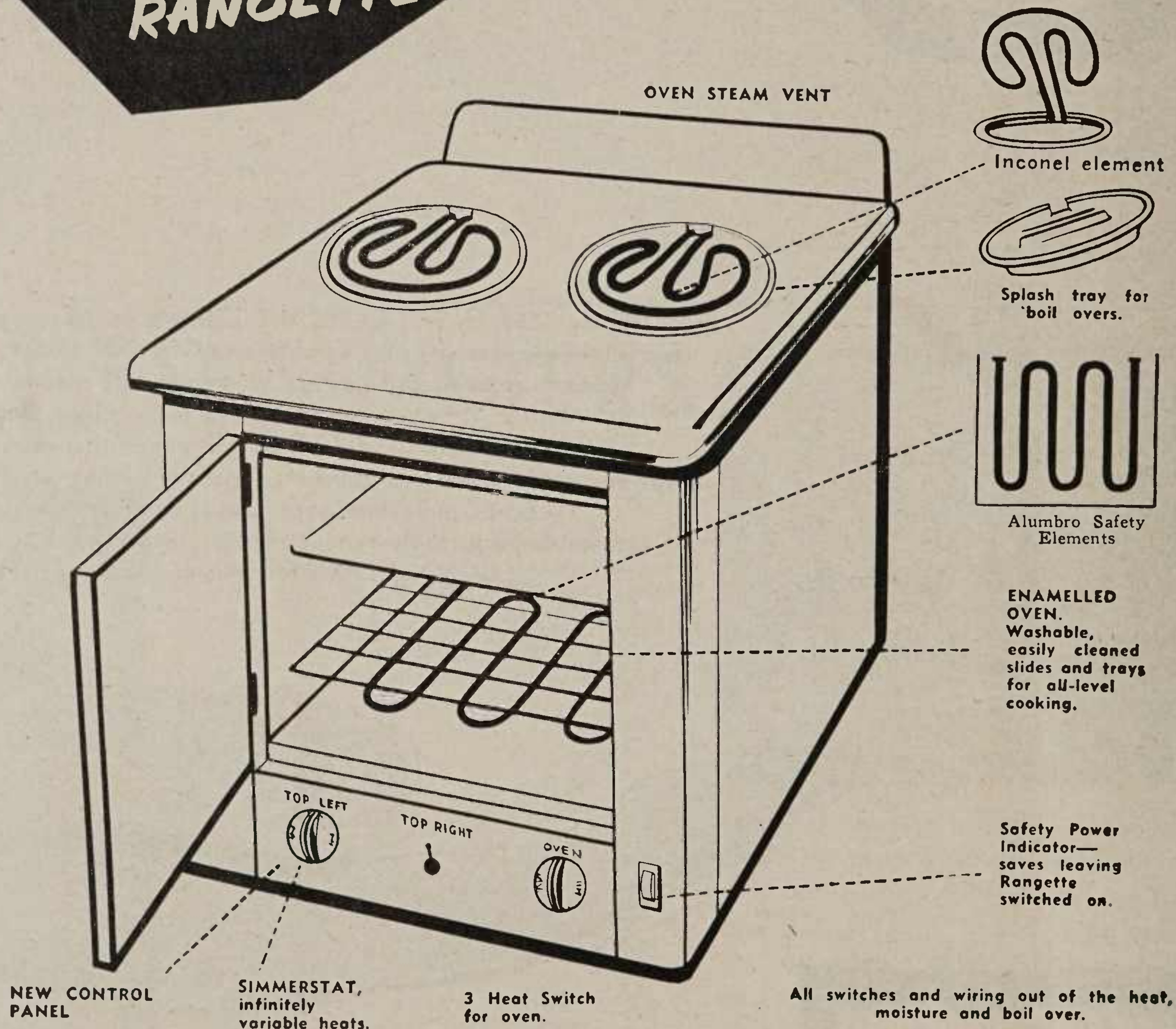
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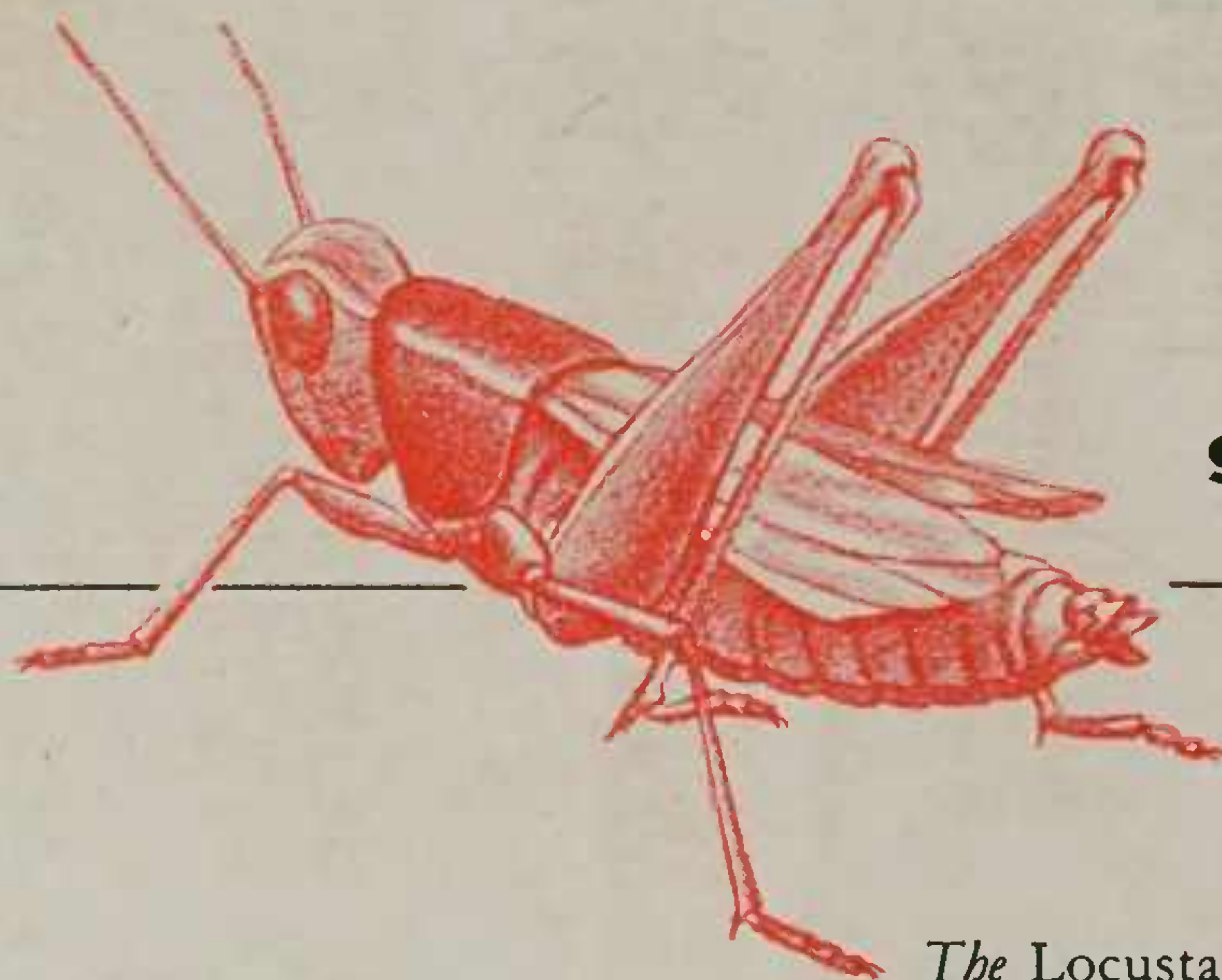


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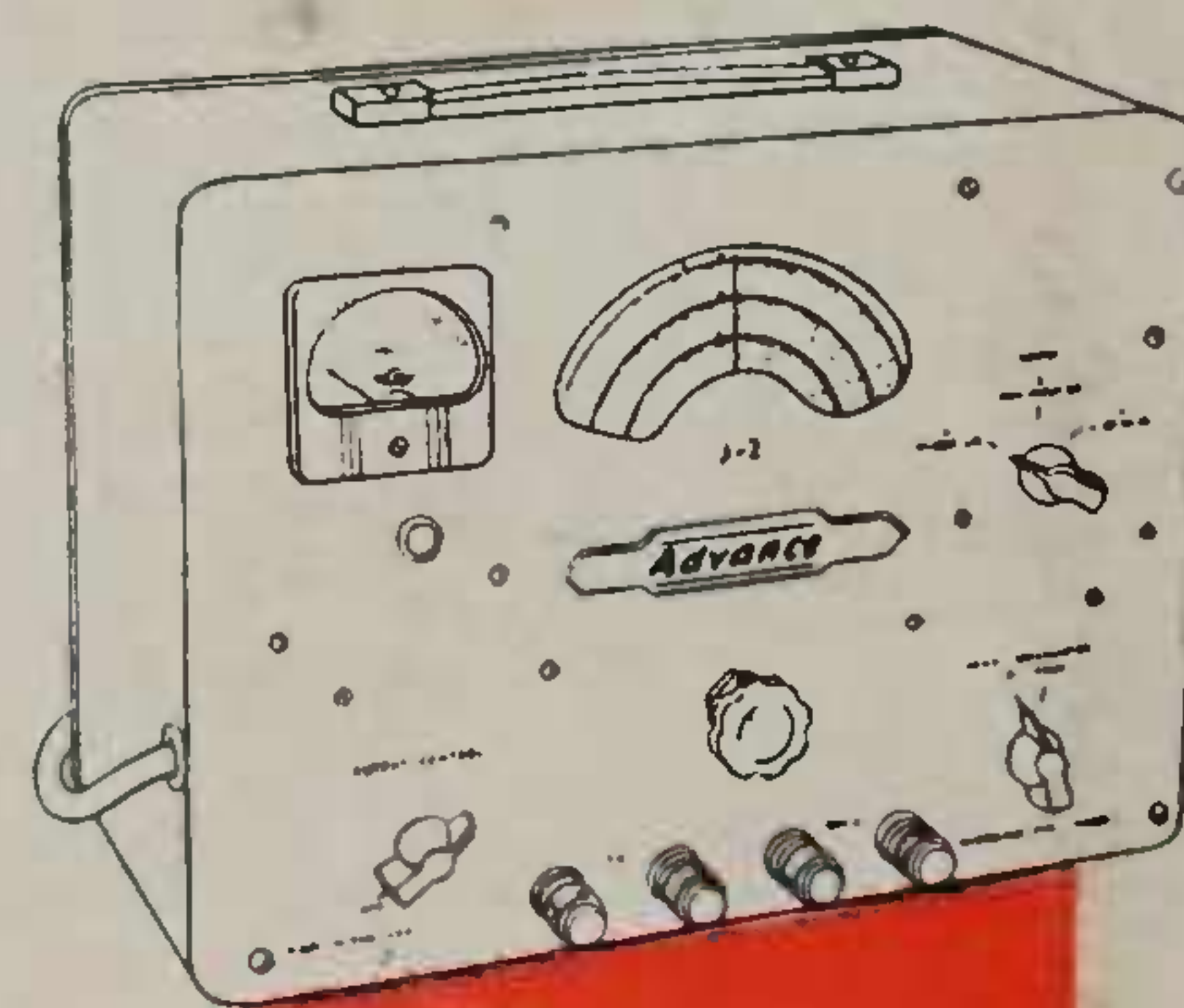
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