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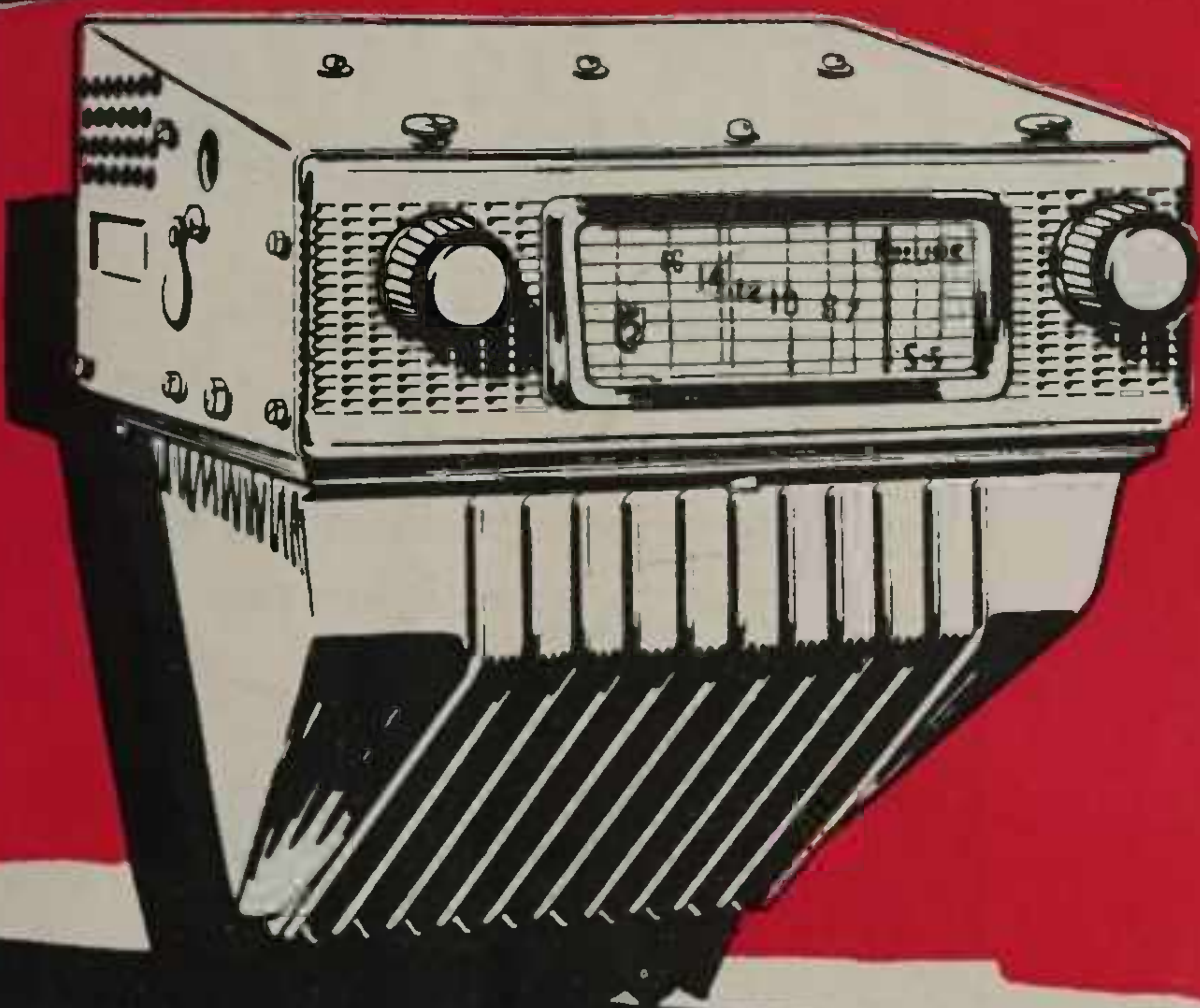
Vol. 13, No. 3

MAY, 1958

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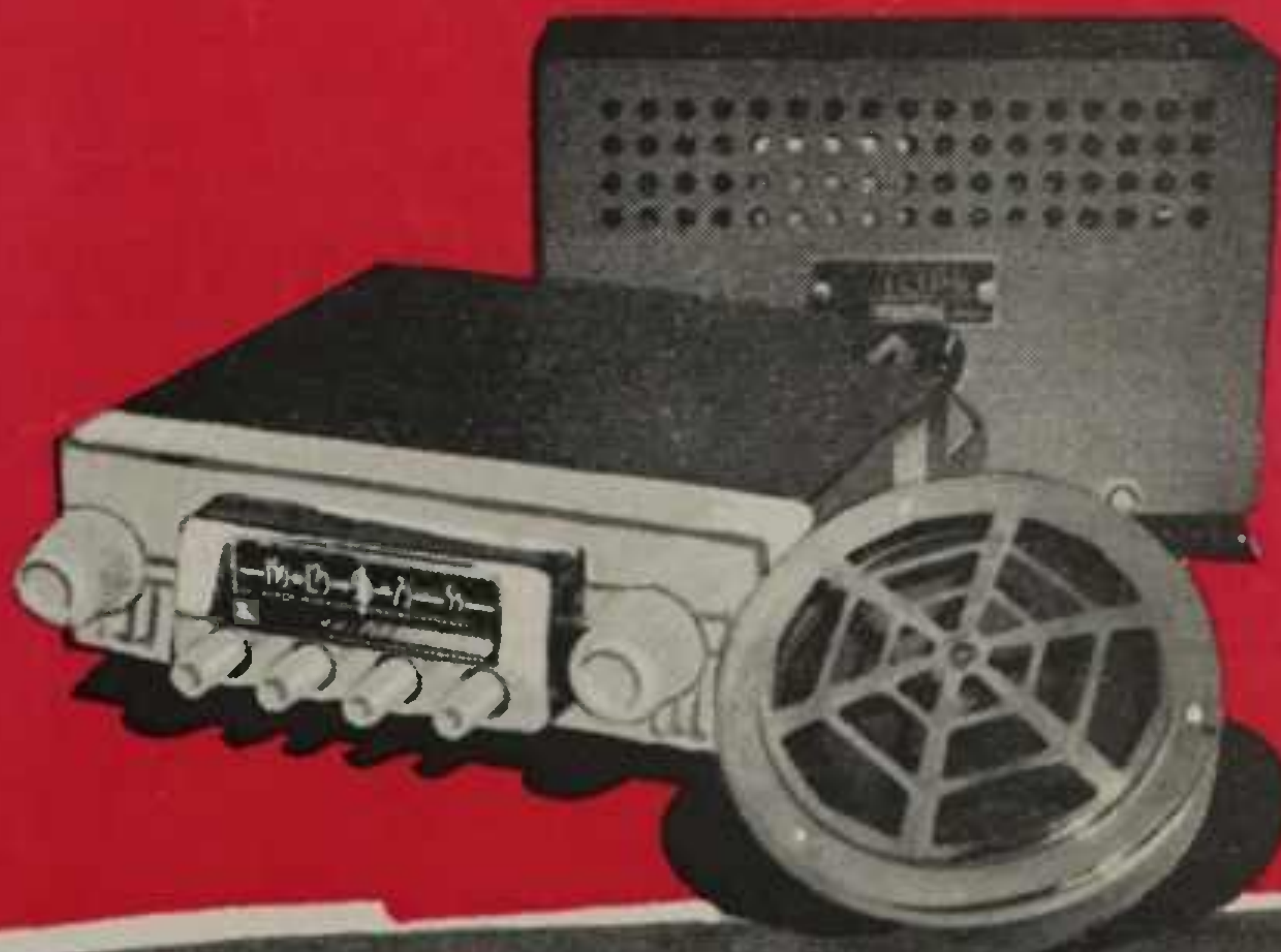
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Radio and Electrical Review

Vol. 13, No. 3

MAY, 1958

Official Journal of
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The New Zealand Radio and Television
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The New Zealand Radio and Electrical
Traders' Federation.
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Transistor Circuits for the Constructor

We have been more than pleased to find that the response from readers to our article on building a transistor audio amplifier has been immediate and enthusiastic. It would appear that we were correct in believing that builders have been waiting both for articles of this sort and for suitable component parts with which to put them into practice. Indeed, at the time of writing, our stock of transformers is almost depleted, and we are at the moment anxiously awaiting fresh stocks from the makers, from whom we re-ordered only a day or two after the article appeared.

All this is most gratifying, and encourages us to proceed with further articles of a similar nature. This being so, readers will no doubt wish to know what we propose to do in this way, and we thus have pleasure in putting on paper our own current ideas. If anyone disagrees with them, or has useful suggestions to make, we will be very pleased to hear from him, and to give his suggestions every consideration.

An obvious candidate for early production in these pages is a hybrid car radio receiver, using a "front end" made up from the popular (with manufacturers) low-voltage series of valves that have been developed specially to run from H.T. voltages as low as 6 volts, thus eliminating the need for any kind of converter, vibrator or otherwise, from which to produce a conventional H.T. voltage.

Transistors come into this plot, because the valve makers have not yet succeeded in producing valves capable of audio outputs of two watts or more, when operated from such low H.T. voltages. Nor is it likely that they will do so, since the problem is almost an insuperable one, and also because it is quite unnecessary to solve it, since transistors are available which will do the job admirably.

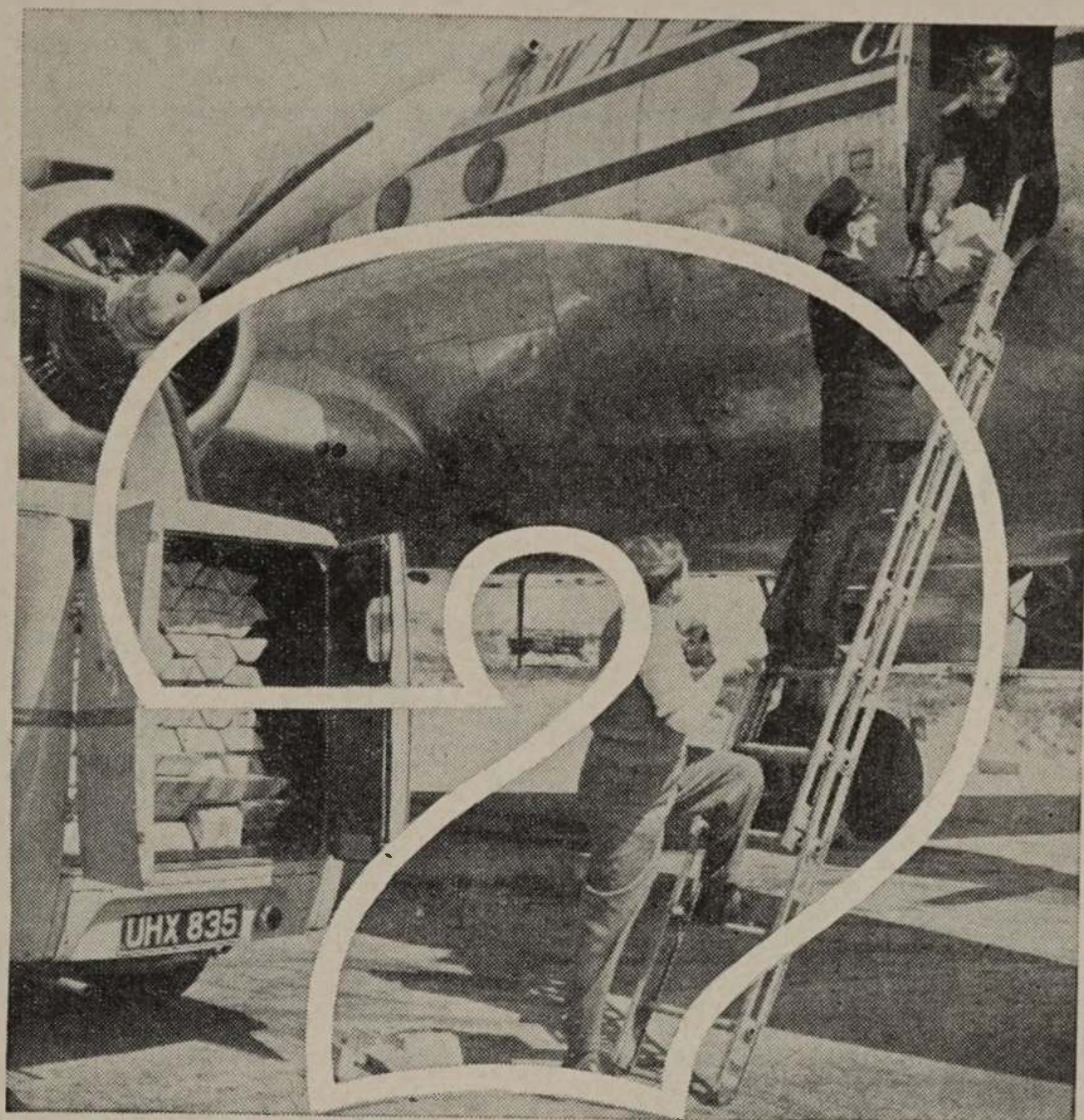
Thus, the hybrid set will comprise an audio end using one or more transistors, while the R.F. end uses low-voltage tubes. From the builder's point of view, this solution of the problem of a vibrator-less car set is a most attractive one, because the R.F. end will hold few, if any, difficulties for him, whereas a transistor front end would be more expensive, as well as more difficult to build.

Further ideas are centred round the use of transistors in tuners that are intended to form part of a battery-operated portable receiver, or a battery set for beating the power cuts. Here, there is a wide variety of schemes that could be used, from regenerative receivers to T.R.F. and superhet tuners of more or less advanced construction. It is not our intention to do these things in any sort of order, for, indeed, circuits have already appeared in these pages for some of them.

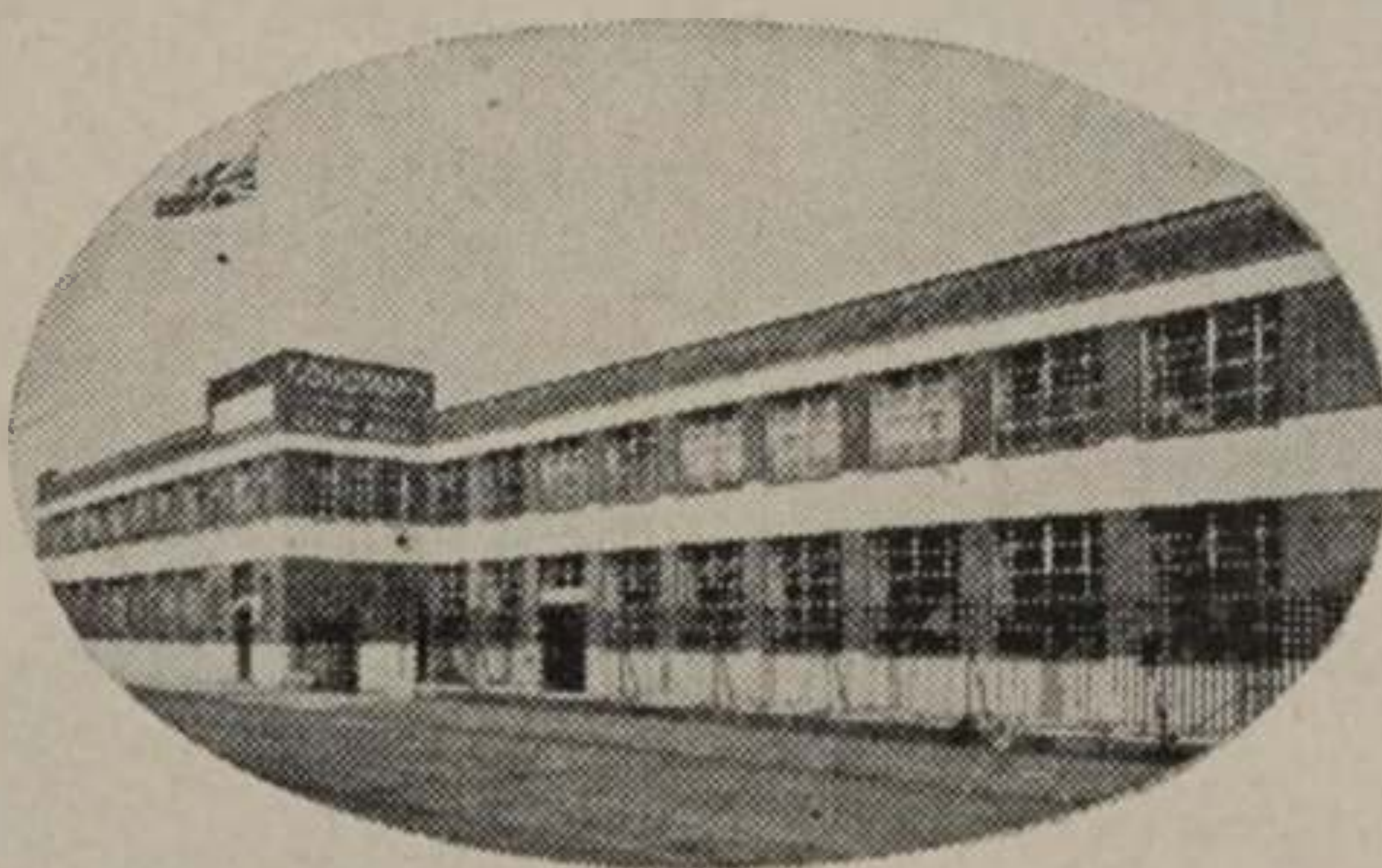
We already have in our laboratory a prototype front end which uses a British permeability-tuned unit that will possibly come on the market later this year. This unit has provision for a stage of R.F. amplification, and an oscillator-mixer circuit using a single transistor. In conjunction with a two-stage I.F. amplifier similar to the experimental one described in this issue, this tuner would make a particularly "hot" receiver of small dimensions, very suitable for a completely transistorized car set or a high-performance battery portable.

Other ideas we have in mind have to do with portable high-quality amplifiers using transistors, and portable receivers suitable for trampers and rescue parties, both of whom need extremely small weight and bulk. In short, there are plenty of things to do with transistors, if only someone can "produce the goods", and it seems that that "someone" might just as well be "*R. and E.*"

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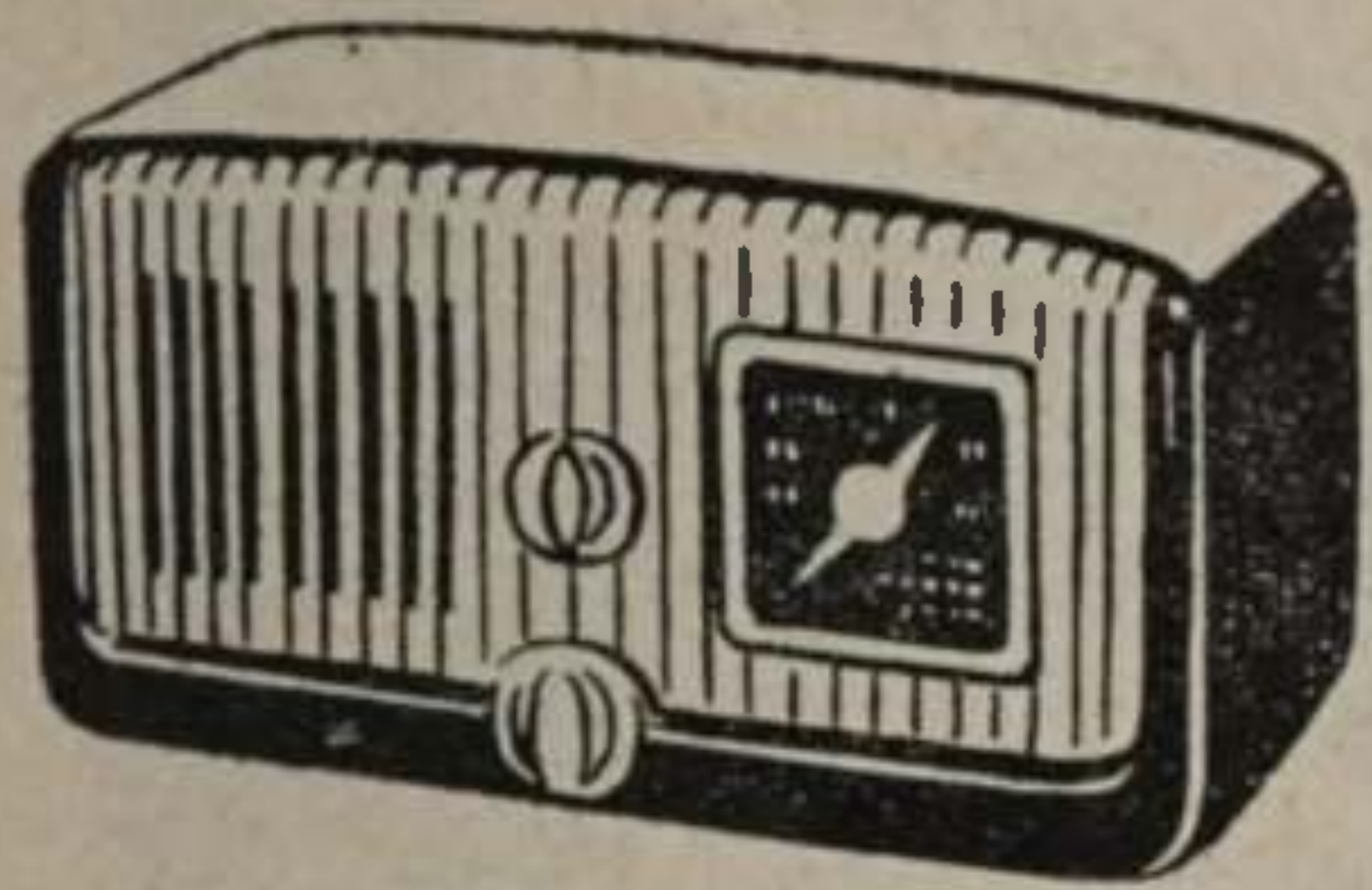
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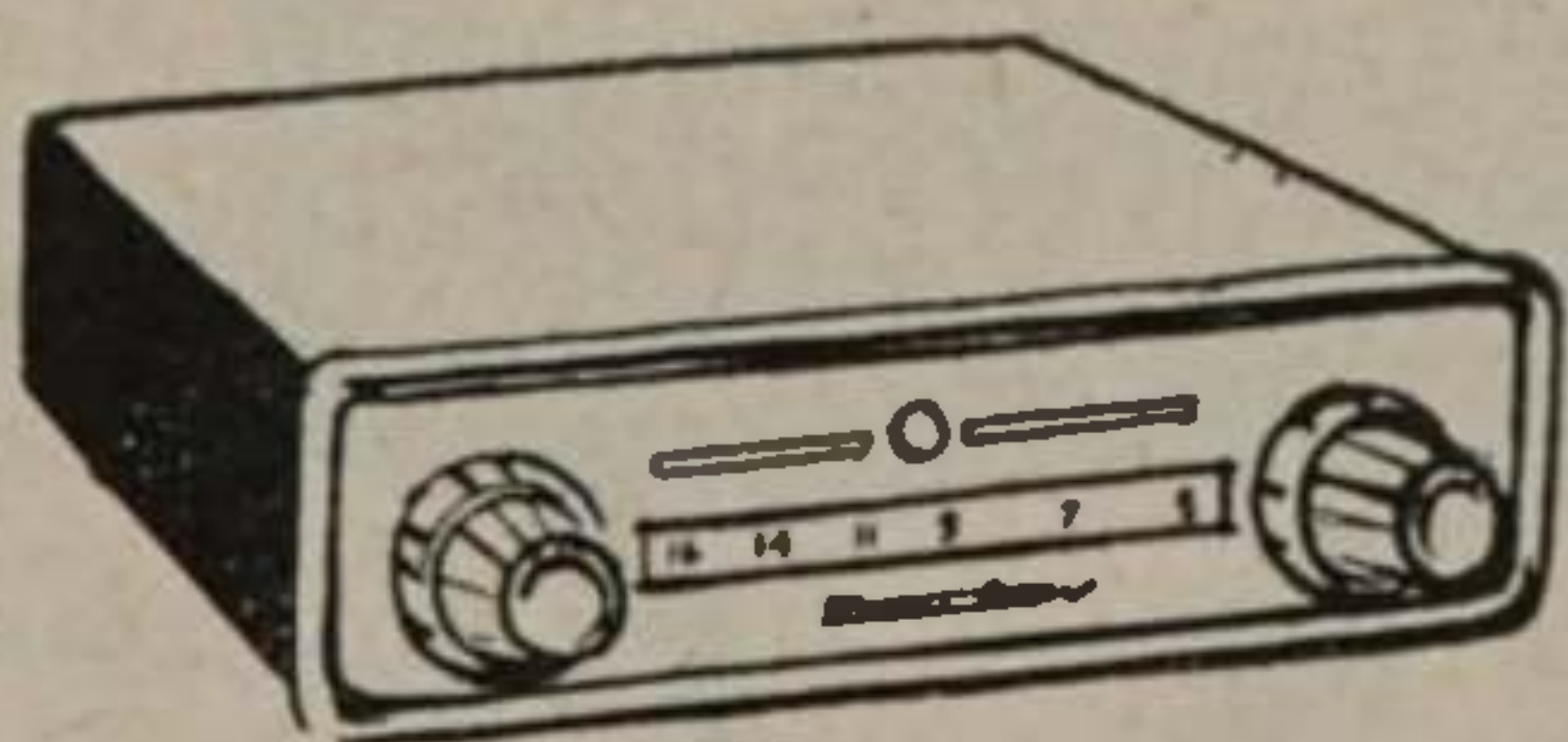
Ten new models and every one a winner! The Pye magic TRANSISTOR, the exclusive Pye printed circuit, Piano Key switching, multiple amplification, mounted tape decks and the use of modern materials, and industrial design techniques . . . these are what sells Pye! And here is the greatest range of completely new models ever released at one show . . . released now to celebrate the 25th anniversary of the Pye factory at Waihi and to give Pye dealers the biggest, most powerful selling range of models they have ever had.



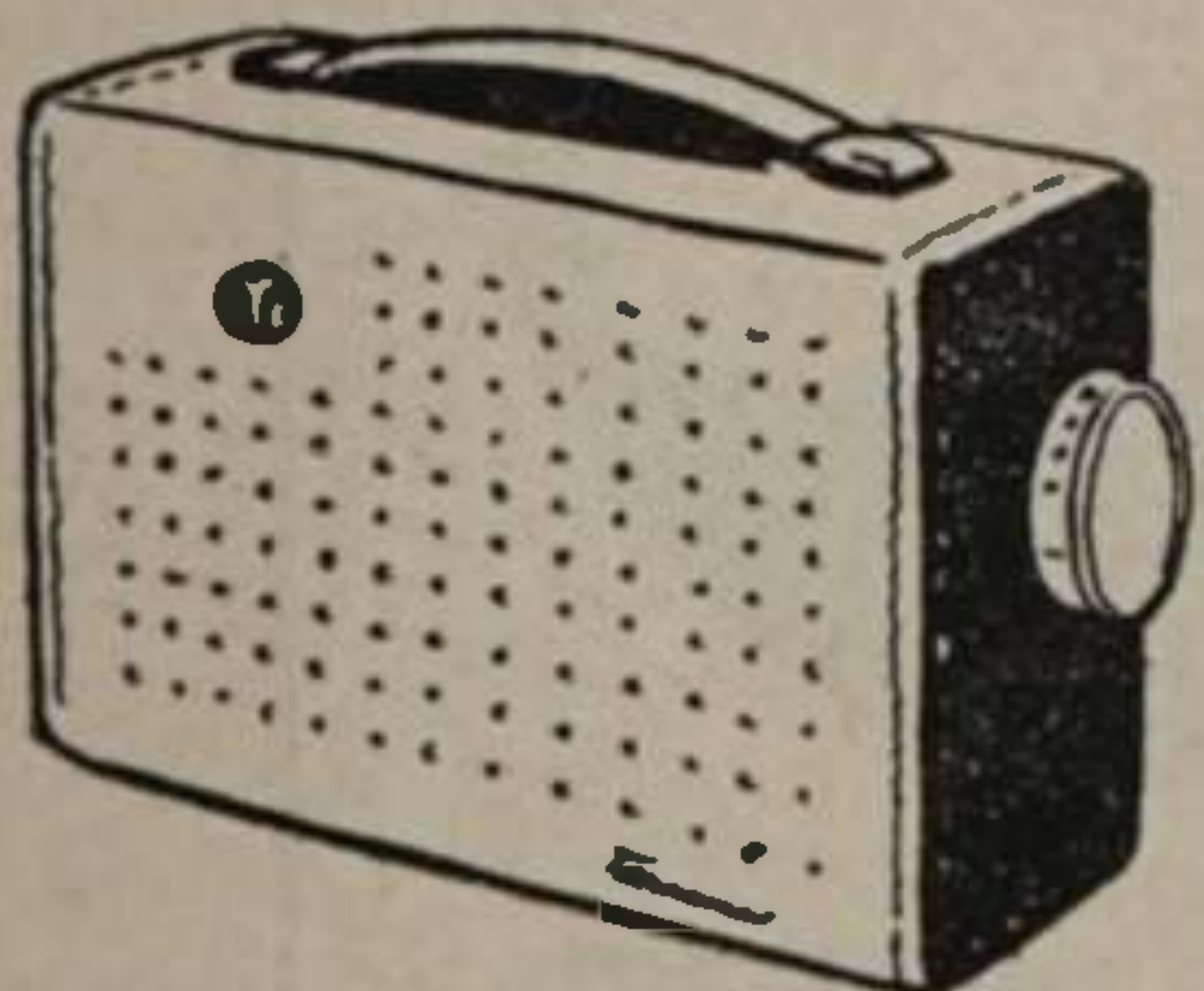
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Five-valve broadcast printed circuit miniature mantel, plastic cabinet in ivory or ivory and maroon. £14 19s. 6d.



MODEL 222
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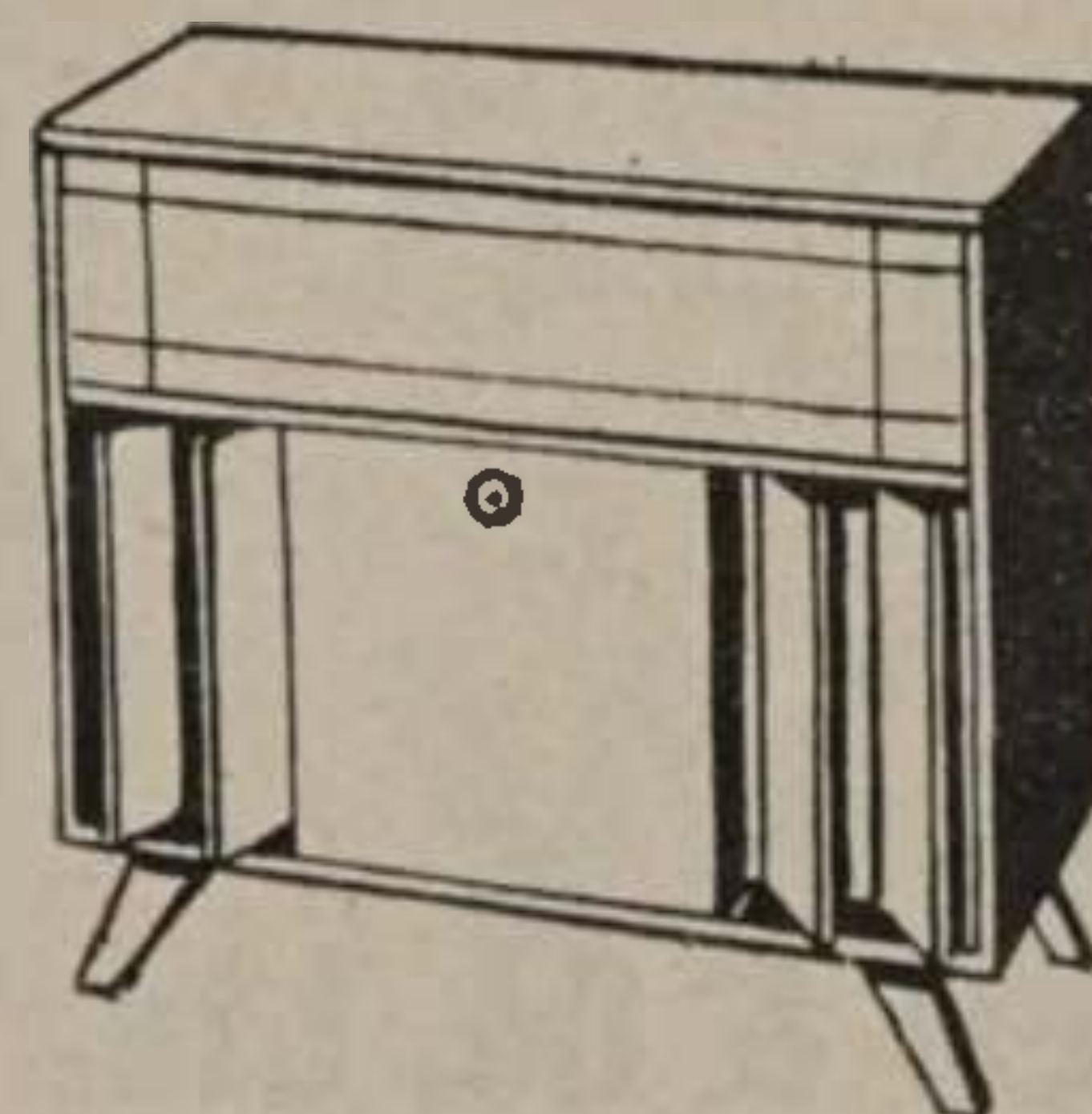


MODEL TCR 1003
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MODEL 125BQ
Printed circuit, 6 magic TRANSISTORS. Large speaker. Attractive leather case portable in choice of colours. 29 GNS.

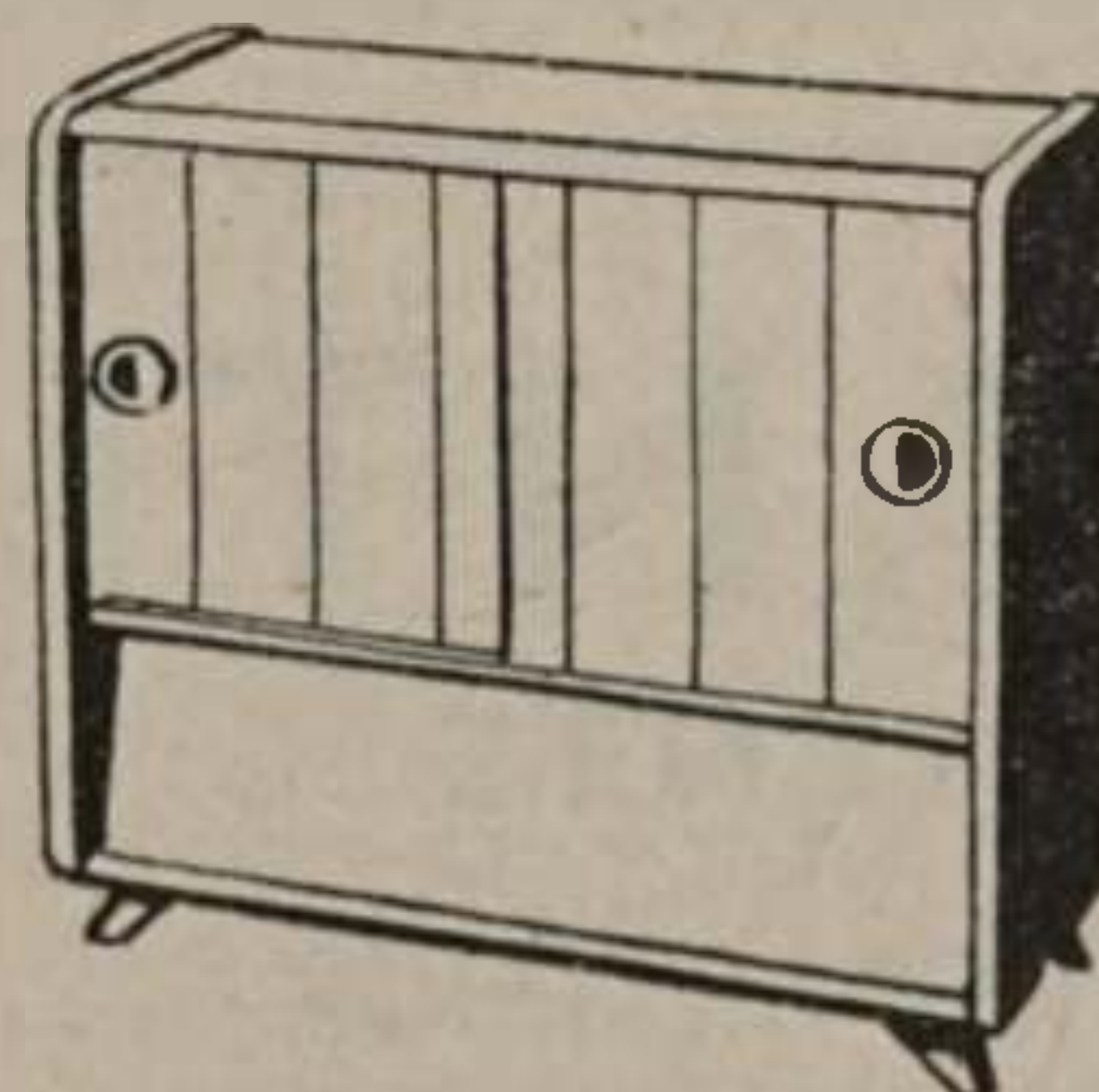
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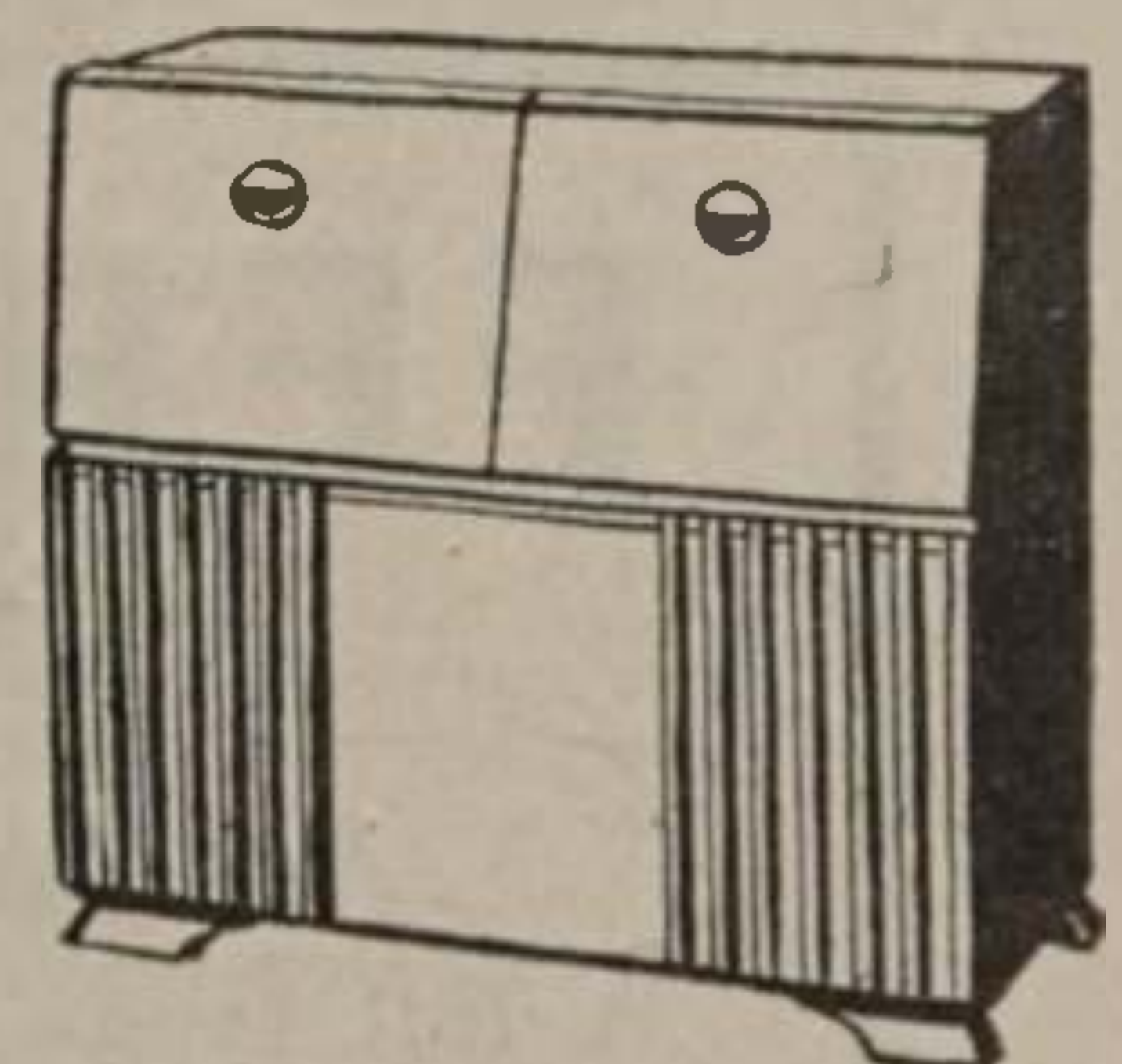
MODEL 61RG
Twin speaker, 6-valve broadcast, sound-directing louvres, solid oak radiogram. 76 GNS.



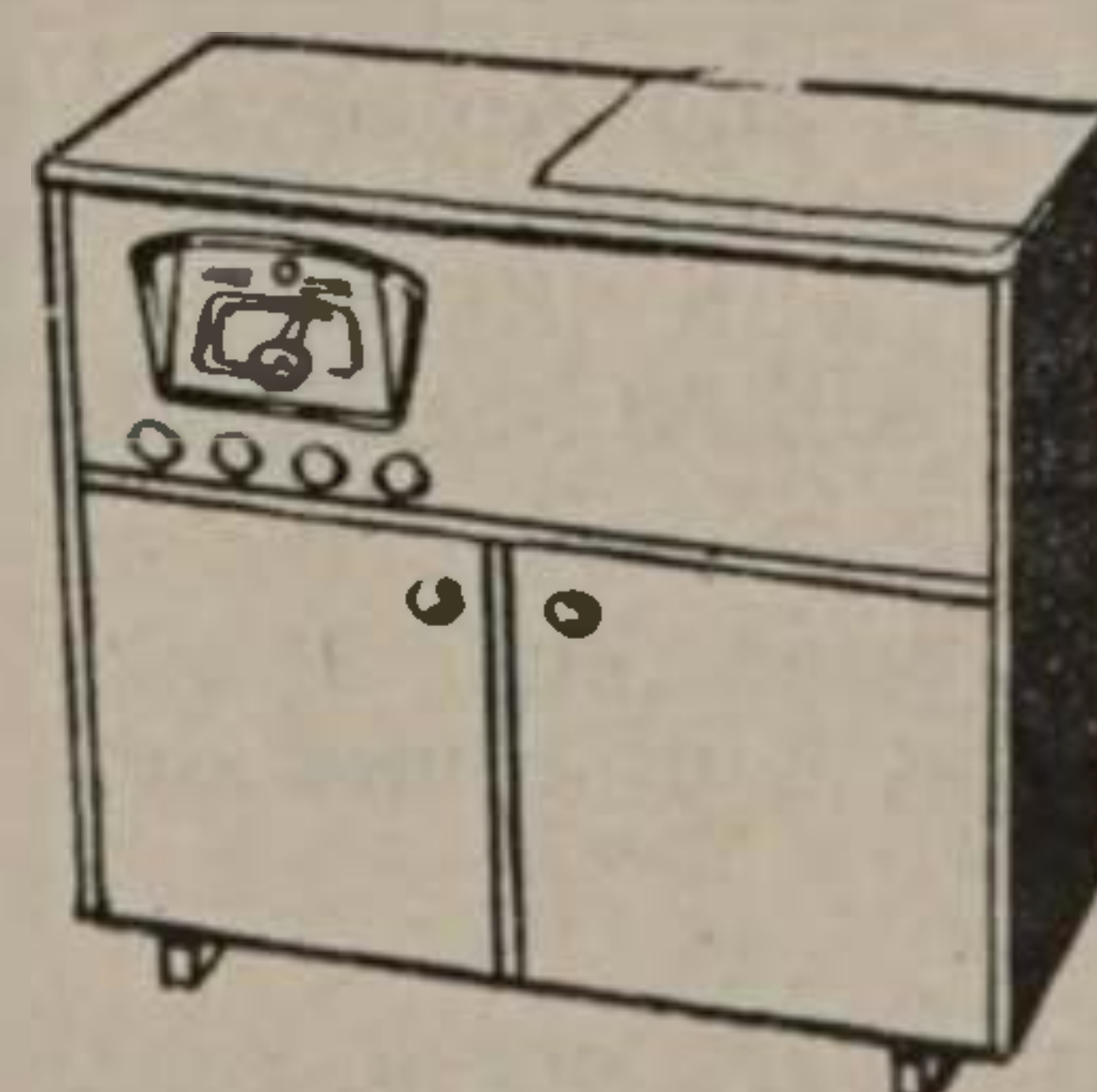
MODEL 223RG
Dual-speaker system, 4-speed autochange, printed circuit, 5 wavebands, piano key switching. In two-tone walnut, TV styled. 68 GNS.



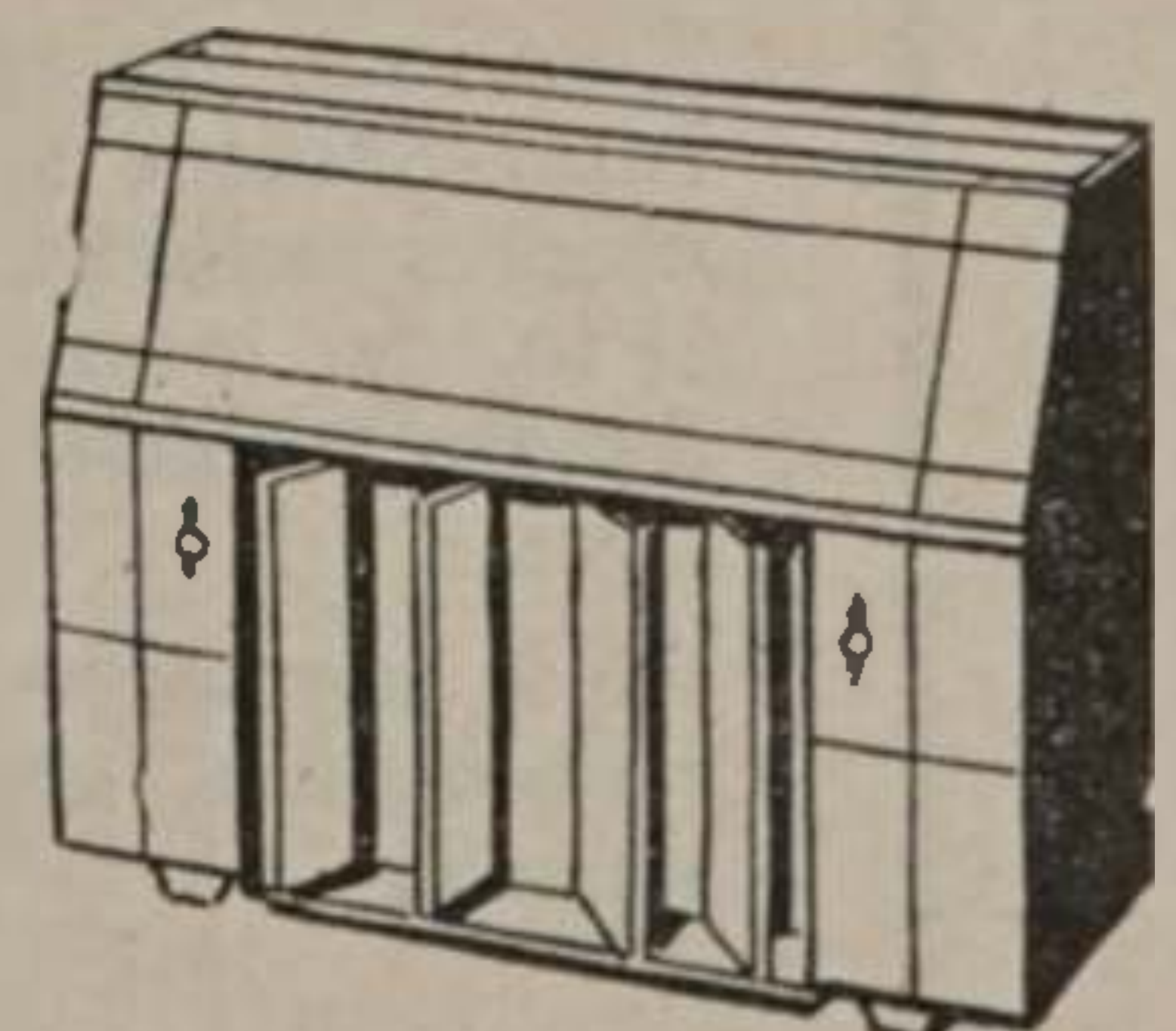
MODEL RG
Six-valve printed circuit radiogram. Piano key switches, 3 speakers, 5 wavebands, 4-speed autochange. Dark mahogany cabinet. 114 GNS.



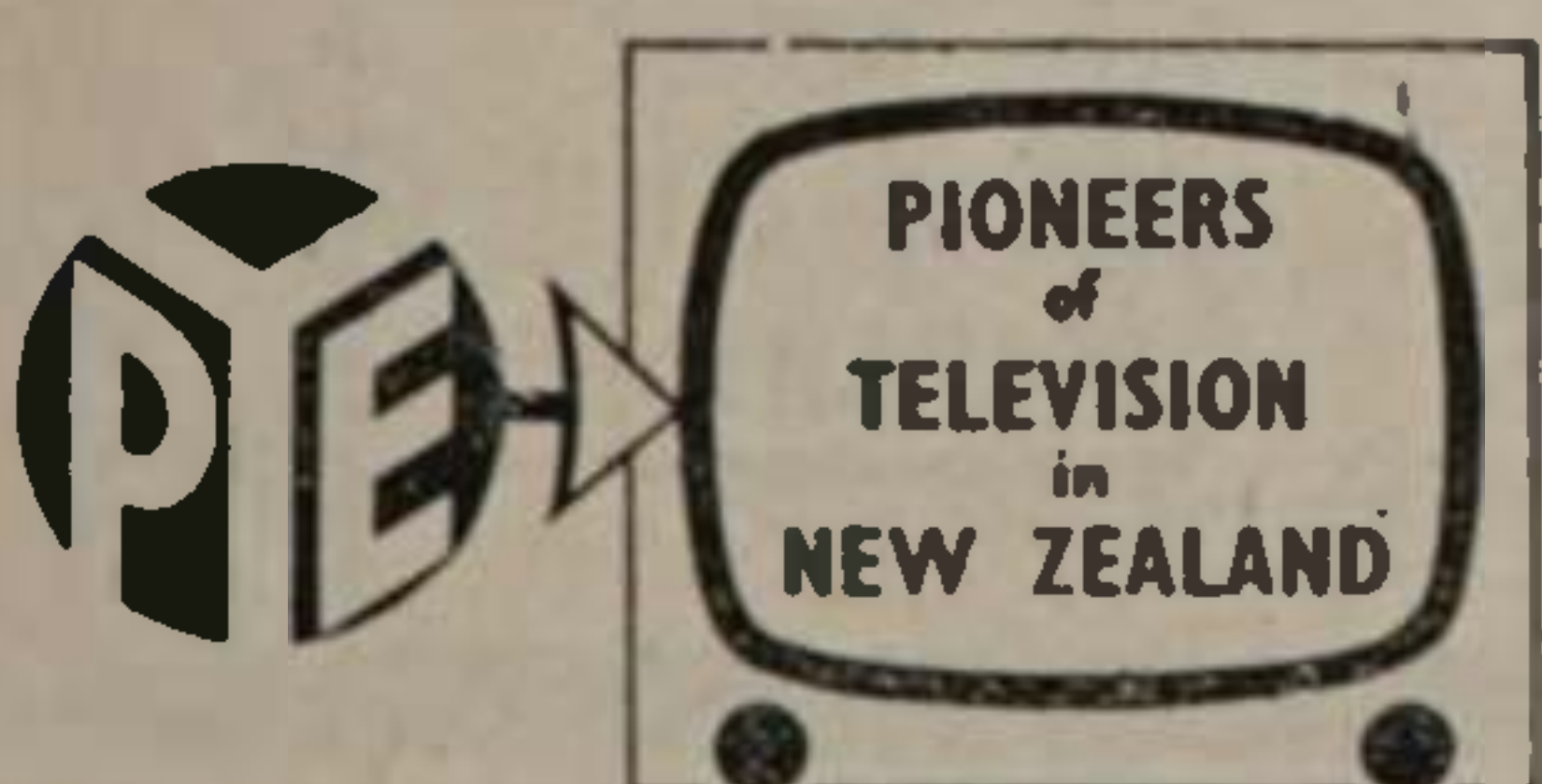
MODEL 62RG
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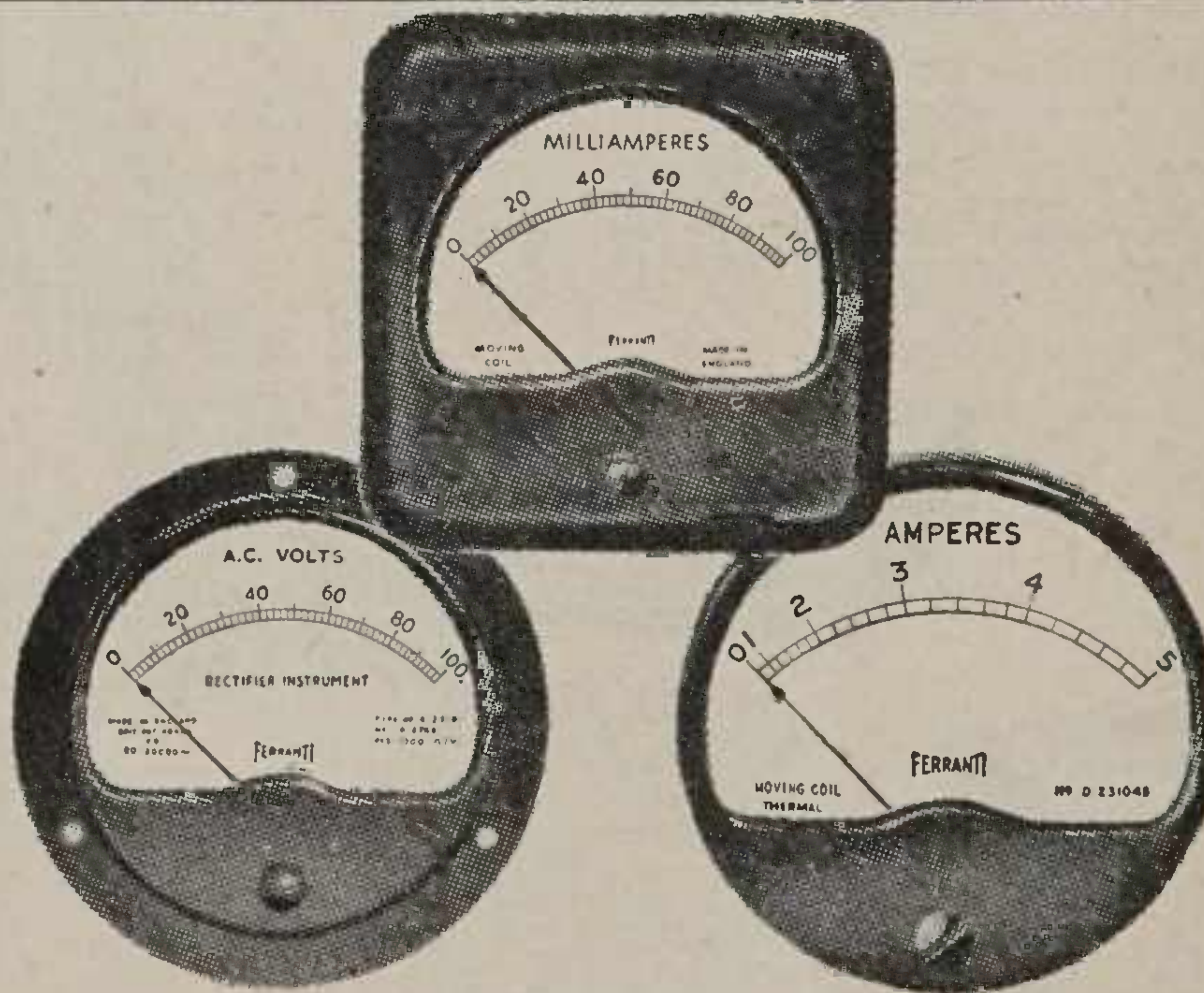
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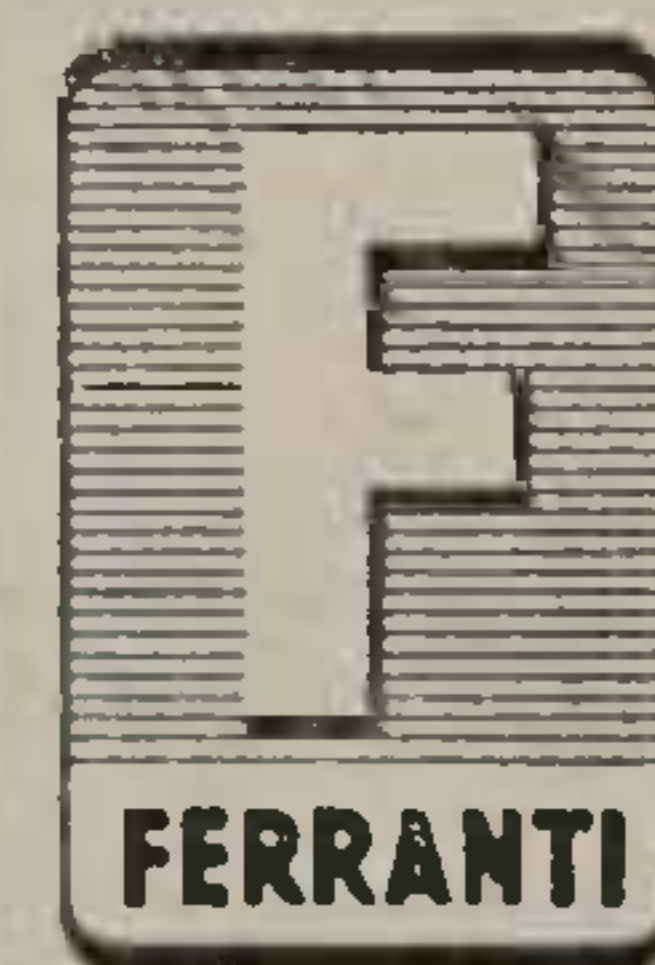


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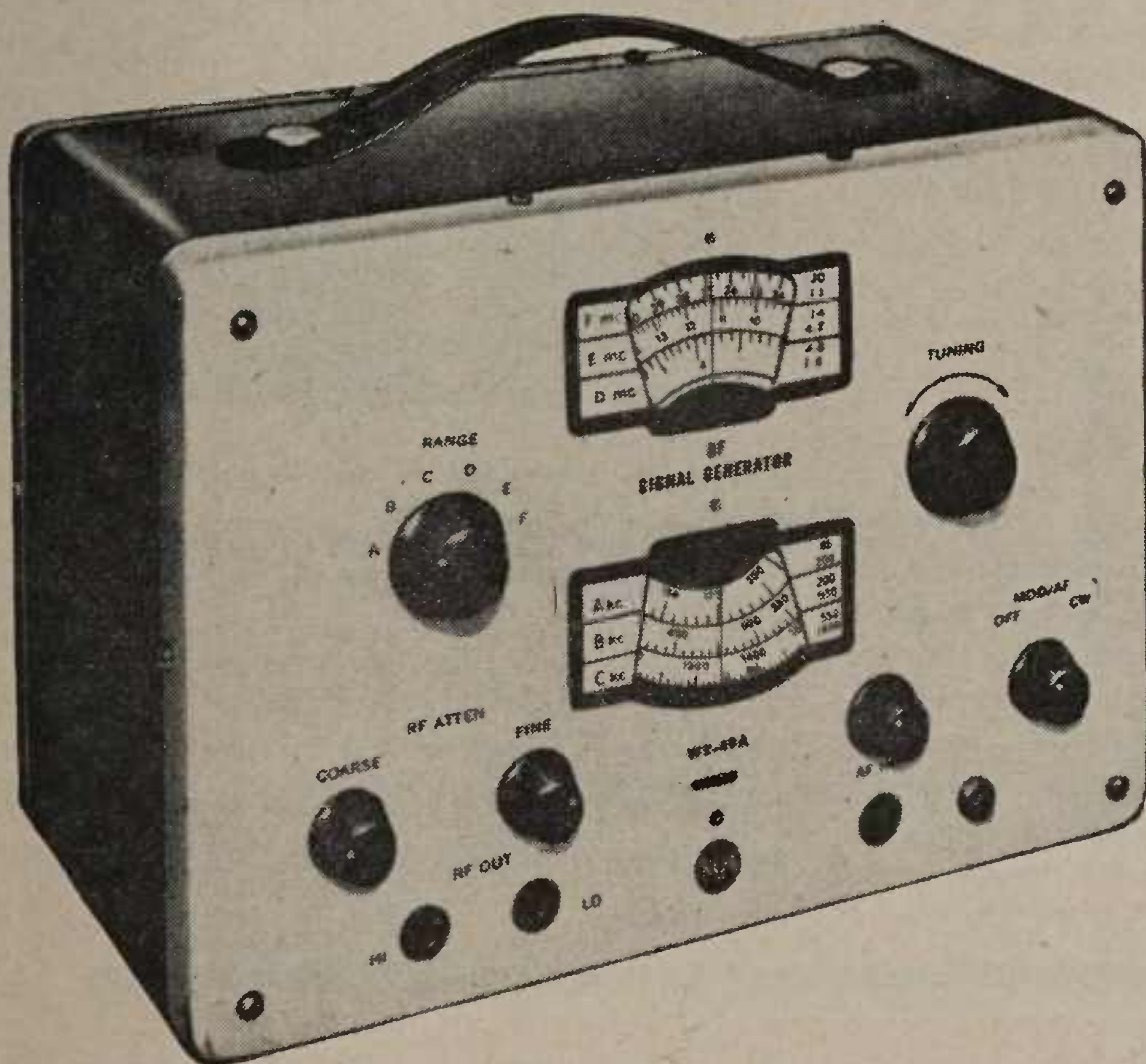
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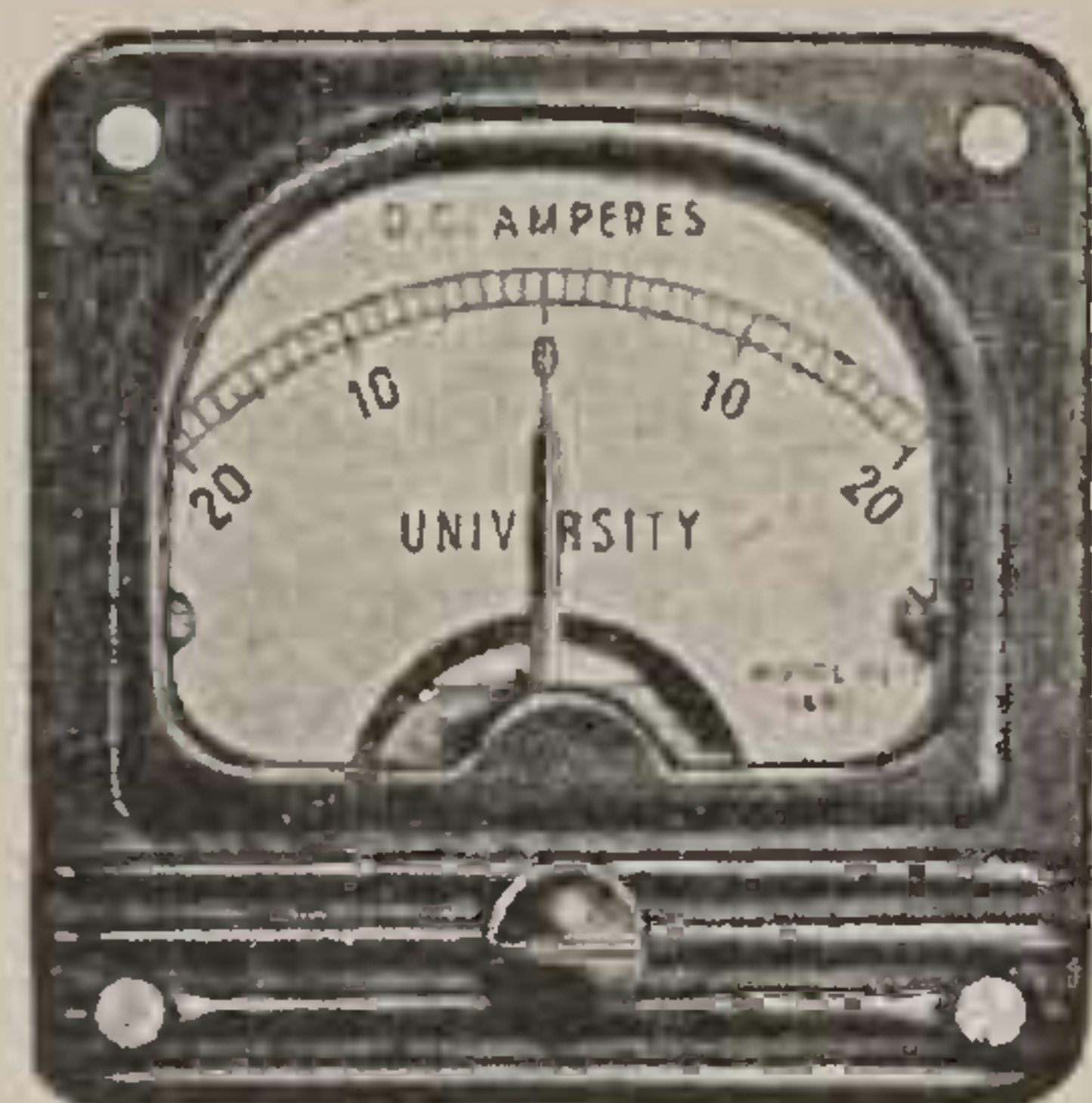
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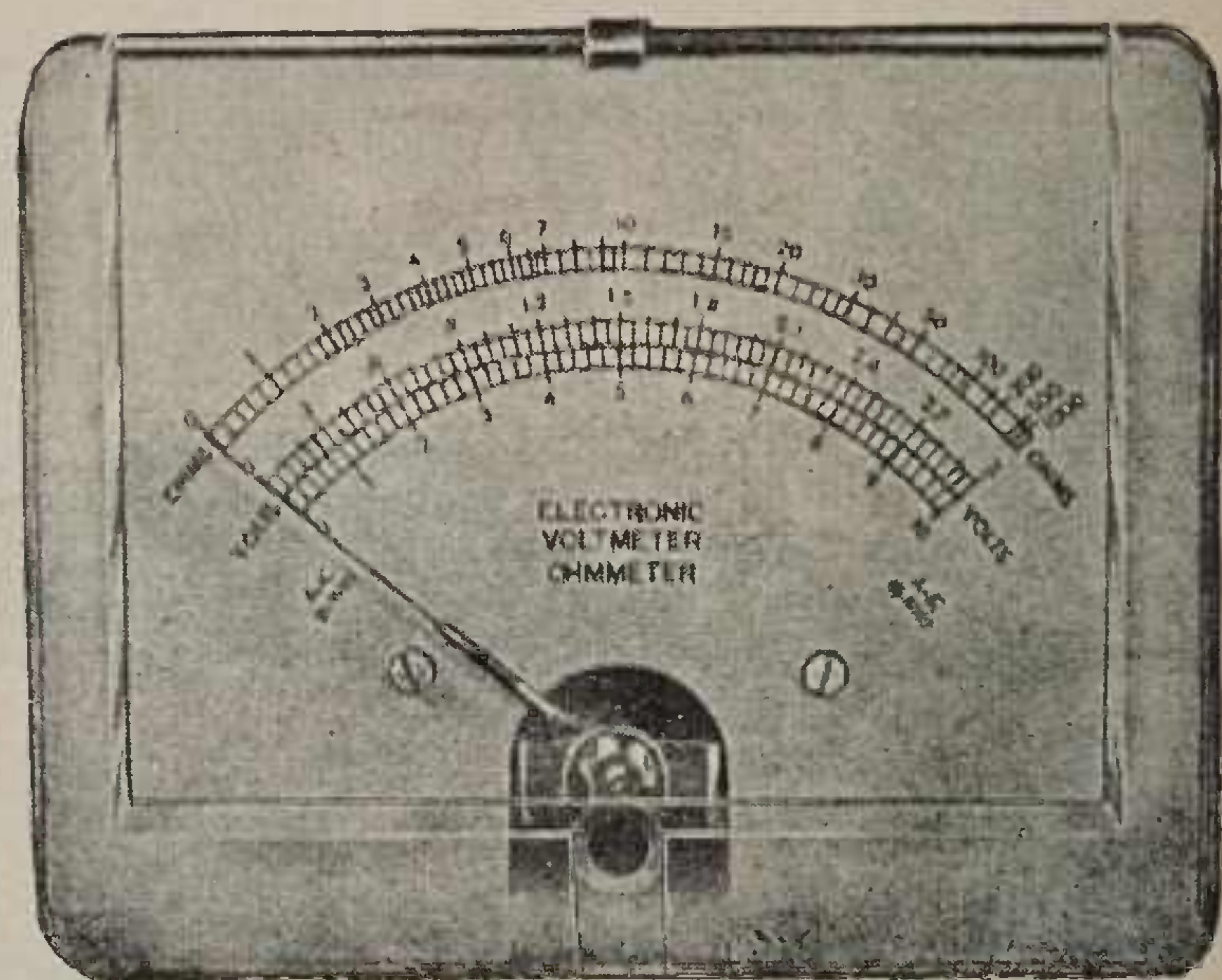
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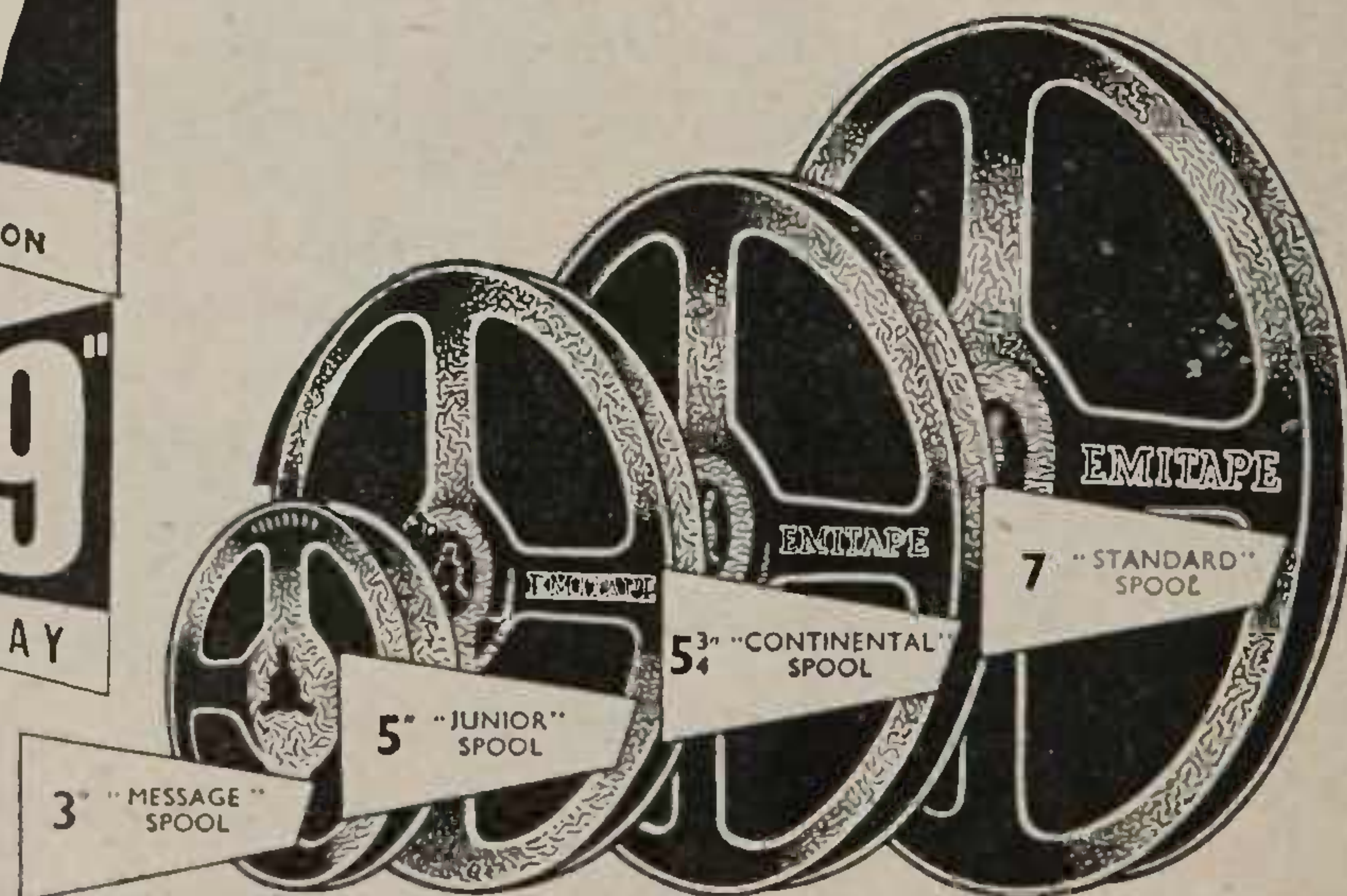
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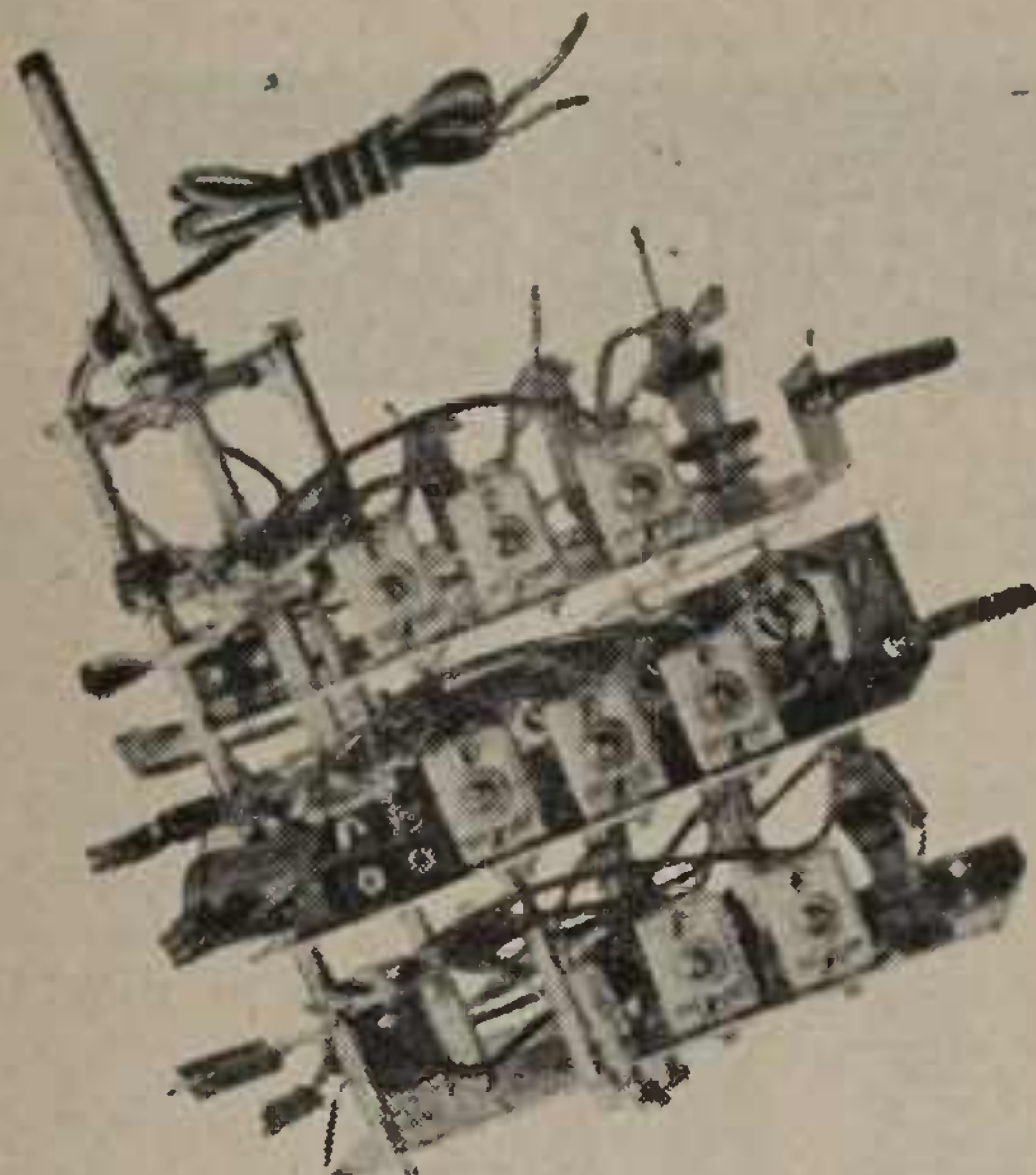


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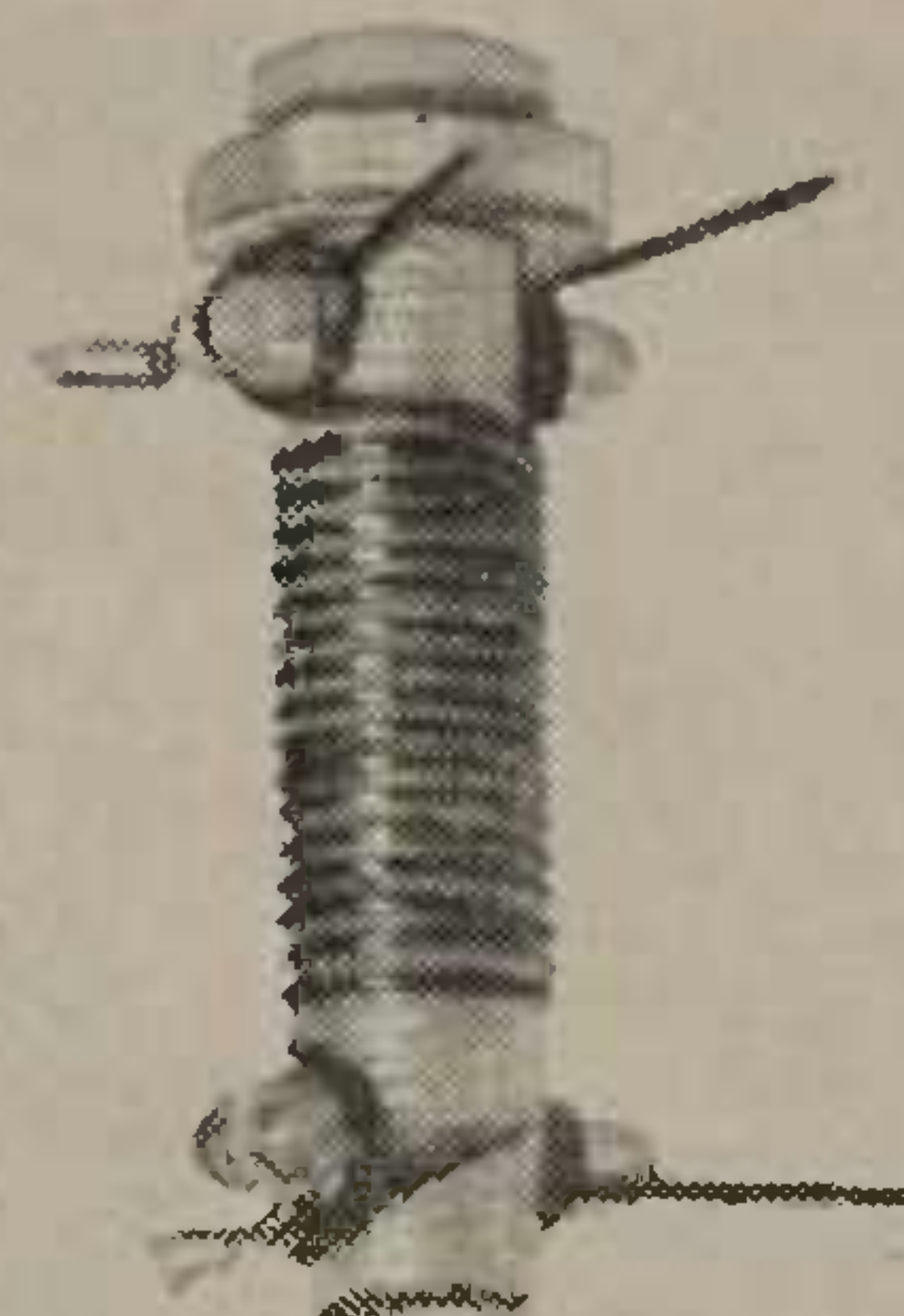
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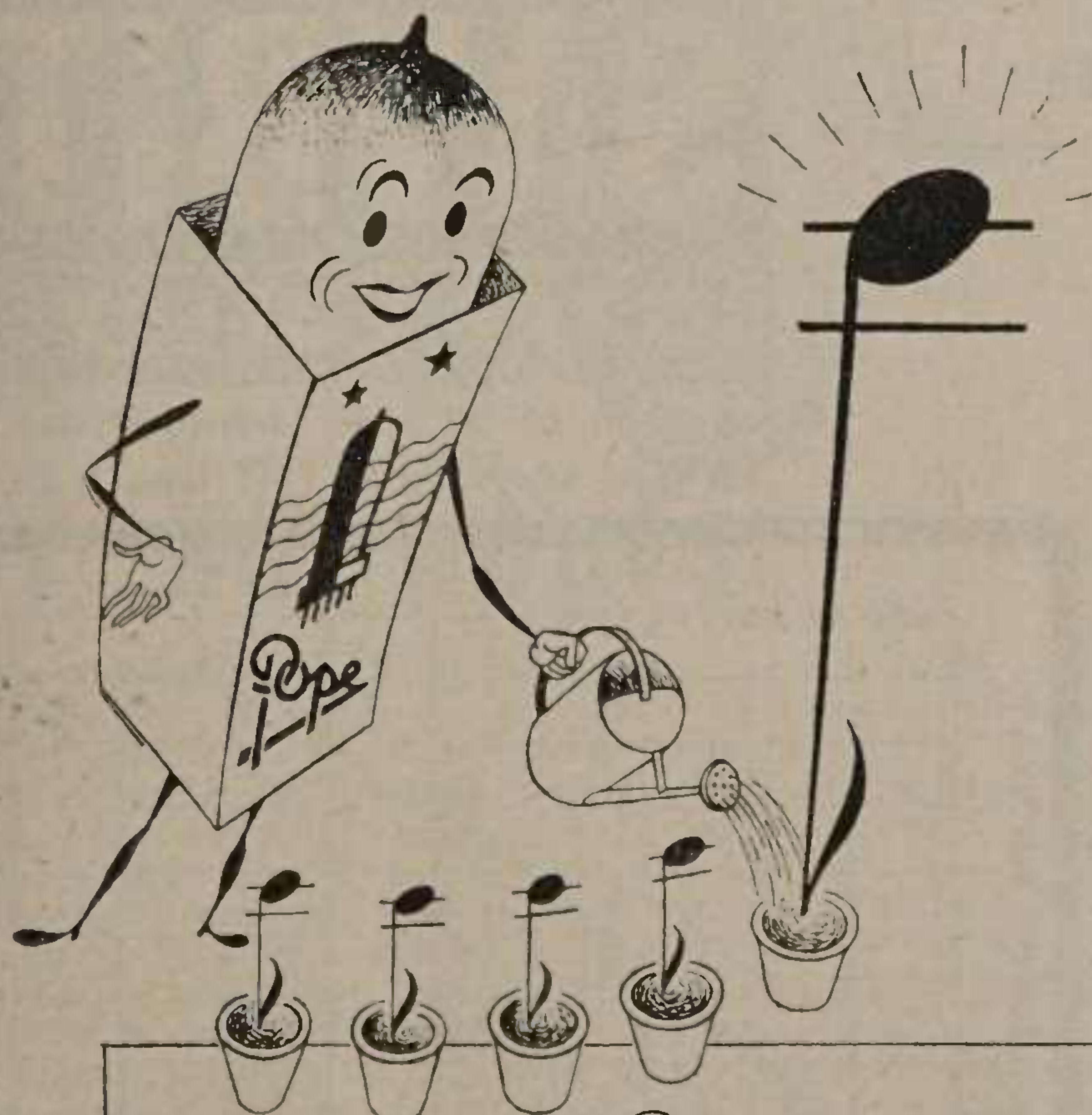
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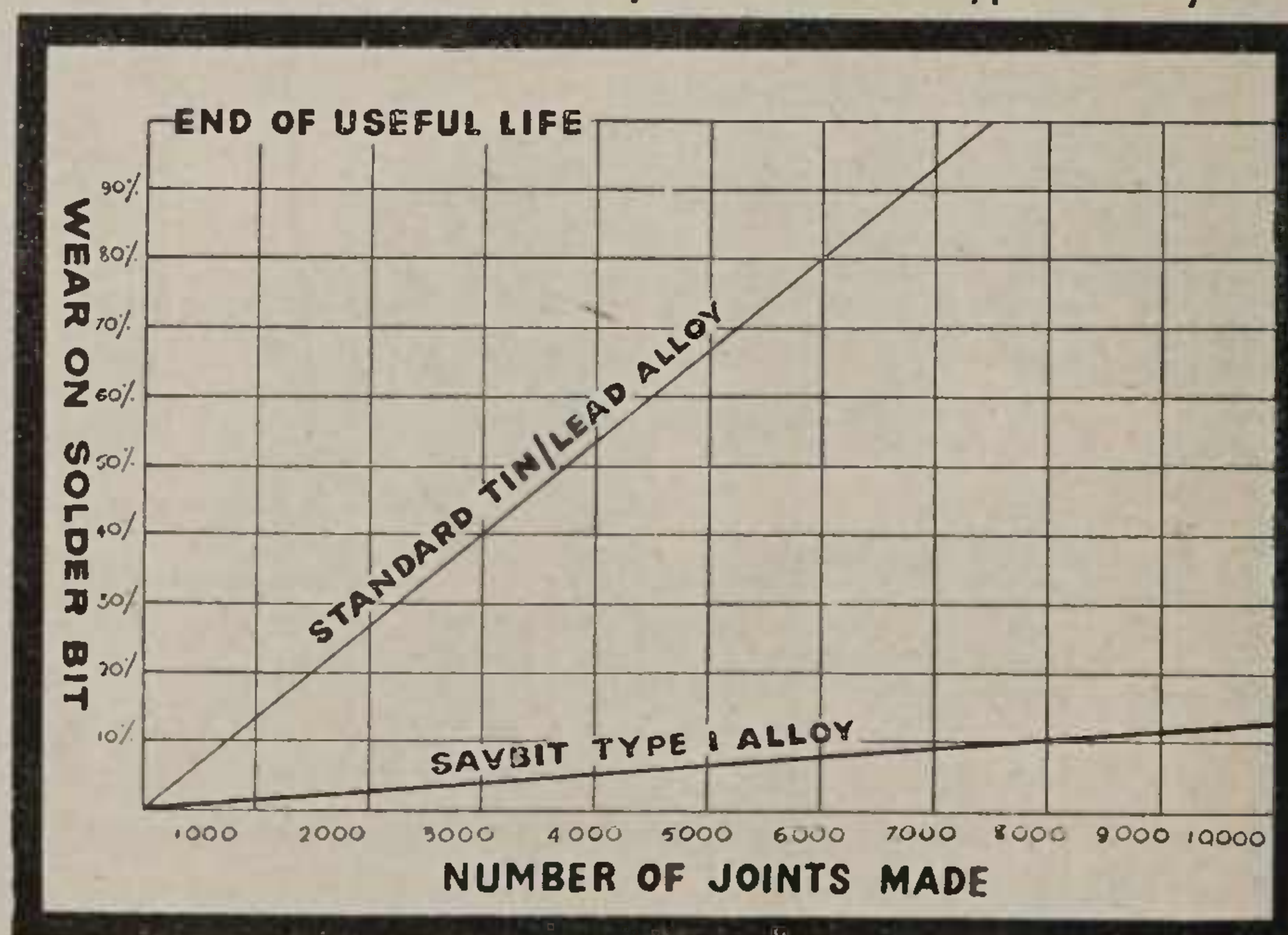
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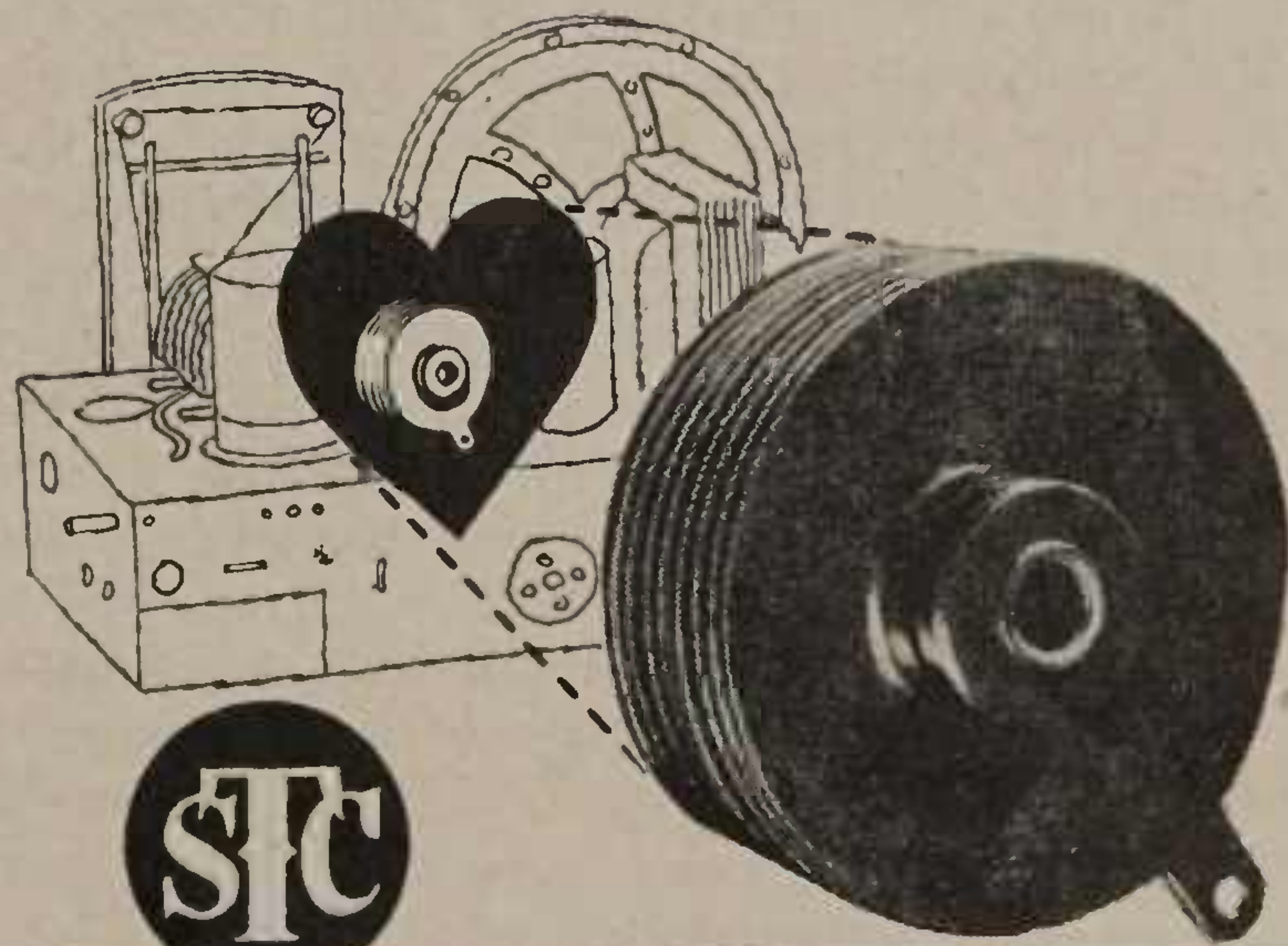
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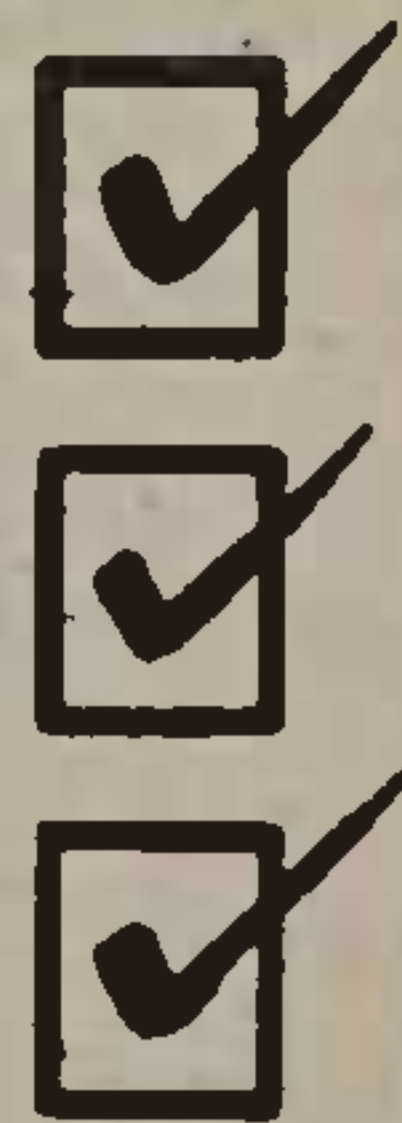
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Transistors

AN EXPERIMENTAL TRANSISTOR I.F. AMPLIFIER

This article describes a two-stage I.F. amplifier which was constructed in the "R. & E." laboratory as a sort of "exercise" in the application of transistors to radio frequency devices, and to receivers in particular. The amplifier has a power gain of over 60db., and can form the basis of a sensitive transistor receiver.

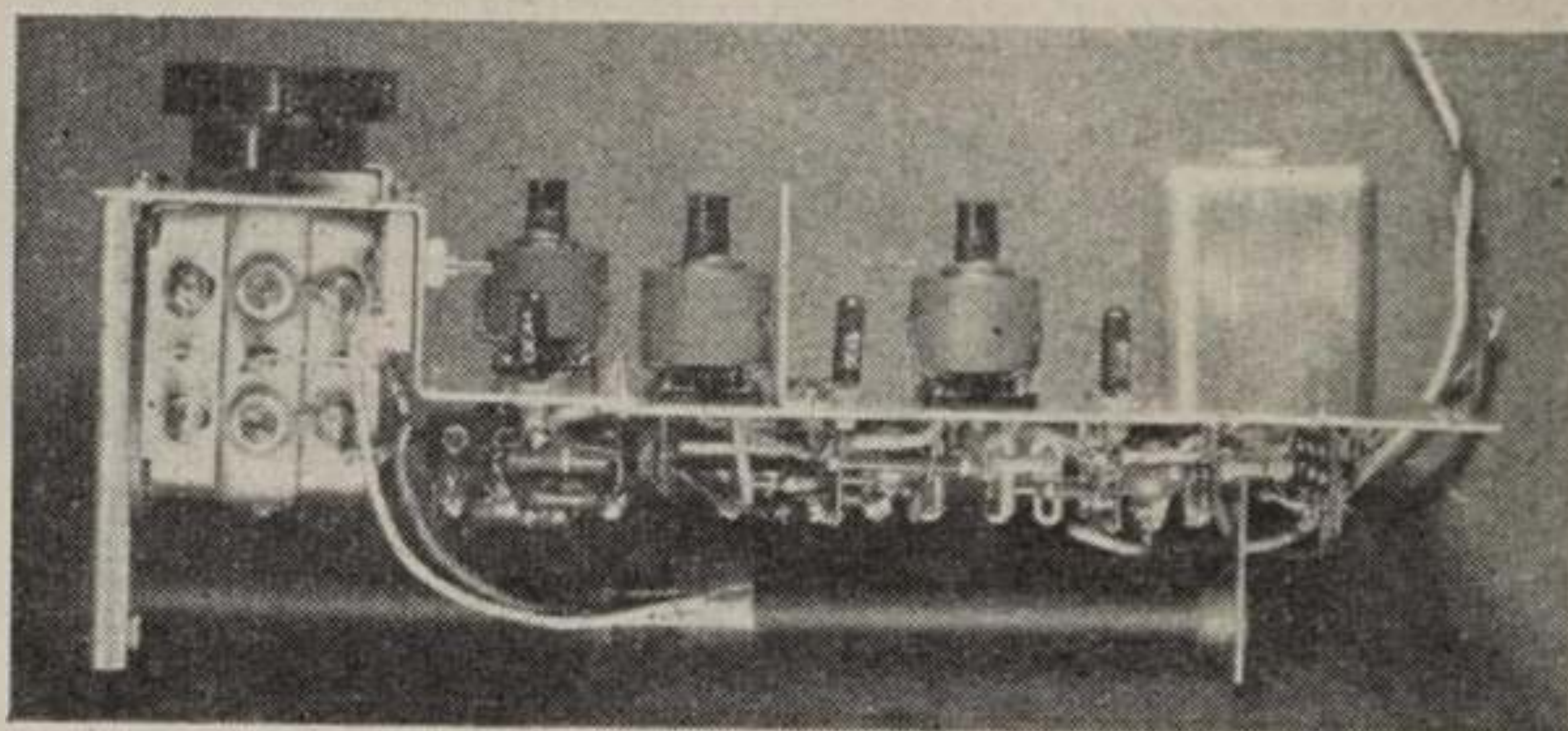
Introduction

These days it seems that those who use some branch of electronics as a hobby, as well as those professionally engaged, prefer to tackle more ambitious projects than those which were popular some years ago. Thus it is that in commencing to describe radio-frequency circuits employing transistors in this magazine, we have chosen to dive right in, as it were, and tackle what might be regarded as a relatively advanced project, rather than creep into the transistor sea gradually, wetting the toes first with a simple regenerative receiver.

First of all, it should be pointed out that the amplifier described in this article is exactly what the title says, namely, an *experimental* one. For example, it makes no pretence to be the best, most sensitive, cheapest, or most easily constructed amplifier that could be devised. On the other hand, it is perfectly practical, in that it works very well indeed, contains no undue building difficulty, and does not cost the world to build. Its only real drawback is that it does not incorporate automatic gain control, or indeed a gain control of any kind, so that if it is used as part of a receiver, it will be necessary to modify it, either to incorporate A.V.C., or so that it has a manual gain control which can be used to prevent overload on strong signals. We hope to show readers how to do this in an early issue of this journal. In the meantime, it is expected that this circuit, and the story that goes with it, should be of considerable interest to the many experimenters, both professional and amateur, who wish to familiarize themselves with transistor techniques.

The Circuit

The first thing that is liable to strike one about the circuit of this I.F. amplifier is that while there are the three I.F. transformers one would expect to find associated with a two-stage amplifier, there are only three tuned circuits, and not six, as are almost always found in a two-stage valve-operated I.F. amplifier. In short, the I.F. transformers are single-tuned, and do not possess two tuned windings loosely coupled together. From this, it might be expected that the amplifier's selectivity would not be very great, but although it may not quite equal that of a valve amplifier, with its six tuned circuits, it is really quite high, as can be gauged from the loss of high notes that is readily ap-



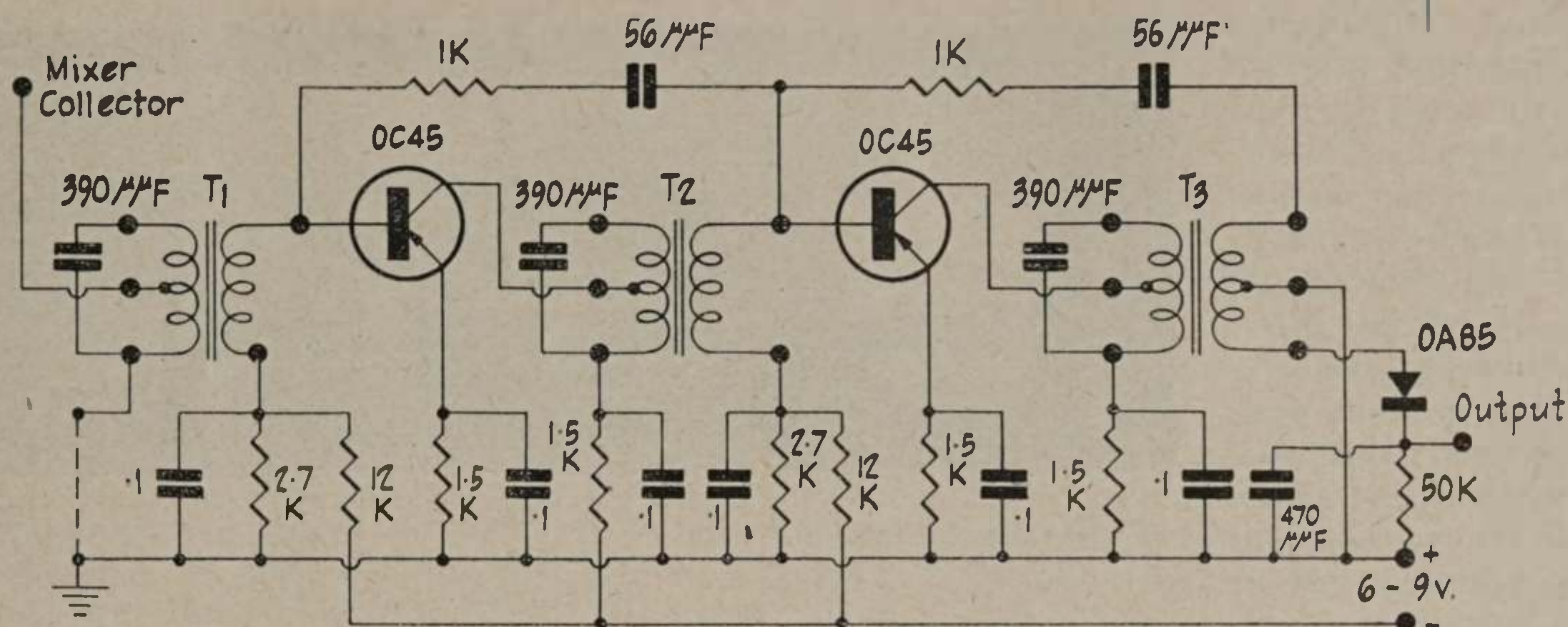
In the two views shown here of the I.F. amplifier, it has attached to it a "front end" consisting of an OC44 as a self-oscillating mixer stage. This is to be described in a subsequent article. The I.F. strip itself ends between the two left-hand pot cores seen in the photo. The left-hand one belongs to the mixer circuit, while the next two are T_1 and T_2 in the present control circuit diagram. T_3 is under the shield can to the right of the photo.

parent when the output of the detector is fed to a high-quality audio amplifier. The reason why such high selectivity can be attained from only three tuned circuits is to be found in the extremely high unloaded "Q" of the tuned circuits, which are constructed from Neosid iron-dust pot cores, and which use Litz. wire for their windings.

Because of the low input impedance of transistors, it is not possible to connect the input circuit of each one directly across a tuned circuit, as can be done with valves. Instead, a high step-down ratio must be used, so that when the transistor's input circuit is connected across the secondary, the impedance reflected across the tuned circuit by transformer action is so high that it does not lower the Q of the circuit too much. Similarly, although the output impedance of transistors is very high it is not so if compared with that of a pentode valve; accordingly, the collector of the transistor is not connected across the whole tuned winding, but across only a portion of it.

Transformer Ratios

Later in this article the exact ratios of the transformers are specified in the winding data, but in general, the step-down ratio from the tuned circuits to the base windings of the transistors is approximately 20:1. This means that the impedance ratio is the square of this figure, or some 400 to 1. Thus, if the input impedance of the stage following a particular



Circuit of the I.F. strip. The dotted connection to the "cold end" of T_1 should be made when the amplifier is being tested by feeding in a signal generator to the tapping which goes to the collector of the preceding mixer transistors, in a complete receiver. The chassis for the amplifier is a plain piece of aluminium sheet measuring $2\frac{1}{2}$ in. $\times$ $5\frac{1}{2}$ in. The transistors and transformers are in a row near one edge of this chassis, while the tag-strips holding the resistors and condensers are $1\frac{1}{2}$ in. from the centre-line through the transformers, the remaining width being usable as a range for bolting the unit to a chassis containing, say, a transistor audio amplifier.

transformer is 1000 ohms, the impedance reflected across the tuned winding is about 400,000 ohms. In more practical language, this means simply that the effect on the tuned circuit of connecting the next transistor to its input winding is exactly the same as would be caused by shunting a resistor of 400k. across the tuned winding itself.

The output impedance of each transistor is about 50,000 ohms, and although the exact ratios vary somewhat from one transformer to the next, a typical tapping point for the collector is at 30% of the turns, from the "cold" end of the tuned circuit. This represents a step-up ratio from the collector to the tuned winding of 3.3 times, so that the reflected impedance across the tuned circuit, due to the connection of the collector is about 550k.

From these figures it can be seen that the purpose of the low-impedance secondary, and the tap on the primary is to ensure that the tuned winding is not too heavily loaded, thereby reducing its Q , which is entirely responsible for the selectivity of the circuit, and in some measure responsible for its gain.

Impedance Matching to the Detector Circuit

It will be noted that the third transformer, T_3 is slightly different from the other two, in that it has a tapped secondary. The upper section has roughly the same number of turns as the secondaries of the other two transformers, but in our case, the lower part of the secondary winding has considerably more turns than this. This is because the detector diode and its load resistor are connected to this winding. The detector circuit also constitutes a load on the transformer to which it is connected, so that we must indulge in impedance-matching here, too. The turns ratio is chosen to suit the particular value of diode resistor that

is used, and since the latter is 50k., a fairly large number of turns is needed.

Neutralization

There is another feature of this circuit which will be found unusual by those used only to receivers using valves, and that is the use of neutralization of the transistor stages. It is an unfortunate feature of transistors that there is feedback inside each transistor itself, much as there is feedback from plate to grid of a triode valve through the grid-plate capacity. When transistors are used in tuned amplifiers, therefore, it is essential to neutralize this feedback, by adding external feedback in opposite phase to the internal feedback, and equal to it in quantity.

When this is done, the internal feedback cannot cause instability, as it can and will if left un-neutralized. Fortunately, however, the neutralization of transistor stages is by no means as critical as that of valves. Indeed, if the neutralizing condensers of $56\mu\text{fd.}$, are of a five per cent. tolerance, no difficulty at all will be experienced, and there is positively no need for an adjustable neutralizing condenser.

In each stage, neutralization is done by connecting from the base of the following stage, back to the base of the stage being neutralized, a series circuit of a condenser in series with a small resistor.

The D.C. Circuit

So far, we have described only the signal circuits of the transistors, but it is just as important that the latter should be operated with the correct standing currents, and further, that they should be protected by stabilizing circuits, from the possibility that the currents should change unduly when the amplifier is subjected to changes of temperature. In order to achieve these objects, the bases of the transistors are connected to the tap on a potential divider, one of

which is provided for each transformer. In addition, there is a resistor connected in the emitter circuit of each transistor. Reference to the audio amplifier published in last month's issue will show that this method of obtaining bias for the transistors is exactly the same as that used in the audio amplifier itself. It is an arrangement that will be found wherever there are transistors, and though it uses three resistors and two condensers for each stage, its advantages are such that these small components should by no means be grudged.

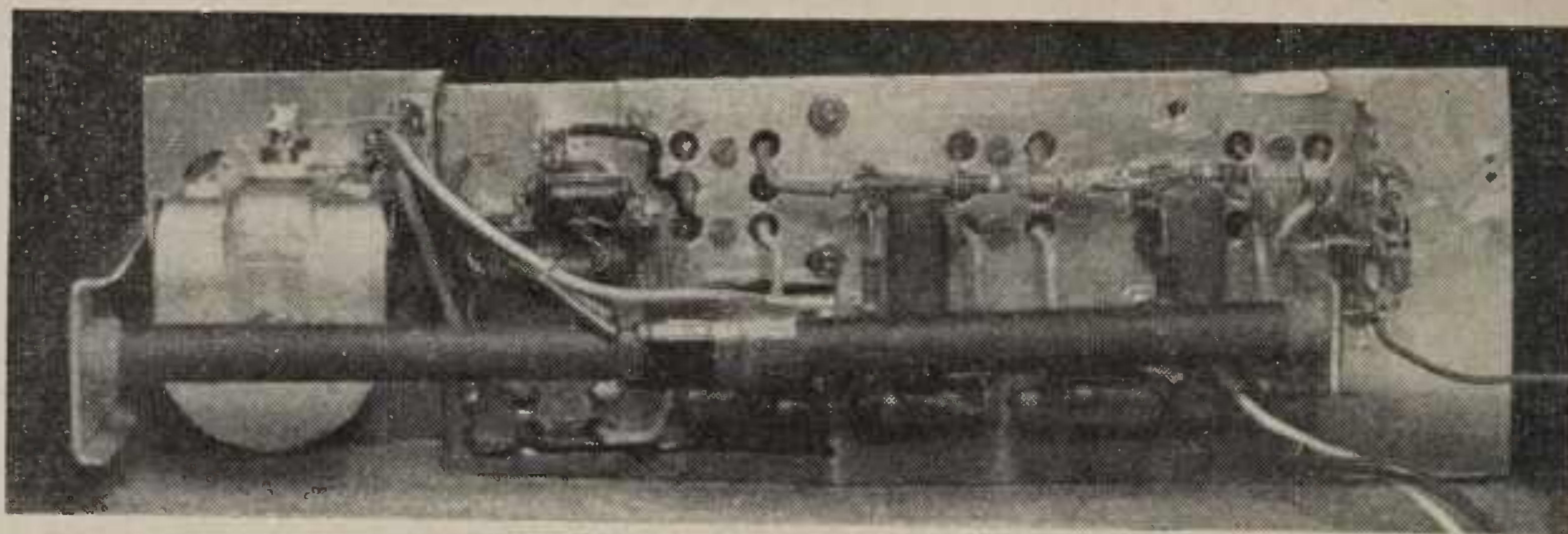
The circuit values have been chosen so that the collector currents of the OC44 transistors are approximately 1ma. each. The bleeders for the bias between them account for approximately another 1ma., so that at the designed voltage of 9 volts for the circuit, the total drain of the amplifier is 3ma.

The only components not so far mentioned are the de-coupling filters in the collector circuits of the transistors. Since the stage gain is high (and for other reasons connected with transistor audio amplifiers), these filters are essential, and should on no account be omitted, even though it may be found that the amplifier is perfectly stable without them.

Construction of the Amplifier

The construction of the amplifier should be fairly clear from the photographs. It follows the circuit exactly, in that the transformers and transistors are mounted in a straight line, while below them is a row of tag strips which accommodate all the D.C. part of the circuit. That is to say, if a line is drawn on the circuit diagram just below the transformers, everything to be seen below that line is mounted on the tag strips. Nothing could be more straight-forward than this layout, and it will be found that it enables all the rules of good R.F. wiring to be followed without difficulty. That is to say, there are no long leads carrying I.F. signals, the fixed tuning condensers of the I.F. transformers can be mounted right on the latter's bases, the output end of the amplifier is a long way from the input end, and the neutralizing circuits are as short and direct as possible.

In case some readers feel that this amplifier is somewhat too ambitious a project for a first attempt at transistor high-frequency operation, we would like to point out that when the amplifier was originally constructed, it functioned perfectly from the start. Indeed, when it was first turned on, the trimming slugs had not even been inserted in the coil formers, and yet the amplifier functioned, peaking nicely a few kilocycles from the official 455kc/sec. Then, when the



In this photograph the lay-out of the wiring can be seen, but the tag-strips holding the small parts are almost obscured, being directly under the aerial rod belonging to the "front end".

slugs were inserted, and tuned "on the nose", it was found that the circuit was oscillating very weakly. At this stage, however, there was no above-chassis shielding of any sort installed, and a complete cure for the instability was found by inserting two small baffle shields, one between the first I.F. transformer and the first transistor, and the other between the second transistor and the third transformer. The can over the latter that is seen in the photograph became necessary only when the "front end" had been added and the rod aerial installed, the latter having been found to conduct some I.F. signal from the output end of the amplifier back to the input end. Once again, this small amount of additional shielding effected a complete cure, not the smallest trace of residual regeneration being observable.

The writer has somewhat vivid memories of the first two-stage I.F. amplifier he ever built. It was a long time ago now, and it used two 6K7 valves, in the days when metal envelopes were just the latest thing. On first turning on, it oscillated violently, and it never did operate without "edginess" on weak signals, even after its oscillating propensities were cured. This amplifier is a different story altogether, partly because of accumulated experience, and partly because, properly treated, transistors appear to be just as easy, if not considerably easier to "sit down".

It must be admitted that a corresponding two-stage valve amplifier would almost certainly have more gain than the present circuit, which would naturally make it more difficult to stabilize, but the behaviour of the present I.F. amplifier gives the definite impression that another two stages added to it would cause no more difficulty than the first!

Construction of the Coils

The heart of the amplifier is the trio of I.F. transformers. These cannot be purchased, as used in the amplifier, but the parts from which they are made are readily available from Messrs Inductance Specialists, and winding them is a simple and interesting job.

The parts for each transformer comprise the following:

- (1) A pair of cups, making up the pot core.
- (2) A former, with base, on which the whole is mounted.
- (3) A threaded slug, for tuning adjustments, which threads into the former.
- (4) Paxolin washers which hold the halves of the pot core together on the former.
- (5) A polystyrene bobbin with three winding slots, into which the necessary turns are jumble-wound by hand.
- (6) (Not used.) A paxolin washer with four solder lugs attached.

These cores, and their associated bits and pieces are exactly similar to the one illustrated in last month's issue of this journal, and used in making the small crystal receiver.

Building the transformers from these cores is an exceedingly simple job, nor will it take much time to accomplish. The windings have only a small number of turns, which makes them easy to put on, but the best feature of all is that when pot cores are used, there is no necessity to go in for wave-winding, as is done for air-cored coils. There is no need either, to layer-wind the wire into the three slots in the bobbin. Just wind the wire into each slot until it is full, and then carry on into the next, as may be necessary. In practice it will be found that only the largest windings will occupy more than one slot, so that plenty of room is left for the small windings of only a few turns. The wire used was silk-covered Litz., and as the holes in the cores, provided for leading out the wires, are amply large, and unlikely to pinch the wires, it is not necessary to cover each of them with sphagetti before it is led out from inside the pot. In our own ones, the wires were brought out the holes (primary out one hole, and secondary through the other) and, with the halves of the pot held firmly together, wax from a disused condenser was melted into the hole, holding the wires firmly. Incidentally, the best way of holding the outside ends of the large windings, and the whole of the small ones, so that they do not tend to unwind, is to melt some condenser wax on to them while they are held firmly in place, immediately after winding.

WHEN WINDING, MAKE SURE THAT EACH LEAD IN THE FINISHED BOBBIN IS PROPERLY IDENTIFIED. If this is not done, it may lead to much difficulty later on. In amplifiers like this one, it really does matter which wire goes where!

Having finished the bobbin, this is fixed to one of the formers, (No. (2) in the above list of parts), having first been put into its pot core, of course, and the lead-out wires are taken to the appropriate eyelets in the base of the former, and soldered in. The best arrangement of the leads on the eyelets is to make them correspond exactly with the circuit diagram when the base is viewed from underneath, as it will be seen when the wiring of the chassis is being done.

That is to say, the base should be oriented so that three eyelets are at the right and three at the left. Then, the left-hand three are wired in the order shown in the circuit diagram to the primary leads. The secondary leads are terminated on the right-hand eyelets. This done, the transformer is mounted on the chassis so that the correct way round will not be forgotten while the others are being made.

With the transformers made and mounted on the chassis, there is really very little left to do to complete the amplifier. Building up the tag-strips which hold the condensers and resistors which make up the D.C. circuit is not likely to present any difficulty, and after these have been finished, they can be mounted on the chassis also. Then, all that remains is to make the wiring connections, and the amplifier is complete.

Testing the Amplifier

The best way to test the amplifier is to use a signal generator tuned to 455kc/sec. It should be fed into the tap of the first I.F. transformer through a 47k. resistor. For test purposes, the "cold" end of the primary is connected to the earth line, as shown dotted on the circuit diagram, so that the signal generator can be directly connected to the circuit. The 47k. resistor deputizes for the missing mixer stage which would normally feed this amplifier, and prevents the signal generator from so shunting the first tuned circuit that its selectivity would disappear altogether, and it would not be possible to tune it up.

Tuning should start with the last transformer, and proceed to the first in the usual way. After the first time, it pays to go over the adjustments once again, because they are almost, but not quite, independent of each other.

If the circuit oscillates, after having been built as shown in the photographs, this means simply that one or more of the neutralizing windings are the wrong way round in the circuit. In the case of the first stage, this does not matter much, because it can easily be cured by reversing the secondary leads, but if it is the case with the second stage, then it means that the secondary will have to be re-wound, in order to get the polarity of the correct, and at the same time, the turns ratio. But if you do have this trouble, check that you have not wound the transformer correctly, but merely have connected the wrong ends of the secondary to the neutralizing circuit and the diode circuit respectively.

It is worth knowing that the original amplifier did not oscillate with the neutralizing circuit to either one of the transistors disconnected. This means that it is possible to check quite easily which, if any, has the wrong polarity of the neutralizing connection. The neutralizing circuit of the first stage is disconnected, while the amplifier is running. If the gain drops, it is this stage that is wrong. If now this stage is set right by reversing the secondary leads of the second

I.F. transformer, a check can be made of the second stage. If removing the neutralizing connection reduces the amplification, then this stage too is wrong.

Feeding an Audio Amplifier

If the I.F. amplifier is to feed a valve amplifier, no complications will arise, as long as a blocking condenser is inserted in the output lead so that the D.C. output of the detector does not get to the grid of the first tube in the amplifier. If a transistor amplifier is to be fed from the detector, then a series resistor must be inserted. This should have a value of not less than 100k. In this case, too, there must be a blocking condenser, but this will almost certainly be incorporated as part of the amplifier.

The I.F. amplifier is quite suitable for exciting the

audio amplifier described in last month's issue, and in this case, only the series resistor will be needed.

Feeding from a "Front End"

There is no necessity to have a transistor "front end" in order to use this I.F. amplifier. It can be excited by a valve mixer stage, if desired, and in this case, the tap on the primary of the first I.F. transformer would remain unused, and the whole primary would be put in the plate circuit of the mixer, as usual.

When a transistor mixer is used, the connection is somewhat different, especially if the mixer transistor also acts as its own oscillator. This arrangement is described in detail in an article to appear next month, so we will not enlarge upon it here.

WINDING DATA FOR I.F. COILS

		Tuned winding	Tap at — turns from cold end	Secondary winding	Neutraliz- ing winding
T ₁		75	40	3	—
T ₂		75	23	4	—
T ₃		75	17	26	3

Note: For T₃, the winding directions are important. With both tuned winding and secondary wound in the same direction, the primary start should be the "cold" end, and the secondary start should be the end which goes to the neutralizing condenser.

America Buys Marconi Doppler Know-how

The Radio Corporation of America has arranged to acquire technical information on the latest doppler navigation equipment from Marconi's Wireless Telegraph Co. Ltd., of Chelmsford, England. This policy has been adopted in the light of the Marconi Company's long experience in the design, development, and flight tests of doppler air navigational aids; R.C.A. is adapting and utilising the Marconi technical know-how in the design of an R.C.A. equipment for use in civil airlines.

B.B.C. TRY OUT STEREOPHONY BY RADIO

An interesting experiment was conducted during the week when the B.B.C. transmitted a short programme stereophonically, using two transmitters for the twin channels. Experimental transmissions were radiated late on Monday night and Tuesday night, with the object of finding out whether a stereophonic effect could be obtained.

The programme consisted of three parts of five minutes each: first, two different sustained tones, that of the right-hand channel being higher than that of the left; second, simultaneous non-stereo transmissions of speech on both channels to assist in obtaining a good balance between the two; and third, a stereophonic transmission from a tape recording.

It was intended that each channel, should be radiated from two transmitters, so that four transmitters would be involved altogether. These were television sound from Crystal Palace and the Third Programme on V.H.F. (left-hand channel); and the Home Service

from the M.W. transmitter and the V.H.F. transmitter (right-hand channel). Actually the television sound channel was not used on Monday. The experiment may be repeated on further occasions, *but the B.B.C. state quite definitely there is no intention to introduce a public stereophonic service.*

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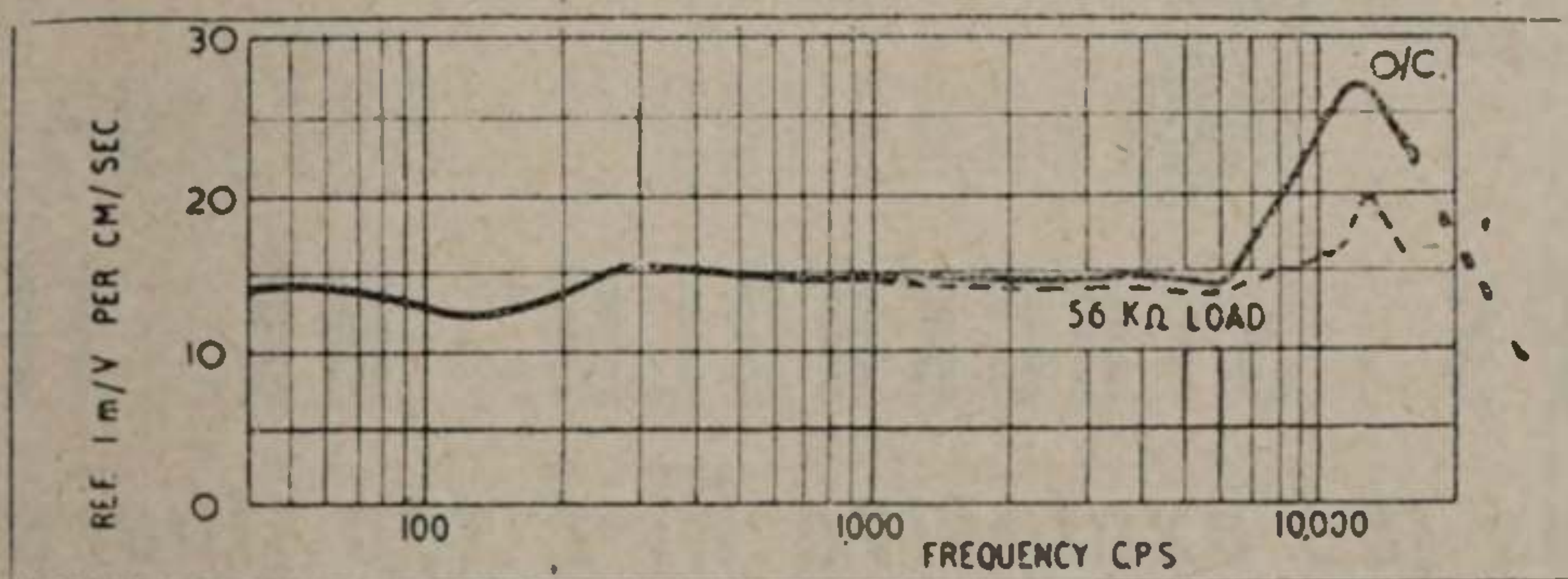
Receivers

AN ASPECT OF THE PHILIPS MAGNETO-DYNAMIC PICK-UP

The new Philips moving-magnet high-fidelity pick-up has excited a great deal of interest in both England and America, and this journal has been most impressed with the results obtained in recent laboratory tests. The article below was written by a Philips engineer in Holland to explain behaviour that was referred to in "Hi-Fi News" by (presumably) Stanley Kelly, a well-known British authority on pick-up design. The original article is reproduced in full, after which come the Philips engineer's criticisms and his proof that the observed resonance was not a mechanical one belonging to the pick-up movement. All interested readers should note how important it is to eliminate the effects of stray capacity, which seems to have led Mr Kelly to an entirely false conclusion.

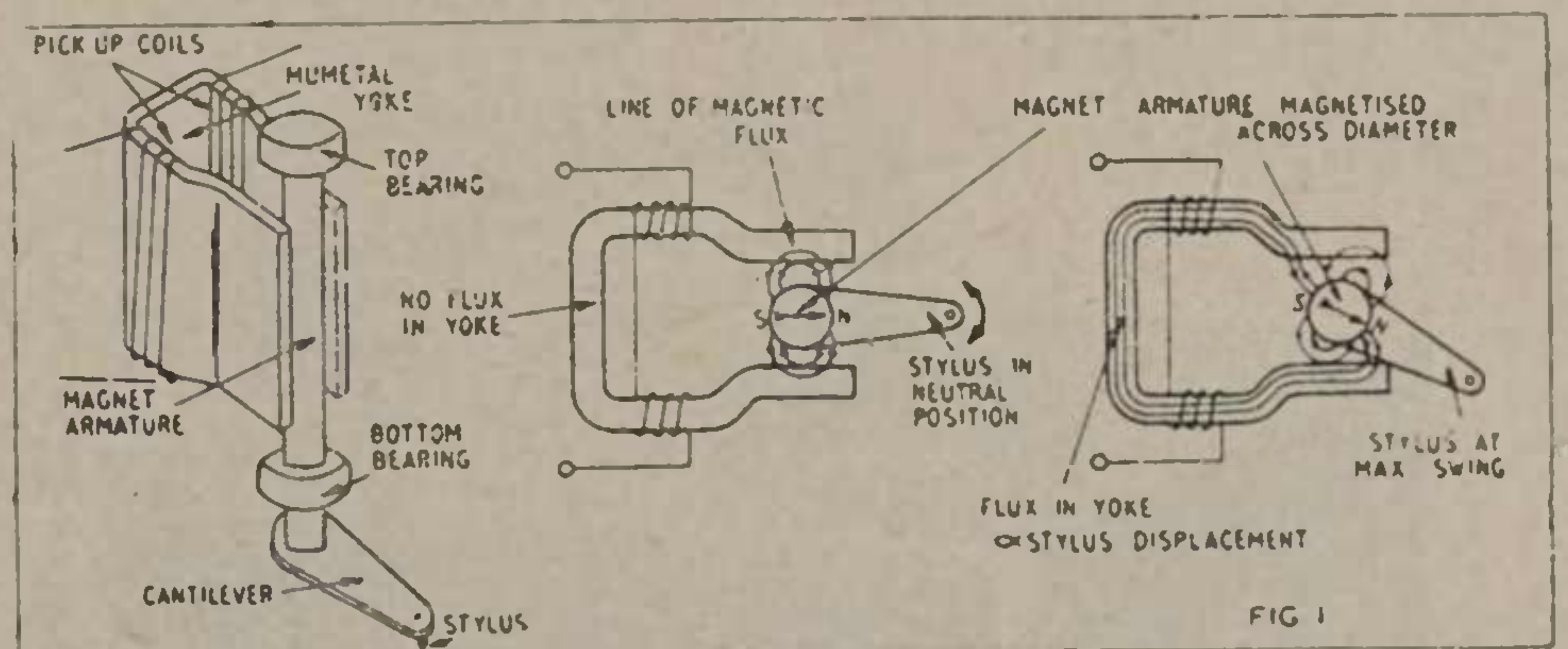
An article on the Philips magneto-dynamic pick-up published in the March, 1958 issue of the English monthly "Hi-Fi-News" made it clear to us that, in particular to people used to working with low-impedance, low-output dynamic pick-ups, the Philips high-output, high-impedance pick-up may offer some problems. Before dealing with these problems we will reprint the article in full.

"The restoring force is commendably low, resulting in a very low playing weight. This, however, results in a relatively undamped moving system, and, as shown in the accompanying graph, the height of the resonance under open circuit conditions is of the order of 12 dB. However, when the pick-up is correctly loaded by a 56 kilo ohm resistance, the height of the resonance under open circuit conditions is of the order of 12 dB. However, when the pick-up is correctly loaded by a 56 kilo ohm resistance, the height of the resonance drops to about 5 dB at 13 Kc/s. Below 10 Kc/s the response is sensibly flat. By virtue of the high compliance the low frequency resonance is below 20 c/s. Harmonic distortion was imperceptible except in the 4 and 5 Kc/s band, when it approached about 5%.



Response curve under open circuit conditions and when loaded with a 56K ohm resistance.

A diamond stylus is fitted as standard. The polish and shape of the stylus in the review sample were everything to be desired. The cartridge is supplied with an extremely elegant and well-designed tone arm which is substantially constructed from a metal tube of generous cross-section. Playing weight is adjusted



These diagrams show the construction and working of the new magneto-dynamic pick-up

by means of a calibrated counter balance in which the accuracy at 5 and 10 grams indicated was within 0.2 of the gram.

Listening to the unit confirmed our first impressions: the bass is clean and crisp and the treble is brilliant, due, possibly, to the resonance in the 13 K/s region. The hum level was below audibility and needle talk was negligible.

To summarize, a brilliantly-conceived, well-designed, and well-engineered cartridge and tone arm. With the exception of the criticism of the high frequency resonance, it is an exemplary pick-up in every way.

The writer's first acquaintance with this cartridge was at the Firato Exhibition in Amsterdam in the autumn of 1956. The lasting impression gained on this first acquaintance was a clean, crisp reproduction. The models demonstrated were pre-production samples, probably hand picked from the laboratory, but, contrary to usual practice, the production unit submitted for review more than fulfilled the early promise of the prototype.

The conception and execution of the cartridge proper is simple in the extreme. It consists of a magnetic circuit in which the moving member is a magnet, the pick-up coils being wound round a Mu-metal yoke. The major advantage of this system is that the magnetic efficiency is many, many times greater than in

(Continued on page 22.)

Watch your customers' faces—see why

SO UN D



PHILIPS STOCKHOLM Mk. II

now joins the exclusive HI-Z top-liners

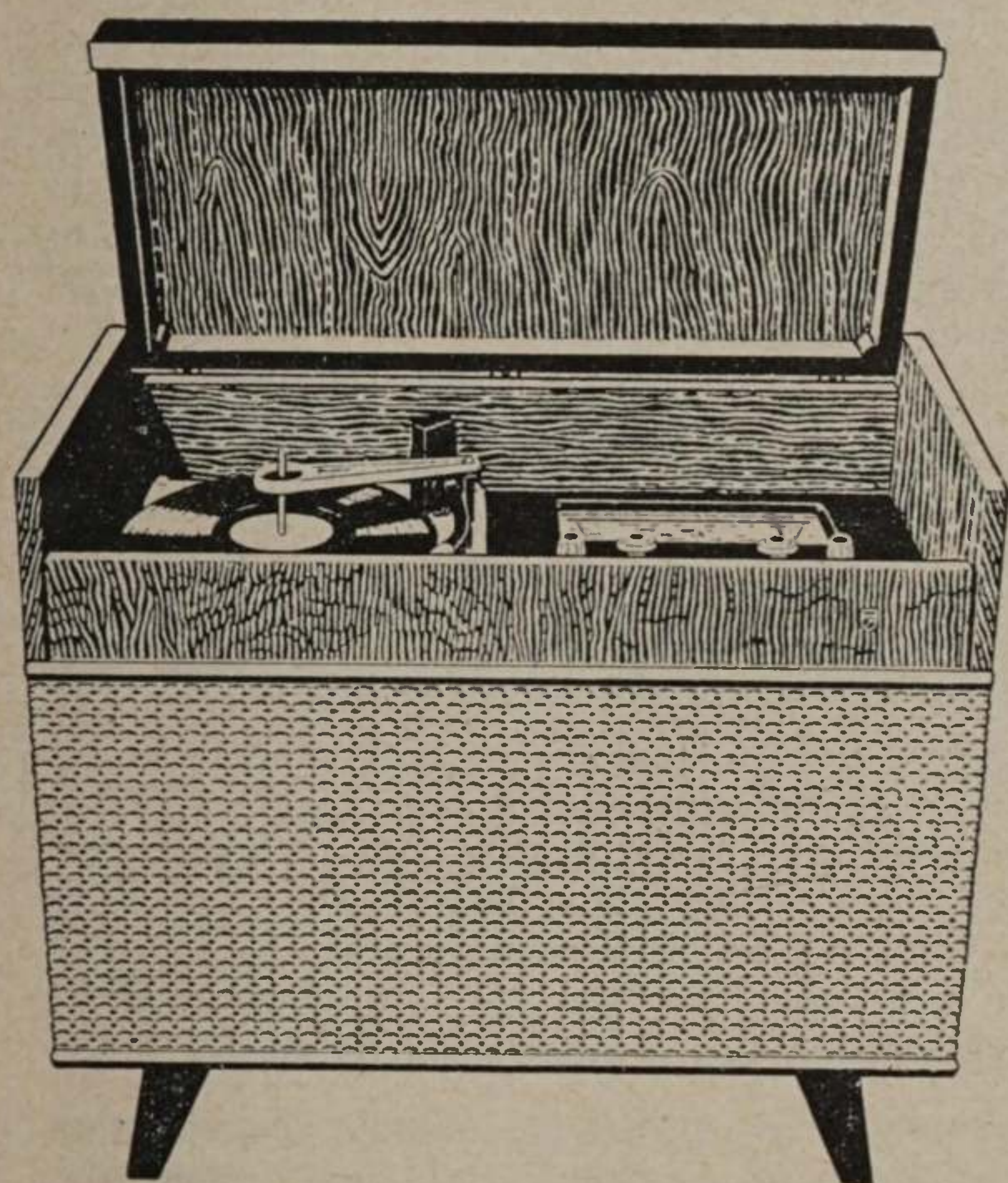
PHILIPS "STOCKHOLM" extended range HI-FI radiogram has been promoted to the HI-Z class. This means that the loudspeaker transformer has been eliminated and the audio output now flows through direct to the loudspeaker. Stockholm's improved HI-Z circuitry has speaker coils coupled direct to the output valves. This is made possible by PHILIPS research which has perfected loudspeaker coils with almost microscopic fine gauge wire to give a voice coil impedance of 800 ohms, compared with 5 to 7 ohms in conventional loudspeakers. All the other well-known Stockholm features remain:

- ★ 10-valve performance from 7 multi-function valves
- ★ World-wide reception
- ★ Tape recorder and extension speaker connections
- ★ PHILIPS "Maestro" Touch-O-Matic record changer for all four speeds, all sizes

Retail prices: 127 gns. in Summer Gold, Walnut, Mahogany
132 gns. in Honey Gold Blonde

these PHILIPS sets are

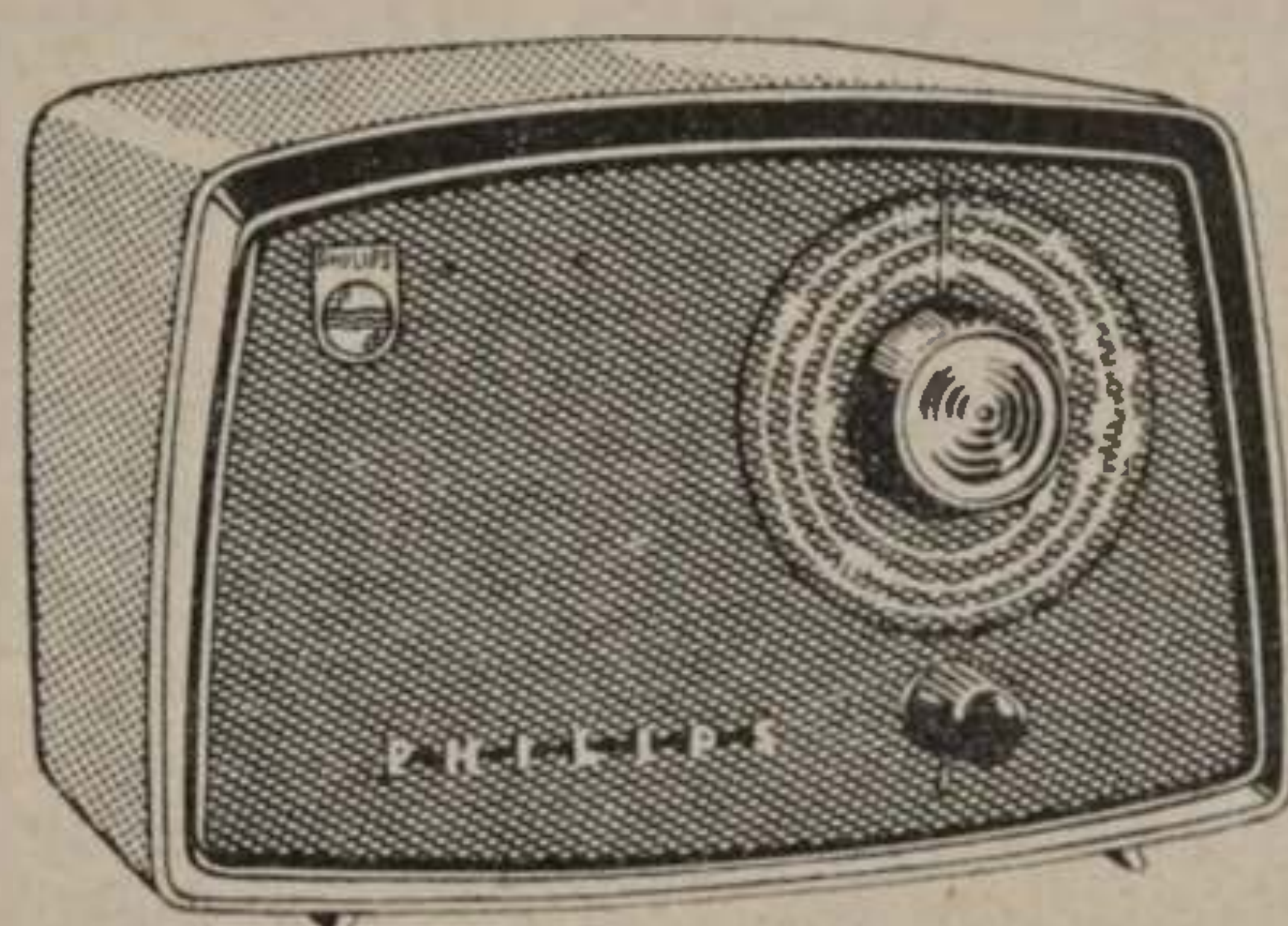
SELLING



PHILIPS "COPENHAGEN"

Another Hi-Fi masterpiece from PHILIPS. Four-speaker performance speaks for itself. And its handsome design, you'll discover, is what people are looking for. Just look at these features: 10-valve performance from 7 multi-function valves; attractive Surrey-walnut solid core veneer for extra strength and permanent beauty; spacious record browser-bin; fitted for tape recorder and extension speaker.

Retail price: 95 gns.



PHILETTE "FIESTA"

A dandy little high-performance bookshelf radio for personal use in the home, or even as a main radio, its power and punch will amaze you. Finished in dove grey and fiesta red, with a large, easy-to-read circular dial.

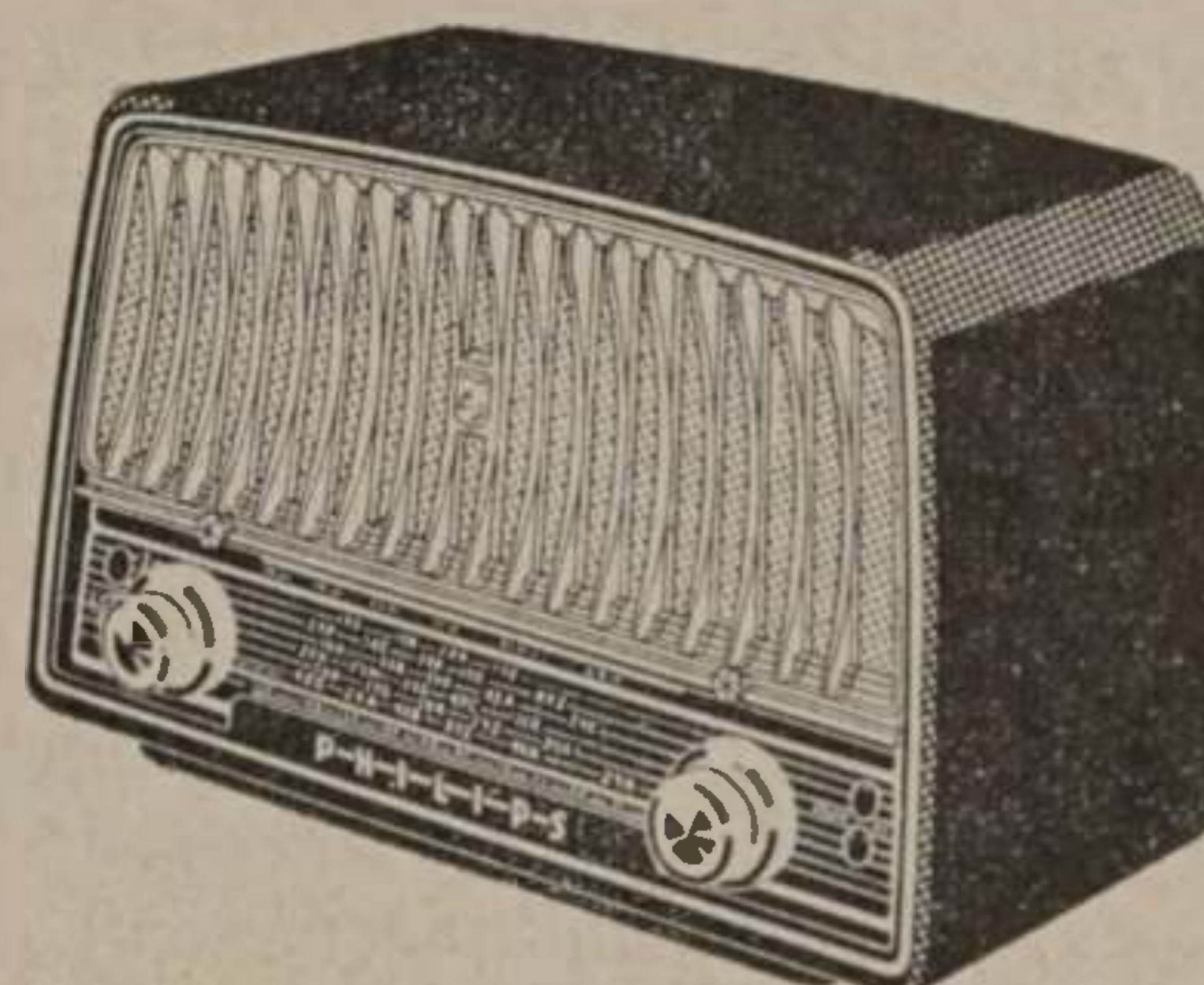
Retail price:
15 gns.

PHILIPS "NEW YORKER"

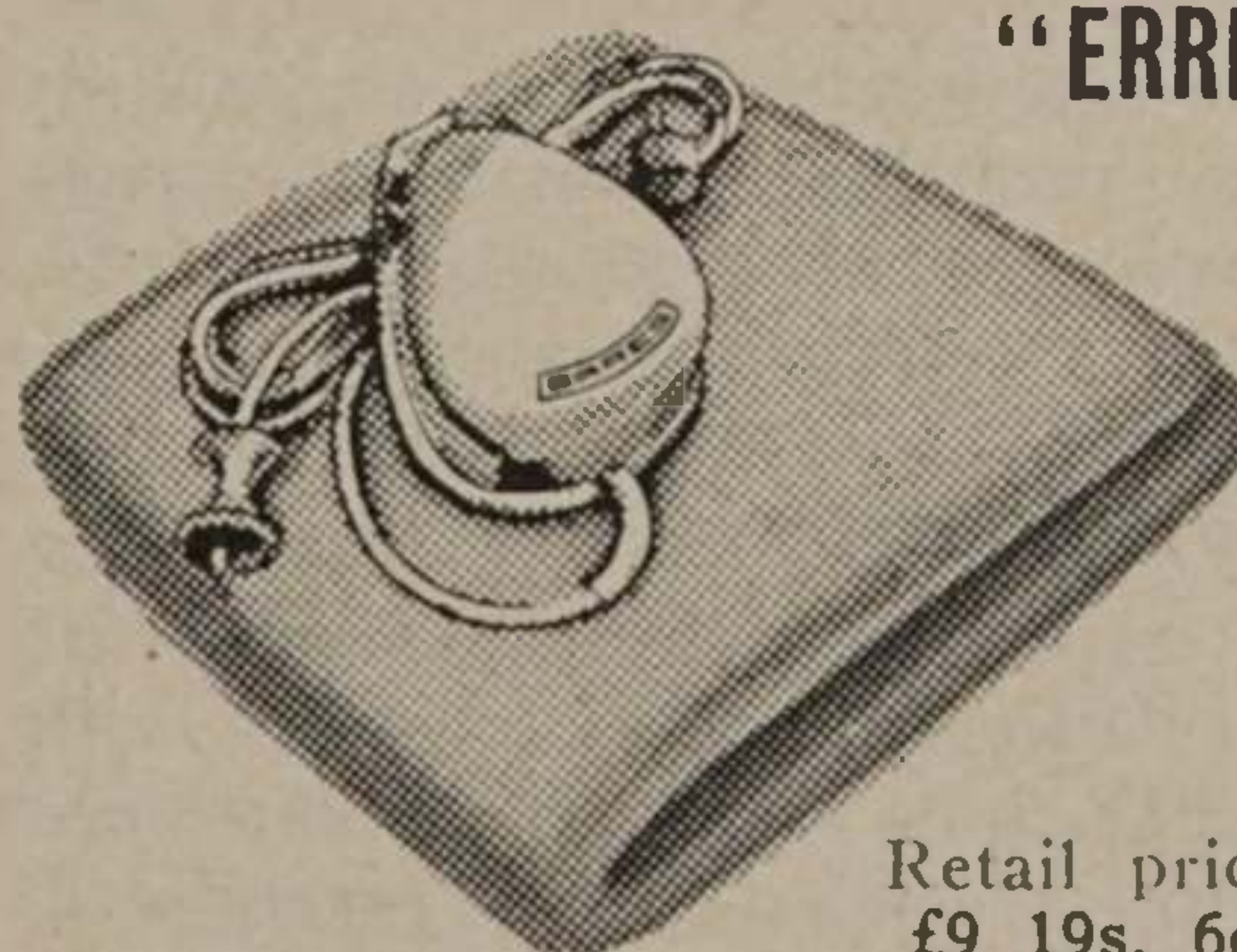
Now in a broadcast version

Seven-valve performance from 5 multi-function valves. Ferroceptor aerial; all PHILIPS latest features. A handsome cabinet with floodlit plastic grille.

Retail price:
23 gns.



"ERRES" Electric Safety Blankets



Retail price:
£9 19s. 6d.

Display these prominently during cold snaps. Customers will buy warmth . . . your sales will go up if the timing is right. Make sure you have stocks now. Low voltage, washable, economical. Complete with heat controller and transformer.



PHILIPS

for faster sales - satisfied customers

PHILIPS ELECTRICAL INDUSTRIES OF NEW ZEALAND LIMITED

the more conventional magnetic cartridge, where either the armature or the coil moves.

In the Philips cartridge the magnet is about $\frac{3}{8}$ in. long x $\frac{1}{32}$ in. diameter and is made of Magnadur, which is one of the new ferrite non-metallic magnets. The static mass of this magnet is only 17.6 milligrams against an average of 5/10 grams with conventional units.

As seen from sketch Fig. 1a, the cantilever stylus is carried on the bottom of a relatively long thin rod. This rod is the magnet, and is magnetized across the diameter, the poles of the magnet being so disposed that at position of rest only a small portion of flux flows through the limbs of the yoke and is equal and opposite, Fig. 1b. Displacing the stylus will rotate the magnet resulting in flux flowing in either one or the other direction through the yoke, thus inducing an E.M.F. in the pick-up coils. Fig. 1c shows diagrammatically the flux when the cantilever is displaced in one direction.

Because of the small diameter and low density of the magnet system, the moment of inertia is correspondingly low, resulting in a fairly high resonant frequency for a given cantilever mass."

If we summarize this article we find that its author was pleasantly surprised by the actual production quality, even though he was already impressed by the first demonstration more than a year ago, but that he has one objection and that is the indeed very pronounced peak he measured at 13,000 c/s. The explanation of this peak given by S.K. (probably Stanley Kelly, who at the moment is consulting engineer but who has been designing high-fidelity pick-ups and loudspeakers of the moving ribbon type) is that it stems from a mechanical resonance of the mentioned system which, as he writes, is relatively undamped. We believe, however, that unless a frequency record was used with unusual mechanical properties a resonance peak of this magnitude and situated at such a low frequency as 13,000 c/s is unlikely to be of a mechanical nature, and a more probable explanation appears to be electrical resonance of the impedance of the coil with the capacity of the pick-up lead and the input of the amplifier. The equivalent circuit of the loaded pick-up is described below.

The pick-up is thus represented by a generator of negligible internal impedance connected in series with a pure resistance of 1,200 ohms and a pure inductance of 0.6 H. The pick-up is loaded by a capacity C parallel to a resistance R. For this system to resonate at 13,000 c/s the value of C should be 250 pF and the magnitude of the resonance peak can then be calculated for various values of the loading resistance, for example, by making use of the curves shown in F. E. Terman Radio Engineers Handbook, London, 1950, section 3, paragraph 2, figure 6. The following values were found:

R is equal	∞ peak far larger than 20 dB
R is equal	1 MOhm peak larger than 20 dB

R is equal	0.1 MOhm peak	9.6 dB
R is equal	0.05 MOhm peak	6 dB
R is equal	0.025 MOhm peak	2 dB

From the calculations the conclusion could be drawn that in the unloaded condition S.K. should have found a far higher peak in the response curve than he actually measured. It should be realized, however, that the Q of the pick-up is very high, in a magnitude of 50 and thus the response peak will be very sharp and narrow. It is most unlikely that the frequency of the test record is exactly equal to this electrical resonance frequency, moreover, even the slightest amount of wow or, for that matter, frequency modulation, will cause a flattening of the resonance peak as it is measured. Only in a case of near critical damping this electro-mechanical measurement has a fair degree of accuracy. With a load of 50,000 ohms we calculated a peak of 6 dB which is actually the value measured by Mr Kelly, and it therefore appears reasonable to state that the correspondence between the measurements and our calculations is such that an electrical resonance appears a likely explanation of the response curves under discussion.

If next we consider the influence of a load resistance on a mechanical resonance of the pick-up system, if we assume the capacity to be that small that it can be neglected, then the load resistance is connected in series with the 0.6 H coil across the generator. The internal resistance of the pick-up of 1,200 ohms may, in most cases, be neglected. The series connection of the inductance and resistance may be considered as a L-R attenuator and consequently at 13,000 c/s when the impedance of the coil is 49,000 ohms, the attenuation caused by a 50,000 ohms load resistor will only be 2 dB. This is far less than found by Mr Kelly, from which we may conclude that the resonance peak is of an electrical and not a mechanical nature.

The lesson we have to draw from the above is that people not used to working with high-impedance, high-output, high-fidelity pick-ups may run into difficulties when using the Philips pick-up. Previously, high-output, high-impedance pick-ups, usually of the magnetic type, had only restricted high note reproduction and the response curve usually dropped sharply at a frequency well below the electrical resonance. With low impedance pick-ups, which, by the way, are also low output pick-ups, considerable stray capacity is permitted before the electrical resonance frequency becomes so low that it can cause difficulties. With the Philips pick-up, however, which combines a comparatively high output with a very extended response curve, steps have to be taken to keep the capacity across the pick-up to a low value. In most cases the capacity can, without undue trouble, be kept below 100 pF, but in order to achieve this low capacity screened cable of the shortest possible length should be used and attention should be paid to the amplifier

(Concluded on page 37.)

BOOK REVIEWS

Wireless and Electrical Trader Year Book: Radio, Television, and Electrical Appliances, 1958. 29th Edition. Published February, 1958 at 12s. 6d. (postage 1s. 8d.) (with a reduction to subscribers to *Wireless and Electrical Trader*) by Trader Publishing Co. Ltd. Size 8½ in. x 5¼ in. 372 pages. Bound Linson.

Wireless and Electrical Trader Year Book, which was first published in 1925, has become the most important reference book to the radio and electrical industries. It is the standard guide for all connected with sales or services, and of great assistance to overseas buyers wanting to contact British sources of supply.

Features of the 1958 edition include condensed specifications of nearly 250 current commercial television receivers, and information on valve and cathode ray tube base connections, with over 300 valve base diagrams. These alone are invaluable to radio and TV service engineers.

New features are a section giving brief specification details of tape recorders and information on Band 111 convertors. The special section giving both alphabetical and territorial lists of radio and electrical wholesalers, in which association members are indicated, is again included, as also is the comprehensive table of television tuning frequencies of superhet receivers and sideband characteristics of superhet and TRF models. Complete information on wages covering radio and television service engineers and apprentices, together with wage rates of radio and television shop managers and assistants, is also given. The comprehensive list of I.F. values of commercial radio receivers which have been marketed during the past ten years has been revised and extended. Other data include specifications of current radio receivers covering nearly 400 models, brief details of domestic electrical appliances which have been reviewed during twelve months in New Products in the *Wireless and Electrical Trade*, a B.B.C. and I.T.A. station guide, legal, and licensing information and a directory of trade associations.

The usefulness of the Year Book has been enhanced by the separation of domestic electrical appliances from the general radio and electrical Buyers' Guide, and users of the directory will find that reference to makers of purely domestic lines is made easier. For ease of reference, the Year Book is divided into sections printed on distinctively coloured paper, and each section is separated by a stout card, with thumb index, giving details of contents.

One of the principal aims of the Year Book is to assist traders to keep abreast of the constant changes in the names, addresses, telephone numbers, and products of the firms engaged in the radio and electrical industries. The directory sections incorporating these

revisions, together with the carefully selected technical information and other practical data, make the *Trader Year Book* an invaluable time-saving reference book for every retailer and business man in the industry.

Principal contents include: Directory of Principal Trade Organizations, Legal and General Information, Wage Rates, Television Tuning Frequencies, Radio Receiver I.F. Values, Valve Base Connections Diagrams, Mains Voltages, Addresses of Electricity Boards, Television Information and Data, Television and FM Station Guide, Receiver Specifications of 1957-58 Models, Brief descriptions of Domestic Electrical Appliances, Wholesalers' Directory, Proprietary Names Directory, Classified Buyers' Guide, Trade Addresses.

Low-Cost High-Quality Amplifier. With Alternative Pre-Amplifiers. By P. J. Baxandall, B.Sc.(Eng.). Published for *Wireless World* by Iliffe Sons Ltd. on 27th February, 1958. 10¼ in. x 7¼ in. 29 pages. Price 3s. 6d. net (by post 4s.).

Many of the dicta of "high-fidelity experts" are based on hearsay rather than fact. For instance, statements of the power necessary for realistic reproduction of an orchestra in an average living-room may range from 10 to 20 watts in this country, or 20 to 100 watts in America!

A statistical analysis by the designer of the main amplifier described in this booklet has shown that an undistorted output of more than 5 watts is rarely called for, even by sound-reproduction enthusiasts when given a free hand to adjust the volume level to their own liking.

Careful choice of operating conditions for the output valves, and the application of adequate feedback has enabled an output transformer of comparatively simple design to be employed with complete stability.

A choice of alternative pre-amplifier and tone control designs is given; one of simple construction for use with a crystal pick-up and the other of much wider scope with provision also for a microphone input.

Portable Transistor Receiver. Sensitive Superheterodyne Circuit Incorporating R.F. Transistors. By S. W. Amos, B.Sc.(Hons.), A.M.I.E.E. Published for *Wireless World* by Iliffe & Sons Ltd. on 2nd January, 1958. 7¼ in. x 10¼ in. 15 pp. Price 2s. 6d. net (by post 2s. 10d.).

With the introduction of R.F. transistors it is now possible to construct a superheterodyne receiver with transistors in all stages having a performance comparable to that of the popular type of valve receiver on the medium and long waves.

This reprint describes the theoretical and practical design of a battery-operated, self-contained, portable set using a total of seven junction transistors, four of which are the A.F. type and three are the latest R.F. type. A point-contact diode is also included.

A.F. power output exceeds 300 milliwatts and the sensitivity is such that with its built-in ferrite rod aerial the push-pull output stage can be overloaded by some of the Continental stations when the set is used in the London area.

The receiver operates from a 4.5- or 6-volt dry battery and at the latter voltage takes an average current of 25mA. A Type PP1 battery, costing three shillings or so, will thus provide 150 listening hours with the set used four hours a day. On this basis the running costs work out at one farthing an hour.

TRANSISTOR A.F. AMPLIFIERS, by D. D. Jones, M.Sc., D.I.C., and R. A. Hilbourne, B.Sc. Published for *Wireless World* by Iliffe & Sons Ltd., London.

The authors of this book are both members of the research laboratories of the General Electric Company of England, and for several years have been actively engaged in the development of improved forms of transistors. They are consequently well qualified to write a book of this nature, and our review copy shows that they have done a very creditable job. The publishers claim that this is the first British publication to give a systematic treatment of transistor audio amplifier technique.

The book starts off with an account of the characteristic curves of transistors, and of the most generally used equivalent circuits, which can be used for a systematic analysis of the performance of transistor amplifier stages, after which the authors dive straight into the subject of small-signal amplifier stages and their design.

It is clear from the authors' treatment that the book is intended for those interested in the direct application of transistors rather than in the fundamental theory of the circuits involved. For example, only four pages or so are devoted to D.C. bias stabilization, and a simple formula is produced giving the stability factor for the commonly-used common emitter stage, with emitter resistor and potential divider to the base. However, this is really adequate, since the bibliography at the end of the chapter refers the reader to more exhaustive treatments of the subject, and also because the common emitter stage, with this particular type of stabilization has already become the standard arrangement for audio work.

Class A and Class B power amplifiers are treated separately, and, as befits their relative practical importance at the present time, the latter have much more space devoted to them. However, in this reviewer's opinion, the performance curves for a 4-watt

Class A amplifier rather disprove the authors' assertion in the Introduction that "The performance of the transistor is comparable with that of a thermionic valve in an application of this type, the main difference being the high efficiency obtainable with the transistor." Since at this point the authors are discussing amplifiers with low distortion, their statement in the introduction is a little optimistic, as their own performance curves show. For example, it would be a poor pair of triodes which would require 16db. of feedback in order to achieve a distortion of 1 per cent. at maximum rated output. Incidentally, this degree of feedback is shown applied round an output stage containing two transformers, and in addition, the driver stage is included in the feedback loop.

The long chapter on Class B amplifiers is largely devoted to descriptions of actual circuits, of various power outputs; the characteristics of each are fully listed, together with design data on input and output transformers.

Complementary symmetry circuits are dealt with in principle, but in view of the complete absence from the British market of n-p-n transistors, such information as it contains is of academic interest only.

Unfortunately, the only description of transformerless output stages to be found in the book is in connection with complementary symmetry circuits. This is more than a little misleading, because the uninitiated reader would be led to expect that transformerless stages are not usable in conventional arrangements, where both transistors are of the same kind. Indeed, the question is quite an important one, and constitutes a rather grave omission.

A book of this nature always seems to suffer somewhat when the authors are writing it as a result of their work for a particular firm, as is the case here. The immediate and obvious result is that there is not a single mention throughout the book of any other transistors than those bearing the G.E.C. trade-mark. It seems to this writer that a book such as this should at least give examples of circuits developed by other firms, or of circuits using other concerns' transistors. While it is true that no new principles are involved when this is done, the book as it stands tends to have far too much the aspect of a "house" publication, which in fact it is not.

These comments, should not be taken to mean that the book is not recommended. Far from it. Those engineers who have had a good deal to do with the design of valve amplifiers will find it extremely useful by way of a "conversion course", while those who are approaching the subject with little or no prior knowledge of amplifier design techniques will find it an extremely useful introduction, especially if it is read in conjunction with the quite wide range of "house" literature on transistor applications that is available today—most of it exceedingly good of its kind.

Techniques**HOW TO SOLDER "LITZ" WIRE PROPERLY**

Since this issue contains two articles in which the use of Litz. wire is recommended, it would perhaps be as well if we described a simple method of ensuring that every strand is soldered.

The Purpose of "Litz" Wire

Multi-stranded wire, or Litz., as it is usually called, is used in R.F. and I.F. coils in order to reduce losses due to skin effect, and thus to raise the Q of the coils thus wound. The subject is a large one to dismiss in a few sentences, but all it is proposed to do here is to emphasize that where this type of wire is recommended, it should certainly be used if the best results are wanted. Although most people know of the advantages of Litz. wire, few except manufacturers use it, mostly because of a mistaken notion that it is very difficult to deal with.

All the radio text-books say, with some emphasis, too, that it is even worse than useless to use this kind of wire instead of solid, unless each strand is separately tinned, because, in theory at least, an idle strand can completely nullify any advantage that might accrue from using it. This immediately brings to mind horrifying pictures of the unfortunate operative attempting to bare the enamel insulation from some 27 strands of wire literally finer than a hair, then separately tinning each one, twisting them together, and then applying solder to the lot!

Not Quite as Bad as This

To say that the job is not quite as bad as indicated above might succeed in putting off a good many possible starters, but in actual fact, the job is as simple as falling off the proverbial log, if only one knows the right way to go about it. So, to remove the suspense, here it is. It consists of nothing more than burning

off the insulation, heating the end of the wire to red heat, and then plunging it into methylated spirits.

When this is done, the strands are usually found welded together at the extreme ends, and for some distance along from the end, the wires are all that beautiful bright copper colour that indicates that they will merely have to be introduced to the solder in order to tin perfectly.

The best way to carry out the process is as follows. A minute container is made from a piece of copper tubing of about a quarter of an inch inside diameter, and half an inch long, by blocking up one end. This container is then gripped in the vice, and filled with methylated spirit, which is then lighted. Because of the small area of exposed surface, the flame will be very small, but large enough to do the job properly. The last half-inch of the wire is placed in the flame. First, the silk and enamel insulation burns off, and in a few moments, the wire becomes red-hot. If the heating is carried on too long, the wire actually burns, and if the required temperature is not reached, the cleaning effect of quenching in the spirit does not take place. Thus, a little practice is needed before one can judge just the right temperature for the wire before the quenching. The latter is carried out by the simple expedient of plunging the hot wire into the container of spirit, at the same time extinguishing the flame so that more insulation is not burned from the wire.

With the cleaning successfully accomplished, the wire is tinned immediately without touching it with the fingers.

ROYAL PATRONAGE FOR COMPUTER SHOW

H.R.H. The Duke of Edinburgh has consented to be Patron of the Electronic Computer Exhibition and Business Symposium, to be held at Olympia, London, from November 28 to December 4, 1958.

More than 40 British manufacturers of electronic computers and ancillary equipment, including all the leading firms, have taken space in the exhibition, which will be the first of its kind in the world.

The symposium will stress the value of the computer as an aid to management and will consist of papers designed to bring to the business executive up-to-date information arising from the latest practical experience of the installation and operation of British computers and data processing systems. These will include applications to general business management, such as payrolls and stores control for railways, steel

works, gas undertakings, farms, and motor sales organizations. Life insurance is also covered.

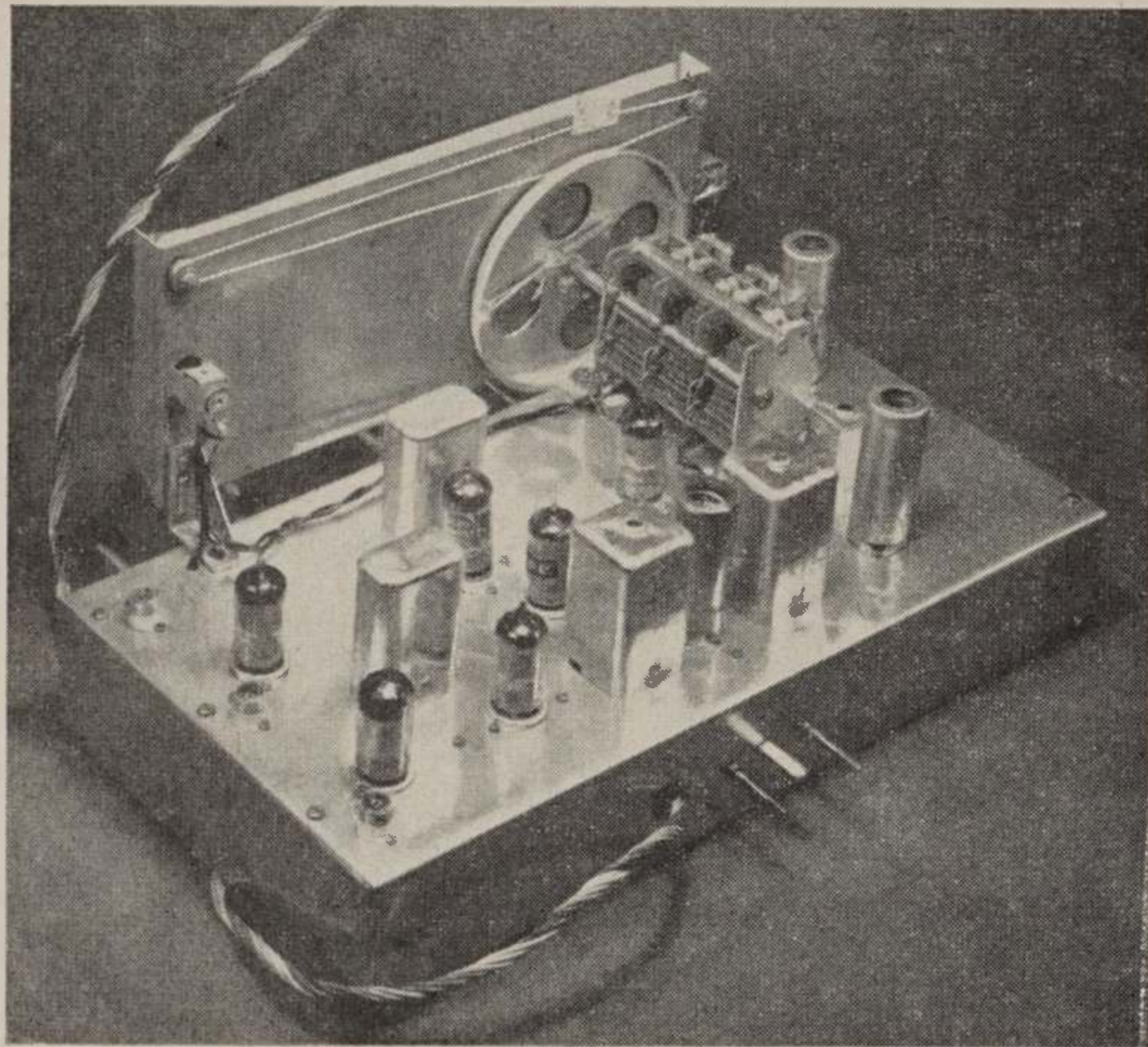
The exhibition and symposium are being organized at the instigation of the National Research Development Corporation by the Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association.

Immediately preceding the exhibition and business symposium, there is to be an associated scientific symposium organized by the National Physical Laboratory, and to be held at Teddington, Middlesex, from November 24 to 27. Admission is by invitation.

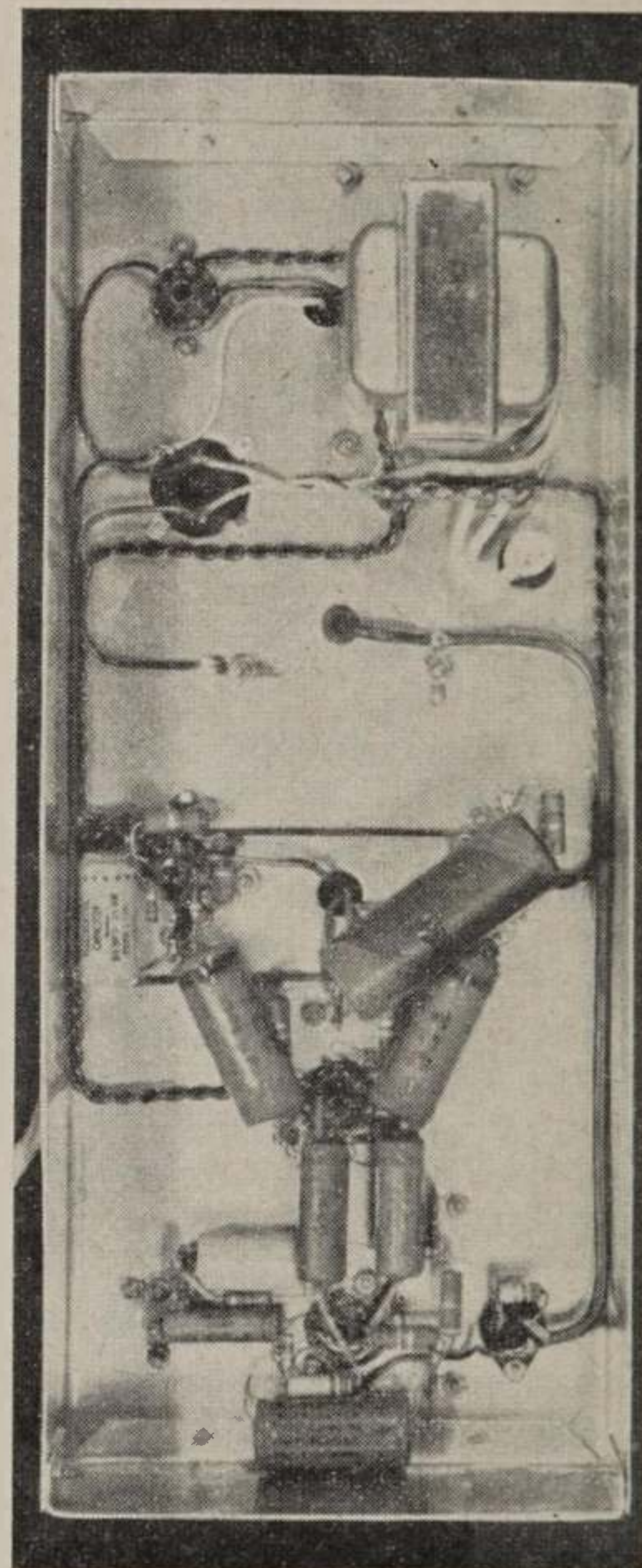
Information about the exhibition and business symposium is obtainable from the exhibition organiser, 11/13 Dowgate Hill, London, E.C.4. Details of the symposium papers and registration fees will be made known shortly.

A RECORDER-GRAM CIRCUIT FOR AMATEUR CONSTRUCTORS—Part 7

This month we continue the series on this equipment with what is essentially a pictorial description of the various chassis, as constructed in our laboratory.



View of the main chassis which holds the tuner, and all auxiliary circuits except the tape recording amplifier and the erase and bias supply, all of which are on the same small chassis which lies close to the tape deck itself. At the right is an under-chassis view of the main amplifier.



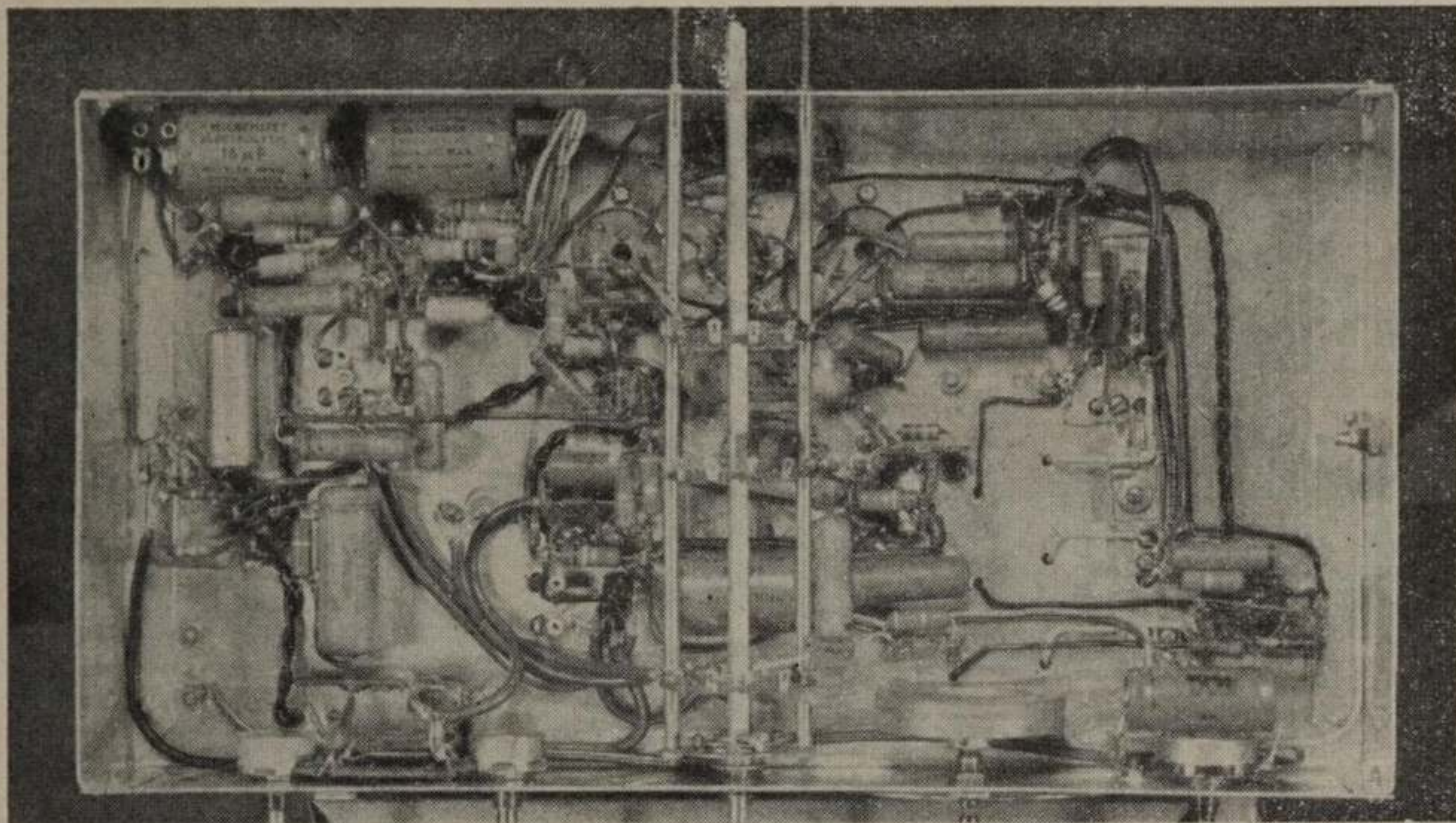
The biggest part by far of the constructional effort that goes into this recorder-gram is to be found in the main chassis, on which are the tuner, all the main controls, and the various pre-amplifiers associated with tape playback, recording from microphone, and with gramophone reproduction. The top chassis view is found above, and the underneath of the same chassis is on the next page. In an earlier instalment, we gave the chassis diagram for this unit, and also described the positions of the valves concerned with the various functions. The photo will enable that description to be visualized more readily, and should bring the drawings to life, as it were. The three tubes with the shields on are the R.F. amplifier, oscillator-mixer, and I.F. amplifier, respectively, the former being at the top right-hand corner in the picture, and the latter being between the two I.F. transformers. The two tubes in the lower left-hand corner of the chassis are those of the tape playback pre-amplifier. We have thus accounted for the complete row of valves along the back of the chassis as well as the R.F. amplifier, leaving only the three tubes in the middle of the chassis and the one near the upper left-hand corner in the photograph.

The latter is the microphone pre-amplifier. The tube just to the left of the gang condenser is the gramophone 'pick-up' pre-amplifier. The one just in front of the rectangular can near the middle of the chassis is the ECC82 which follows the tone control circuit, and which feeds the low-impedance volume control circuit.

The Relays

The two relays that form part of the system are to be seen in the photograph as the two rectangular cans with rounded corners. The left-hand one, close to the two tubes of the tape playback pre-amplifier, is the one which switches the compensation to suit either tape speed. The other is the relay which switches the output of the tape pre-amplifier to the tone control circuit automatically when either playback button of the tape deck is depressed.

These relays are miniature Post Office-type units mounting vertically, and with the shield cans remove-



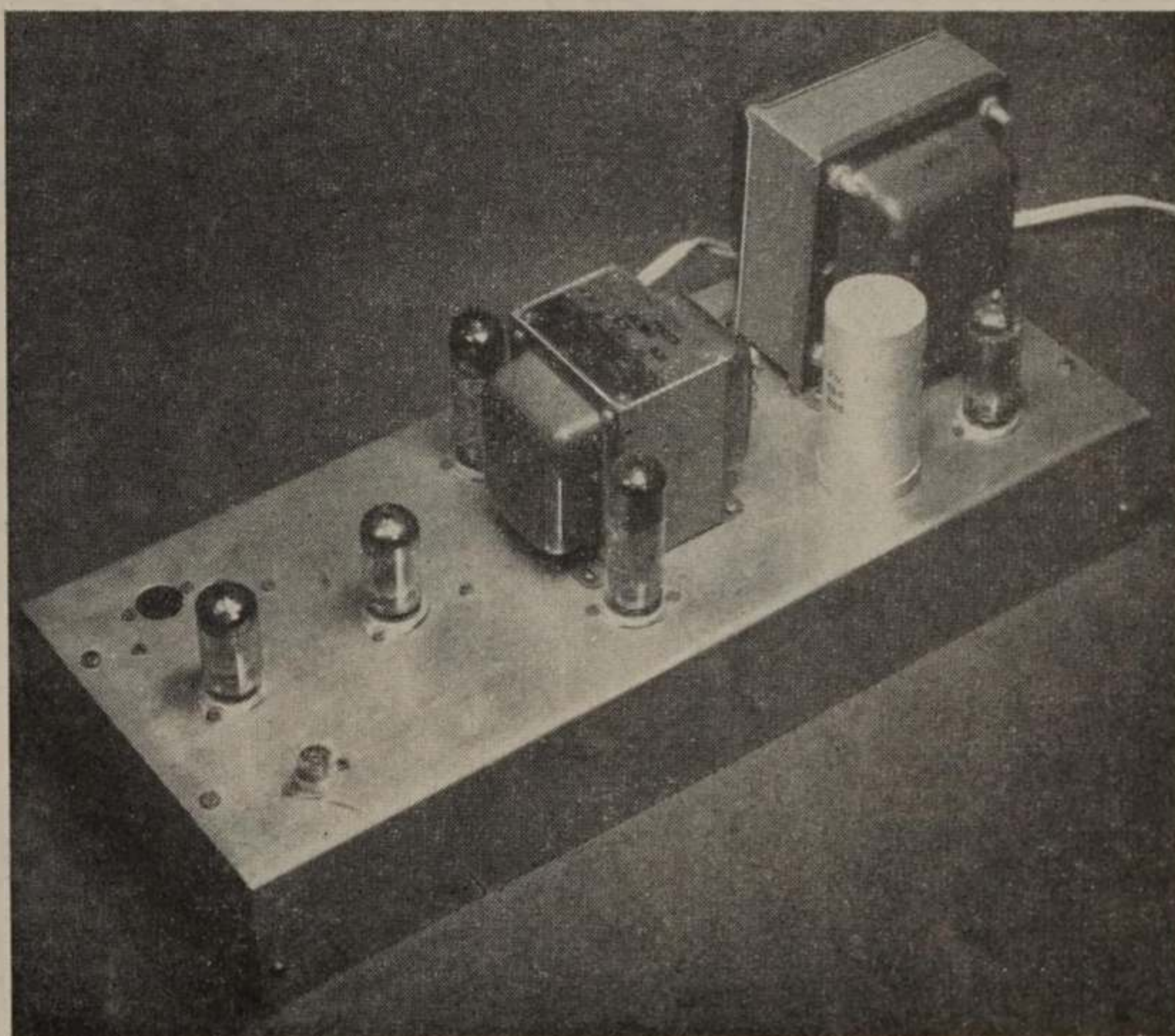
Underneath view of the main chassis. Below top-chassis view of the main amplifier.

able from above to enable cleaning and adjustment to be done in the rather remote eventuality that these should be necessary. Each has a coil of 10,000 ohms resistance, and two sets of change-over contacts. They will operate with a minimum coil current of about 6ma., and the series resistors through which they are operated from the 250-volt H.T. line give an actual operating current of about 8ma.

The relays used in our prototype were made by Magnetic Devices Ltd., which is a company in the Pye group, and they are available from the Wellington office of Pye (N.Z.) Ltd. However, there is nothing to prevent the builder from using any alternative relays that he may have available. There may well be suitable Post Office relays available from war surplus sources which would do the job equally well.

Underneath the Main Chassis

Reference to the underneath view of this chassis shows that although there is a good deal of circuitry tucked away there, there is ample room available for it. In the upper left-hand corner of the photo are the two tubes of the tape playback pre-amplifier, and next to them, the bases of the I.F. transformers can readily be recognized. Between them, and directly under the switch shaft is the EBF80, while at the very back of the chassis, also under the switch, is a tag strip containing all the resistors and condensers associated with A.V.C. circuit. To the right again can be seen the crop of small parts associated with the oscillator-mixer stage.



The back wafer of the main switch carries the two sections which change the selectivity of the I.F. amplifier from Narrow to Broad. The middle wafer carries the switched condensers for the gramophone pre-amplifier, while the front one holds the two banks which select the appropriate output for feeding to the tone and volume control circuit, and which also arrange for the microphone pre-amplifier to have its output routed to the recording amplifier chassis.

Construction

Each section of the main chassis can be built as a separate entity, as was indeed done when the proto-

(Continued on page 36.)

ELECTRICAL AND TRADE SECTION

PHILIPS FACTORY IS FIRST IN N.Z. DESIGNED FOR TV



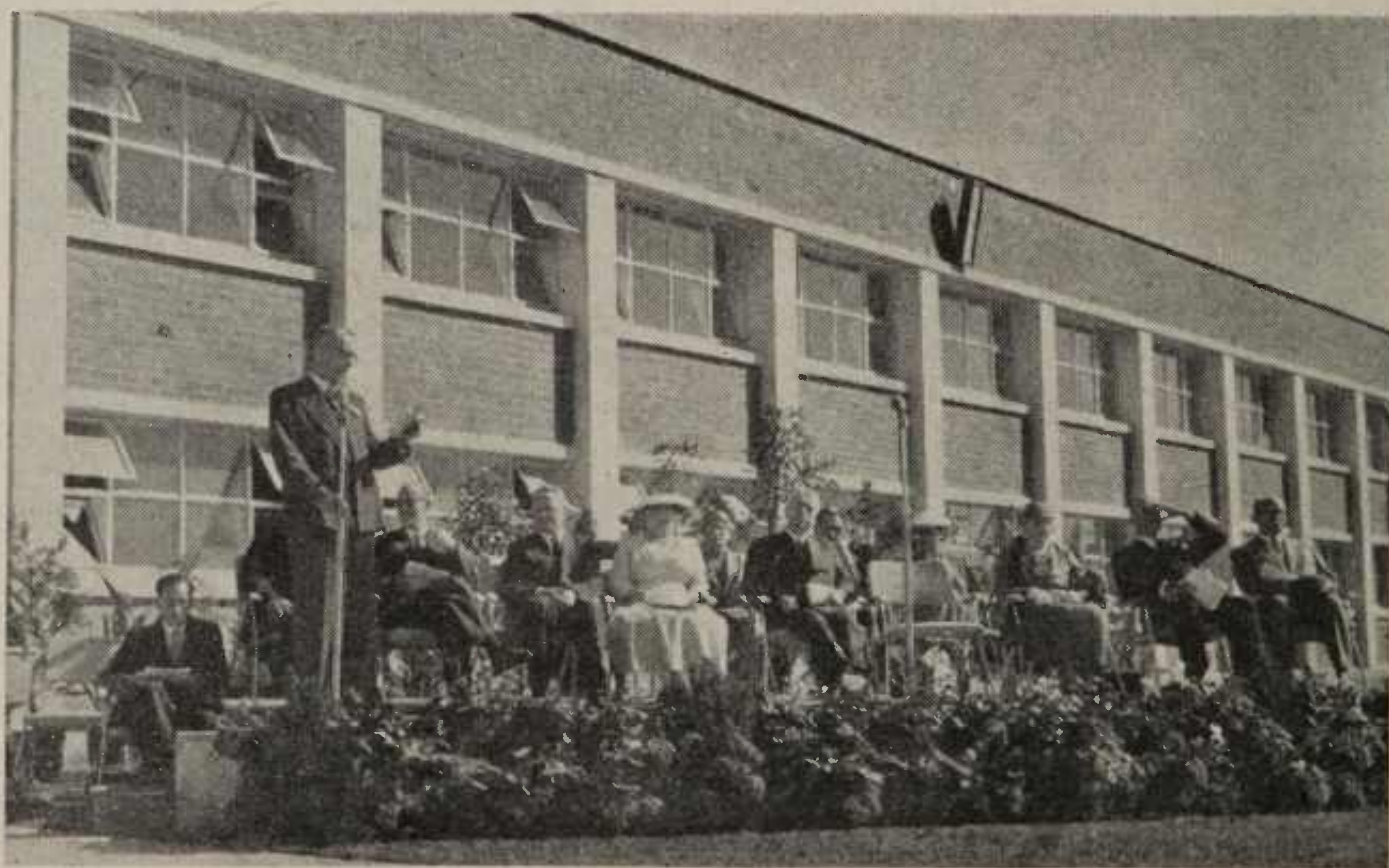
Left: A view of the Electronic Centre with a Hutt Valley pipe band in the foreground, entertaining guests before the official ceremony began.

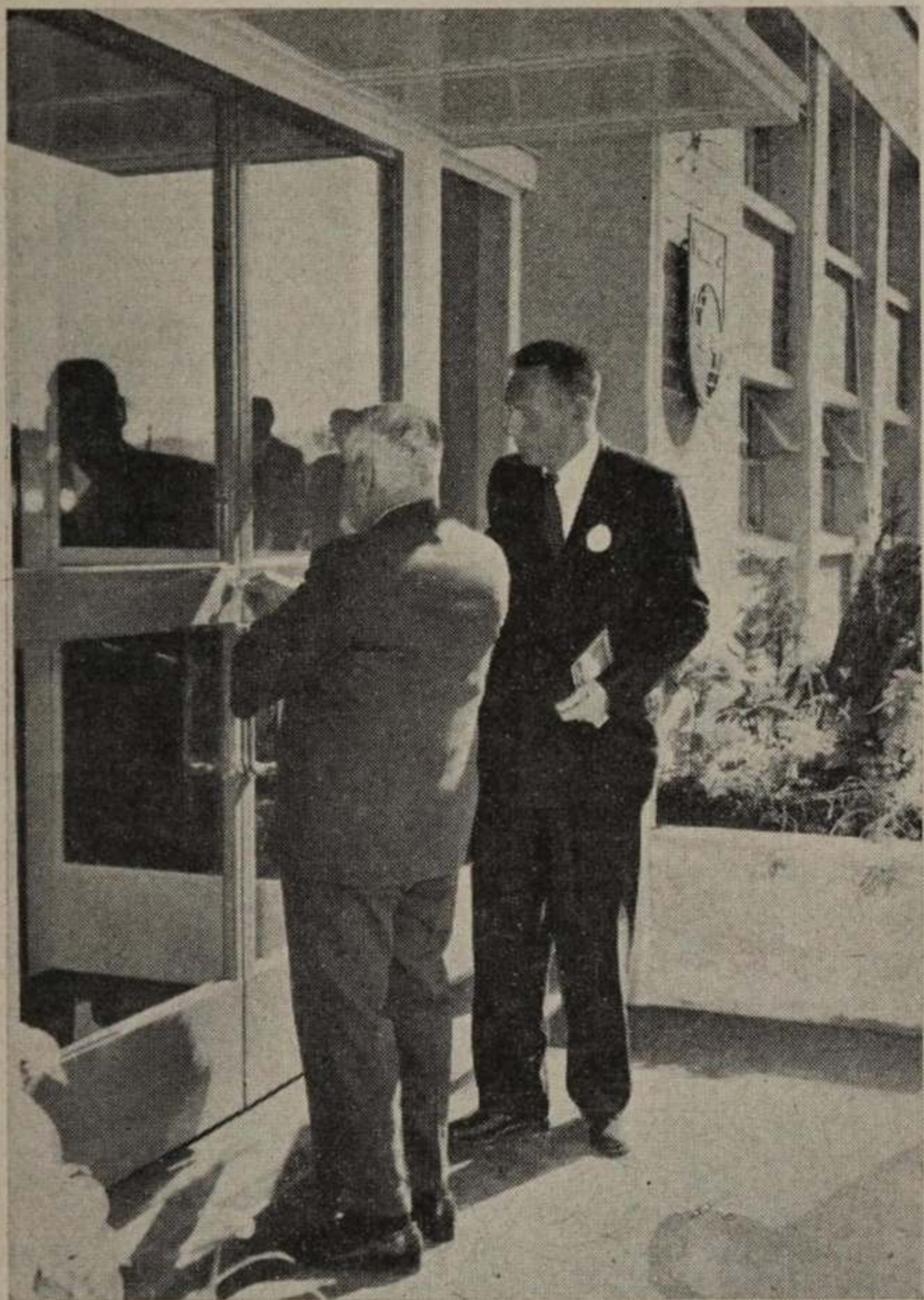
Below: The chairman of the board of Philips Electrical Industries of New Zealand Limited, Mr Leighton Lord, speaking at the opening of the new Philips Electronic Centre. On his left are Mr D. Noordhof, a director of the light group at Philips headquarters in Holland, the Minister of Industries and Commerce, Mr Holloway, the Mayoress of Lower Hutt, Mrs P. Dowse, the Prime Minister, Mr Nash, Mrs Nash, the Leader of the Opposition, Mr Holyoake, and the Netherlands Minister, Mr B. A. Piets.

New Zealand's first factory planned with the manufacture of commercial television sets definitely in mind—the Philips Electronic Centre at Naenae, Lower Hutt—was opened by the Prime Minister, Mr Nash, on April 12.

The factory can switch over to producing television sets just as soon as Government permission is granted.

Another feature about the factory is that it houses the finest commercial research laboratory in New Zealand. Scientists will be constantly engaged in adapting equipment to New Zealand conditions and experimenting with television, radio, and other electrical apparatus.





Philips Electronic Centre being officially opened by the Prime Minister, Mr Nash, with a souvenir silver key which was presented to him. With Mr Nash is the managing director of Philips, Mr Dirk Hudig.

Backing the laboratory work will be the research by 11,000 scientists at the Philips headquarters in Holland.

Room for Expansion

The factory covers an area of 44,000 square feet, but can be expanded to three times that size. It is set in attractive surroundings and is to be laid out in lawns and gardens.

All the working rooms are designed with the windows extending down close to floor level. Other lighting and colour schemes have been specially designed to give maximum visual lighting to employees.

Philips opened its first New Zealand office in 1926. Before then, Philips products, particularly lamps and lighting equipment, had been shipped direct from Philips overseas factories to wholesale distributing agents. The first Philips sets were imported into New Zealand.

First Production Line

By 1931 the total number of radio sets in the country had grown from a mere 3,600 in 1926 to 62,700. The depression years provided only a temporary



The Prime Minister, Mr Nash, watching a radiogram being assembled at the new Philips Electronic Centre, after he had opened the centre. With him are Mrs Nash, Mr D. Hudig, managing director of Philips, Mr Hollaway, Minister of Industries and Commerce, and Mr B. A. Piets, Netherlands Minister.

setback. In 1935 Philips took over a building in Blair Street, Wellington, and with six men began operating its first New Zealand production line. Since 1938 all the Philips receivers sold in New Zealand have been manufactured here.

The company's output grew rapidly until war intervened and the entire Philips production switched over to war work. The company had to find a larger factory to cope with the urgent work, so it took over 18,000 square feet on the two top floors of Austin House, Wakefield Street, Wellington, where production continued until last year, when the building became Philips New Zealand head office.

Reduce Cost of Living

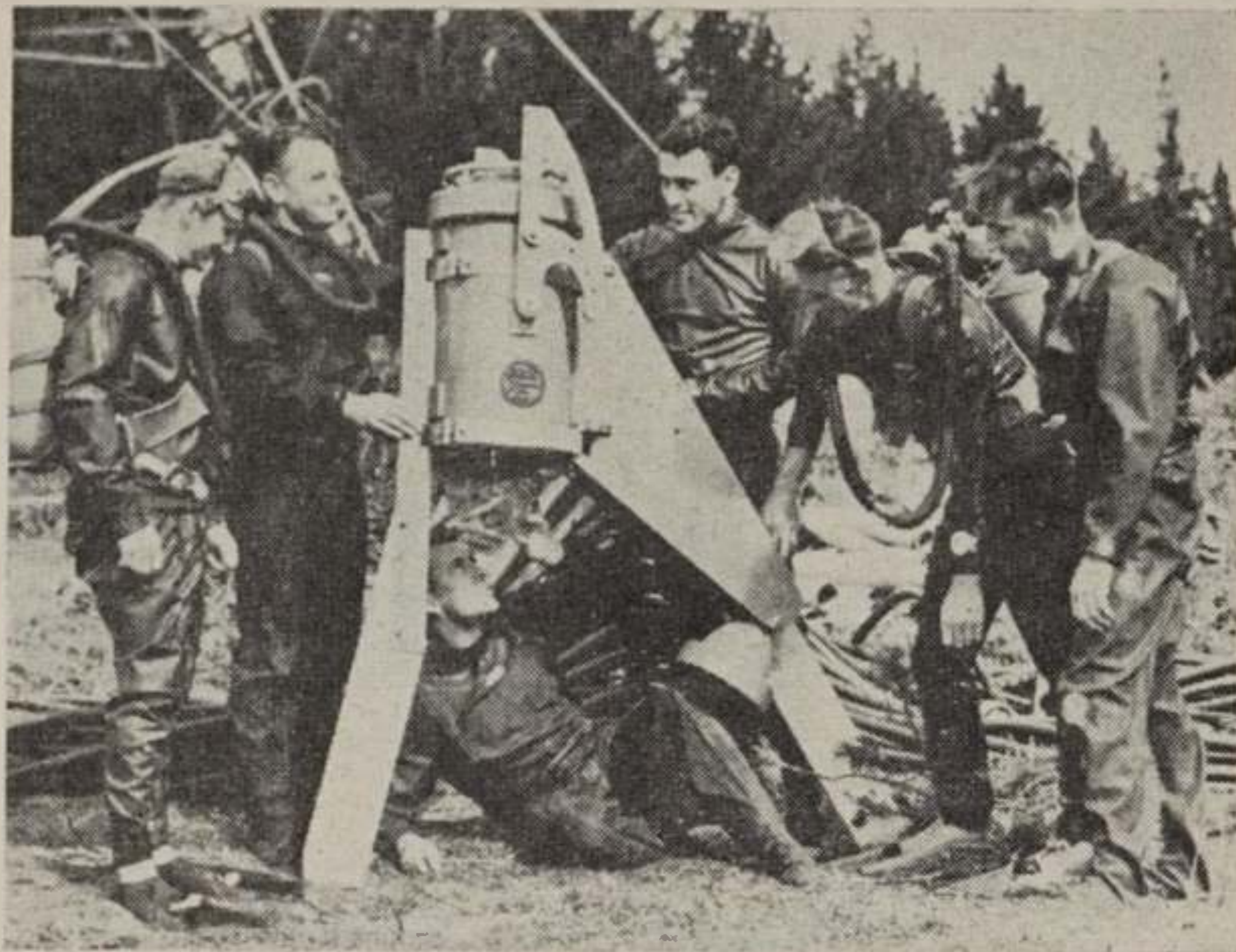
Speaking at the opening ceremony, which more than 1,000 people attended, the chairman of the board of Philips Electrical Industries of New Zealand Limited, Mr Leighton Lord, said that one of the aims of the electronic centre was to reduce the cost to the public of the company's products. "We feel sure that the factory will help to reduce the cost of living by lowering the cost of electrical equipment needed in the home," he said. "With the equipment in our laboratory, we hope that New Zealanders will have all the benefits which can be given to them in this electronic age."

Congratulations from the Philips headquarters in Holland to the New Zealand company were received in a recorded speech by Mr T. P. Tromp, a member of the board of management. He assured the New Zealand company that it would always receive the assistance of the vast research laboratories at Eindhoven, Holland.

"Our research laboratories, developing and engineering sections, our factories and our staff can always be used for the development of the great New Zealand enterprise," he said.

TRADE WINDS

Engineers Use Pye—and Stay Dry



Frog-men examine the Pye underwater TV camera with which they worked.

A product of Pye television craftsmanship recently enabled New Zealand engineers to carry out a complex underwater examination without getting wet. They sat in a hut watching a screen while a diver manoeuvred a Pye television camera 25 feet below the surface of the water in the Arapuni Power Station headrace. On a special viewing screen they were able to inspect damage to the headrace without donning a diving suit.

After a large volume of water had passed through the headrace during recent floods, leaks became apparent. At first, the water was so discoloured that skin-divers had to investigate the damage, and then repair it, by touch alone.

When the water was clearer an urgent call went out and the Navy answered with the loan of their Pye underwater television camera. As the apparatus was manoeuvred 25 feet below the surface by Mr J. Michleson, an Arapuni suit-diver, engineers examined the damage from the comfort of a nearby hut. Photographs for study, and as a record, were taken from the screen at the same time.

It may be remembered that the first Pye underwater TV camera was developed for, and successful in finding, the Comet aircraft that crashed into the sea off Italy.

* * *

Staff Doings at Philips

Ted Rogers has assumed the position of article chief valves, taking over from Mr Duerden, who has left the firm and is now residing in Auckland.

Mr Norm Williams has been promoted to manager of our Christchurch branch and his successor as Dunedin branch manager is Mr Laurie Fair, formerly of records sales promotion, Wellington.

Mr Lord, our chairman of directors, is on six months' leave overseas. While on the continent and

other countries he will be visiting, Mr Lord will be looking after the interests of Philips (N.Z.).

Also on leave is Mr Groeneveld, our financial manager, who is attending to the financial interests of Philips (N.Z.) in the countries he will be visiting.

Mr Leary, our chief accountant will assume Mr Groeneveld's responsibilities while he is away.

Mr Gregg, manager, medical apparatus, will shortly be going overseas to attend the Philip's International X-Ray Conference, which is to be held in Eindhoven. While away, Mr Gregg will visit relating factories in Hamburg, London, and New York.

Shortly, we will be taking over the first floor of our new buildings in Wakefield Street (this floor is at present occupied by *Truth* (N.Z.) Ltd. This will mean that when this floor is occupied by our stores warehouse, at present located in Newtown, all our Wellington and head office departments will be collected under one roof in "Philips House".

* * *

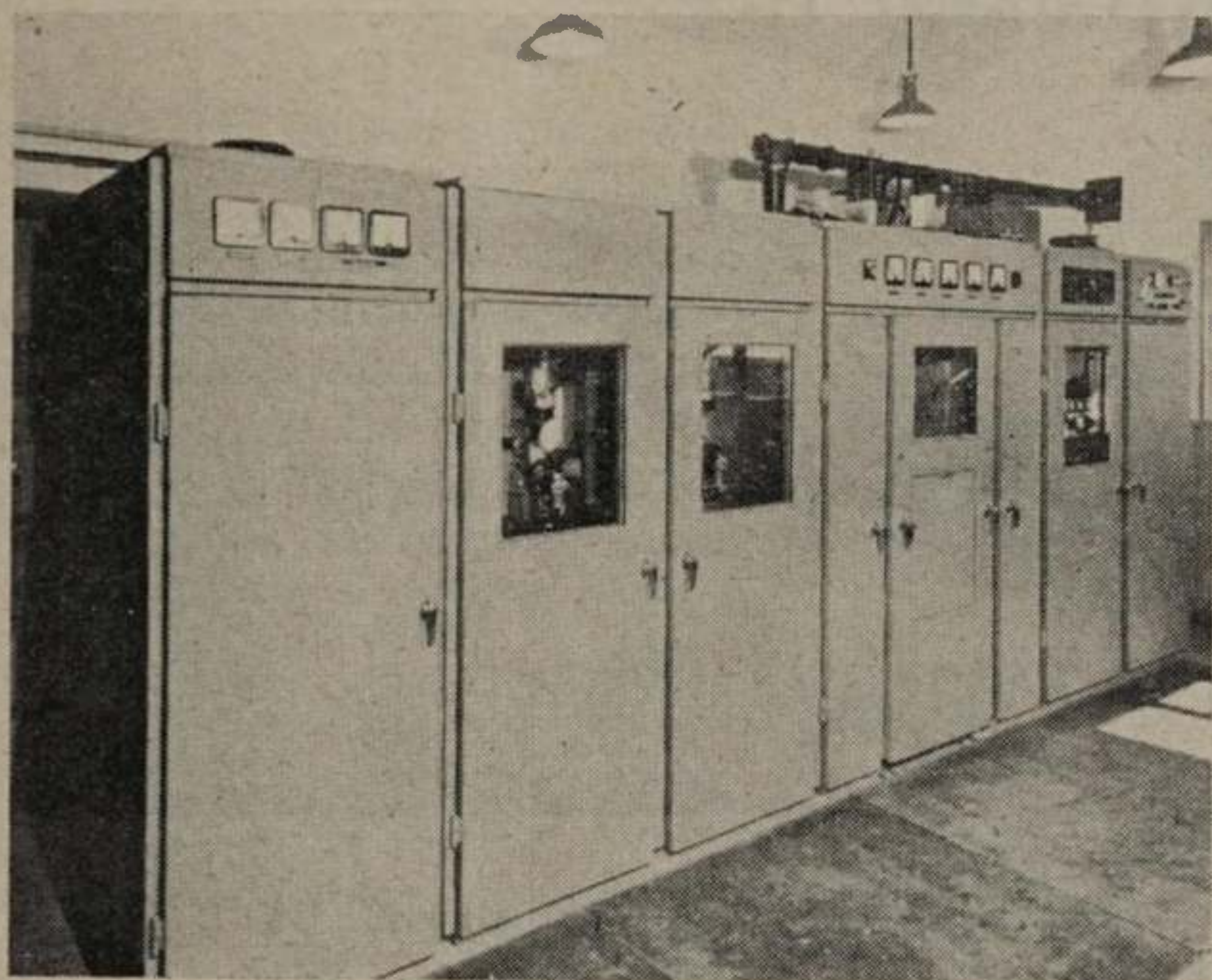
NEW TROPOSPHERIC SCATTER LINK



The vast parabolic reflector aerial used with the link.

For some years Marconi engineers have been carrying out experimental work using tropospheric scatter propagation and for the past two years have had in use an experimental system between Bromley in Essex and Catterick in Yorkshire. This experimental system has been used mainly for analysis of the transmission characteristics and to provide data for systems planning.

In parallel with this work, a range of tropospheric scatter transmitting and receiving equipment has been



Some of the racks of radio equipment required by the link

designed and is now being put into production in the Chelmsford factory. The first production units have now been assembled as a multi-channel radio link between Start Point, Devon, and Galleywood, Essex, a distance of just over 200 miles. The link, which works on a frequency of 858 Mc/s and has an initial capacity of 24 telephone channels, is single way with the transmitter situated at Start Point and the receiver at Galleywood. As at present manufactured the equipment is designed for a maximum of 60 simultaneous telephone channels, but features are provided which will subsequently permit experimental wide-band transmissions with a view to carrying a much greater number of channels. Later, television pictures are also to be transmitted over the link to ascertain whether an acceptable standard of quality can be realized.

The Start Point transmitter employs a water-cooled four-cavity Klystron developing an output power of 10 kW. The associated aerial system, a 30 ft. diameter paraboloid "dish" excited by a horn radiator, is mounted with its centre 35 ft. above ground level. This aerial system has a gain of 36 dB over a dipole at the chosen frequency (858 Mc/s) and thus provides an effective radiated power in the direction of maximum intensity which is of the order of 40 megawatts.

The receiving equipment at Galleywood is of the dual diversity type, employing two dish aerials each of 30 ft. diameter and spaced 100 ft. apart. This method, it has been found by previous experience, does much to counteract the rapid fading of the signals which is a characteristic of tropospheric scatter working.

Multi-channel tropospheric scatter links can satisfactorily provide a point-to-point transmission of signals over distances of 200 miles or more as compared with the 40-mile average of direct-beam systems.

MISSING AND STOLEN RADIOS

Auckland:

Pacemaker car radio. Grey enamel case with chromed front. Serial number 46461. Five-valve set with one transistor. Value £22 10s. 0d.

Autocrat six-valve, twelve-volt car radio. Grey colour. Bakelite face. Serial number not known. Value £22.

Ultimate Troubador portable radio. Ivory plastic cabinet. Serial number 193147.

Pye portable radio. Battery operated. Wooden case covered with light grey fabric with blue band around the middle. Model 114 BQ. A small blue ink mark on top right-hand corner of lid. Serial number not known. Value £12 10s. 0d.

Christchurch:

Clipper car radio. Model 4 C.R.7. 6 volt, 4 valves. Consists of two separate units, speaker and dial. Value £18 18s. 0d.

Personal model Clipper battery portable radio. Cream colour. 4 valve. Light brown leather bag container. Value £18 18s. 0d.

Ford car radio. 5 valve. Iridescent brown colour. Manual control. Separate speaker. Serial number 25607. Value £24.

Autocrat transistorized car radio. 12 volt. Complete with speaker unit. Push-button type. Serial number 43738. Value £40.

Feilding:

Claremont car radio. 7 valve. Grey metal case. Serial number not known. Rust behind dial. Value £35.

Hamilton:

Autocrat transistor car radio. Light mottled grey colour. Push-button control. Model HH/T.P.L. Serial number 45986. Value £27 17s. 1d.

Bell mantel radio. Green plastic. New condition. Serial number 50543.

Aerial car radio. Eight valve. Painted aluminium grey. Almost new condition. Serial number 6V/5857.

Hastings:

Columbus electric portable. Brown bakelite case. Station dial flush with top. Carrying handle on top. Serial number 65856. Identifiable by Serial number 65856. Value £15.

Nelson:

Clipper battery and electric radio. Light blue plastic cabinet. Name "Clipper" across the handle. Serial number 73444. Value £24.

New Plymouth:

Clipper portable radio. Blue plastic cover with grey coloured ends. Black handle on top. Wire speaker grille in front separated from dials by chrome strip. Serial number not known. Value £32 10s. 0d.

Oamaru:

Phillips electric battery set portable radio. Six valve. Model 546. Dark red bakelite case. Serial number not known.

Opunake:

H.M.V. car radio. Five valve. Model 524. Serial number 303444. Value £40.

Rotorua:

Autocrat car radio. Single unit model. Five valve. Serial number 46778.

Temuka:

Clipper car radio. Five valve. Black face, gold figures. Paint chipped off inside of dial. Serial number 93984. Value £26.

RADIO ROUNDABOUT

Latest transistors released in New Zealand by R.C.A. include five new drift transistors for R.F. applications. Outstanding among them is the 2N384, with an alpha cut-off frequency of 100 mc/sec., and a frequency for unity amplifications of 250 mc/sec. Needless to say, this type is not a cheap one; it retails at £14 8s. 0d., according to the price list supplied this journal by Messrs A.W.A. Ltd., who are the local agents and distributors.

In contrast to this highly specialized type, the list of fifteen types includes some retailing at less than 30/-. Most of the drift transistors, which undoubtedly have the best radio frequency performance of any available here today, retail at £3 2s. 1d. Trade prices are, of course, considerably less. Even so, there is no need now for those experimenters who wish to carry out practical work with R.F. transistors to go without them.

Many of these new types replace previously issued R.C.A. transistors, but as yet we have no indication of what will be the relative supply positions of the older and newer types respectively. Below, for reference purposes, is a complete list of the new series of transistors.

<i>Type</i>	<i>Basing</i>	<i>Description</i>
2N405 2N406	3 Pin Leads	Class A audio frequency driver service.
2N407 2N408	3 Pin Leads	Intended for Class A and B audio service. Replaces 2N109, 2N217 respectively.
2N409 2N410	3 Pin Leads	For 455 Kc. I.F. amplifier service. Replaces 2N139 and 2N218 respectively.
2N411 2N412	3 Pin Leads	Especially designed for converter and mixer oscillator applications. Replaces 2N140 2N219 respectively.
2N274	Leads	Drift transistor for R.F. amplifier service.
2N370	Leads	Drift transistor intended for R.F. amplifier operation.
2N371	Leads	Drift transistor intended for oscillator service.
2N372	Leads	Drift transistor for mixer service.
2N384	Leads	Drift transistor for V.H.F. applications frequency for unity

power amplification 250 Mc alpha
cut-off, 100 Mc.

2N398	Leads	Junction transistor for high voltage "on/off" control applications.
2N404	Leads	For medium speed switching applications.

❁ ❁ ❁

Two-billionth Tube Produced by R.C.A.

In January of this year R.C.A.'s two billionth electron tube came off the line at the company's plant at Harrison, New Jersey. It was a travelling-wave type designed for the armed services' latest equipment. Mr John L. Burns, R.C.A.'s president, said in announcing this milestone in the firm's progress that in twenty-eight years of valve manufacture, R.C.A. had made enough receiving tubes and picture tubes to equip 17½ million TV sets and 300 million radio sets. The remainder of the total is made up of industrial tubes, power tubes, television camera tubes, oscilloscope tubes, and tubes for microwave equipment.

✻ ✻ ✻

Ferrite-Duplexer Switch

Specified for handling 300 kw peak power and 300 watt average power in the frequency range 8.5 to 9.6 kmc, the new Model XL447 Cascade Ferrite Duplexer-Switch performs the function of switching between two waveguide outputs from a single input. In this application it eliminates the need for moving parts in waveguide switching for radar applications, for example. In another use, the Model XL447 is applicable as a high-power current-controlled modulator.

In its use as a duplexer switch, the unit directs microwave energy to one or another of two antennas when current is reversed in the coil of the electromagnet.

With this arrangement, the need for a power-absorbing isolator is eliminated, because antenna reflections are always directed to the receiver t-r tube.

Giving a 20 db isolation between outputs, the XL447 has an insertion loss of 0.5 db, and an input vswr of 1.2. Switching time is 4 milliseconds. Standard coil specifications are 1.0 amp at 28 volts d-c, but coil parameters can be established to meet individual requirements. Waveguide is RG-51/U.

TV ROUND THE GLOBE

Austria

The first experimental television transmission in Austria took place on the 1st August, 1955, via a small transmitter erected atop the Lichtenberg near Linz. For the purpose, a school served as improvised studio building; a class-room was converted into a small studio, the gymnasium was made into a small theatre, while the interviews and talks were recorded in the corridors of the building.

The reason for this rather difficult start was a lack of capital. All costs had to be paid out of a small government allowance. As opposed to most other West European countries, the Austrian TV service was wholly independent from the national radio service, so that no financial support came from that side. This situation still persists today, although the financial strain was somewhat relieved when television started officially on January 1st, 1957, and a registration fee of Sch.600 a year became obligatory. However, the number of licensees being small, there still are financial difficulties which force the Austrian TV service to fill half its programme with relays—mainly from Germany—and with films. Nevertheless, transmission time more than doubled since television first started in Austria.

Development of the Network

A condition set by the Government for the official start of television was that 50% of the population would be within reach of it. Besides the transmitter at Linz, three more were operating at the beginning of 1957; they were erected in Graz, Salzburg, and Vienna. In the course of the same year, four more became ready, e.g., Sonnenstein, Klagenfurt, Baden, and Schladming, so it can be said that the Austrian TV network developed rapidly. It is hoped that in 1958 the western part of the country—part of which can only receive the German programmes—will also be covered so that from 80+ to 90% of the Austrian population will then be within reach of television.

* * *

Canada

Three Million TV Sets Sold

End of January, 1958, the Canadian television industry produced and sold its three millionth TV receiver. This achievement has been accomplished in about nine years in spite of the fact that Canadian television stations have been operating for slightly more than five years.

In 1949, when television production began in limited amounts in Canada, reception was limited to locations near the international border where programmes originating in the United States could be received. Now, with 40 Canadian television stations and 3,000,000 television sets, approximately 80% of the population

is within range and about 72% of wired households have sets.

Even with 3,000,000 TV sets sold, there are still about a half-million wired homes, within programme range, which have yet to buy their initial sets, and the replacement market in 1958 is expected to increase, as a number of the older sets have become obsolete in the face of the technological improvements made over the past five years.

Television buyers nowadays are in a fortunate position. In 1951, the average selling-price of the 21 in. screen model was \$523; the same model but greatly improved, both technically and in style, at the end of 1957 was priced below \$300—a reduction of more than 40%.

* * *

United Kingdom

TV Set Sales Drive by Pye

A scheme designed to increase sales of its 21 in. TV receivers is being installed by Pye, of Cambridge.

Pye says a sample analysis shows that some 40,000 owners of the company's V4 and VT4 14 in. TV models are considering buying larger screen sets but many are discouraged because of the low trading values, £5 and £8 respectively, of their present sets.

Dealers who adopt the scheme will, for a limited period, offer £12 10s. Od. for a V4 and £17 10s. Od. for a VT4 to owners who buy a 21 in. Pye model.

The old sets will be returned to Pye, which is to run a factory refurbishing line to bring them up to standard specification and performance for all B.B.C. and I.T.A. stations. The refurbishing charge, including purchase tax, to dealers will be £12 10s. Od. for VT4 and £17 10s. Od. for a V4. The renovated sets will carry a standard manufacturer's guarantee.

Third Television Network?

The rapidity of expansion of the first I.T.A. network brought the second service "very close", delegates to a weekend course on television advertising were told by Sir Robert Fraser—I.T.A.'s director-general.

Outlining the future of I.T.A., Sir Robert Fraser said: "We hope that 1960 will see the virtual completion of the first I.T.A. network. Our stations for 1959 are East Anglia (we hope, at Mendlesham), South-East England, Northern Island (where the station will be at Black Mountain) and, I hope, the Carlisle area. This will give us a coverage of about 94% of the population.

"Two sizeable service areas will be added in 1960—North-East Scotland and South-West England. By this time we shall have examined, and where possible,

(Concluded on page 36.)



John Gray

JOHN GRAY'S RECORD PAGE

RECORD OF THE MONTH

'Espana!'—comprising Capriccio Espagnol (Rimsky-Korsakoff); Spanish Dance No. 5 (Granados); Espana Rhapsody (Chabier); Spanish Dances, Book 1 (Moszkowski). London Symphony Orchestra conducted by Ataulfo Argenta. Decca LXTM 5333 (12-inch L.P.).

RECORD OF THE MONTH

The overall title is misleading in more ways than one, for only a single item, and that the shortest, is actually by a Spanish composer—it is, of course, the haunting Granados dance, better known as "Playera" or "Andaluzia". For the rest, we are reminded of the old jibe that the best "Spanish" music is by the composers of other nationalities, a saying with a grain of truth, for one has only to think of the evocative power of the pieces of Chabrier and Rimsky Korsakoff, not to mention Ravel's "Rapsodie Espagnole" and the more obviously "Spanish" parts of Bizet's "Carmen". This then is a disc which should enjoy wide sales and deserves them. Decca have rarely captured such brilliant orchestral sound and the local pressing of it is a fine job of work. The performances, under a noted Spanish conductor, whose death, at the age of 44, occurred with distressing suddenness in Madrid only a few months ago, are of the highest order. Perhaps the most interesting item is the suite of dances by Moszkowski, a Polish-German composer and pianist whose music once had an enormous vogue but who nevertheless died in poverty in 1925. Now only these Spanish Dances keep his name alive. This is their first appearance on L.P. and they are decidedly welcome, for they are both gracious and spirited, and expertly orchestrated. What a real Spaniard would think of them is beside the point—this conductor does them as handsomely as anything else on the record.

Fresh pressings of two R.C.A. discs serve to draw attention to something worth the attention of people of all shades of musical taste and all heights of brow. One is LM 2054, a record of **CLASSICS FROM R.C.A.** highlights from "Madam Butterfly", an intriguing release, since it does appear to be excerpted from a complete recording which never materialized as such. Licia Albanese and Jan Peerce have the leading roles with Italians in the supporting parts, and the orchestra and conductor (the Rome Opera under Vincenzo Bellezza) are the same throughout the generous compass of the record, which manages to include all the expected highlights and an unexpected bonus in the shape of the so-called "Letter Duet" between Butterfly and Sharpless in the second act. This is an important release because Licia Albanese, who may not be as much in the limelight these days as are one or two of the more spectacular prime donne of the headlines, is undoubtedly one of the great "Puccini" sopranos of our time, and she has rarely sounded so affecting as she does here. Her "One Fine Day" and the death scene are extraordinarily moving, in fact she emerges as possibly the best Butterfly on records since the (to me) incomparable Toti dal Monte. Nobody would claim that the brassy tones of Jan Peerce are particularly beguiling, but they seem right for the

character of Pinkerton and, whatever his voice is like, Peerce is a splendid singer in the full-blooded manner of today. The remainder of the cast give good support, so do the orchestra and chorus. The recording is low-level in some instances but there are obvious ways of correcting that—the whole disc is cordially recommended to those who are content with a one-record condensation of an opera.

The other R.C.A. release (LM 2097) couples Artur Schnabel's performances of Grieg's Concerto and Rachmaninoff's Rhapsody on a theme by Paganini. He has recorded both before but these are brand-new versions, and it would be difficult to find others that are more satisfying in the long run. The Rachmaninoff, which is played with brilliant backing by the Chicago Symphony under Fritz Reiner, is the piece which was catapulted to popular fame through the "Story of Three Loves" film, which made use of the most luscious passage in the work. Rachmaninoff wrote it only as long ago as 1934 and it is, in fact, the most recent work for piano and orchestra to achieve world-wide acclaim, in the sense that it is being continually played almost everywhere. Grieg's Concerto, now well over half a century old, was famous from the very beginning, and it is now represented by more recorded versions than most of us would care to calculate. Rubinstein's performance is in the grand manner and the orchestral playing under Alfred Wallenstein does everything possible for it.

"Pat Boone Sings Irving Berlin", declares the cover of a new London L.P. (HAM-D 6009) and there is a testi-

MORE FROM PAT—
AND OTHERS

monial from Mr Berlin himself to assure us of the treat in store. We listen contentedly through "All Alone", "How Deep is the Ocean", perhaps also "Say it with Music", before we realize with mounting boredom that the style and tempo are not going to vary one iota throughout the length of quite a long record. After half a dozen items we would give anything to hear something belted out in the manner of Sinatra's "Swingin' Lovers" or even (dare I say it and survive?) Elvis Presley's "Teddy Bear". But those who like "sweet music" will have no cause for complaint.

For a song with a swing, we turn to something as different as is chalk from cheese—Vanguard's magnificent disc of "German University Songs" as rendered by baritone Erich Kunz with the Vienna Volksoper male chorus and orchestra (PVL 7042). Students being the same the world over, it goes without saying that no one need be intimidated by the title of this record. The sub-title, "Songs of wenching, wining, and other irreverent pastimes", clinches the matter in no uncertain way. Some are traditional melodies known the world over, others will be new to non-Germans, but all are done with a full-blooded heartiness which is well nigh irresistible. The cover carries the full texts and translations, and all we do now is hope

“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 MAY 17, 1958

Title	Artist	Position last week	Record Make
1 All I Have to do is Dream	Everley Brothers	1	Cadence
2 Witch Doctor	David Seville	2	Liberty
3 Twilight Time	Platters	3	Mercury
4 He’s Got the Whole World in His Hands Laurie London	Laurie London	4	Columbia
5 Wear My Ring Round Your Neck Elvis Presley	Elvis Presley	5	Capitol
6 Return to Me	Dean Martin	7	Victory
7 Chanson d’Amour	Art and Dotty Todd	6	Capitol
8 Kewpie Doll	Perry Como	8	Victory
9 Big Man	Four Preps	12	Capitol
10 Looking Back	Nat King Cole	9	Capitol
11 Sugar Moon	Pat Boone	11	Dot
12 Secretly	Jimmie Rodgers	17	Roulette
13 Book of Love	Monatones	10	Argo
14 Johnny B Goode	Chuck Berry	15	Chess
15 Oh, Lonesome Me	Don Gibson	14	Victory
16 Tequila	Champs	13	Challenge
17 For Your Love	Ed Townsend	21	Capitol
18 Catch a Falling Star	Perry Como	19	Victory
19 Do You Want to Dance?	Bobby Freeman	—	Josie
20 You	Aquatones	—	Fargo

that the second disc has arrived before the shut-down on imports and is ready for release. Another singer with a following is Deanna Durbin. A record released some months ago is said to have caught on so well that a further sample (Festival FR12-1663) is now offered to the public. She was a good little singer as film stars go, and her pictures, in the late thirties and early forties, charmed us all. How they would appear today is an interesting question (I understand at least one is being re-released); as interesting, indeed, as the fantastic suggestion by a newspaper correspondent that a diet of Deanna would be good for our bodgies and widgies! Another old-timer from Festival’s stable is the enduring Al Jolson (FR 12-1588). He is not my favourite but may well be yours; at any rate this new release has a number of his standard items, in one or two of which he is joined by Bing Crosby and the Mills Brothers.

After a lull in the appearance of Mozart piano concertos, it is refreshing to welcome the arrival of two more, this time on a superlative disc by Rudolf

NEW PIANO RECORDS Serkin (Coronet KLC 621). This was one of the crop produced to mark the 1956 bi-centenary and its arrival is all the more welcome for being delayed: this magnificent pianist plays in a bold, full-blooded, romantic manner far removed from the style of some who would remind us of the thin-toned instruments of Mozart’s day. Whether or not it is correct is beside the point. The works are the C major (K 467) and the last one of all, in B flat (K 595). The former is adorned with a nocturne-like slow movement which is, in my opinion, more sheerly beautiful than any other Mozart wrote: the later concerto has, in its final movement, a theme which surely must have been

haunting Brahms when he wrote the finale of his own concerto in the same key. The Columbia Symphony Orchestra which plays on this record is, we are told, “Directed”, not conducted, by Alexander Schneider, for the reason that the noted violinist is here leading the orchestra with his bow.

The other piano record of outstanding interest is Richard Farrell’s of some works by Brahms (Pye CCL 30109). Rather surprisingly this is chosen as the first release here by one of our own most distinguished pianists, in place of his record of Grieg and Liszt concertos which would surely have had more appeal to the general public. His playing of the large-scale set of Variations on a theme by Handel is more deliberate and less immediately exciting than those of some other keyboard celebrities but it is deeply satisfying in the long run and in a way it is refreshing to have a younger pianist not primarily concerned with dazzling us by his brilliance. Very few of them have at any time an inclination to play really slowly. We have, for instance, heard more dashing performances of the little C major intermezzo and the tremendous E flat Rhapsody than those given here, but how often have we been able to hear all the notes so clearly? Make no mistake about it, this is a well-made and very satisfying record. I have not so far been able to hear the latest record by Lola Johnson (issued on H.M.V. MBLP 6006), but from what I have seen of the items as listed on the cover, it appears to be more interesting, musically, than her earlier one. It is intriguing that this player is apparently chosen, from the many worthy ones domiciled here, to receive H.M.V.’s red carpet and red label treatment. I do think, however, that the cover notes have rather much to say about Miss Johnson and not

(Continued on page 37.)

TV ROUND THE GLOBE

(Continued from page 33.)

be starting to fill in such gaps as may be left—certainly West Wales, probably Berwick, the Channel Islands, the Isle of Man, Inverness, and perhaps Londonberry."

Referring to the "third television service," Sir Robert said: "I think it is now clear that the pattern of television we ought to have in this country is four television services—but not four national services."

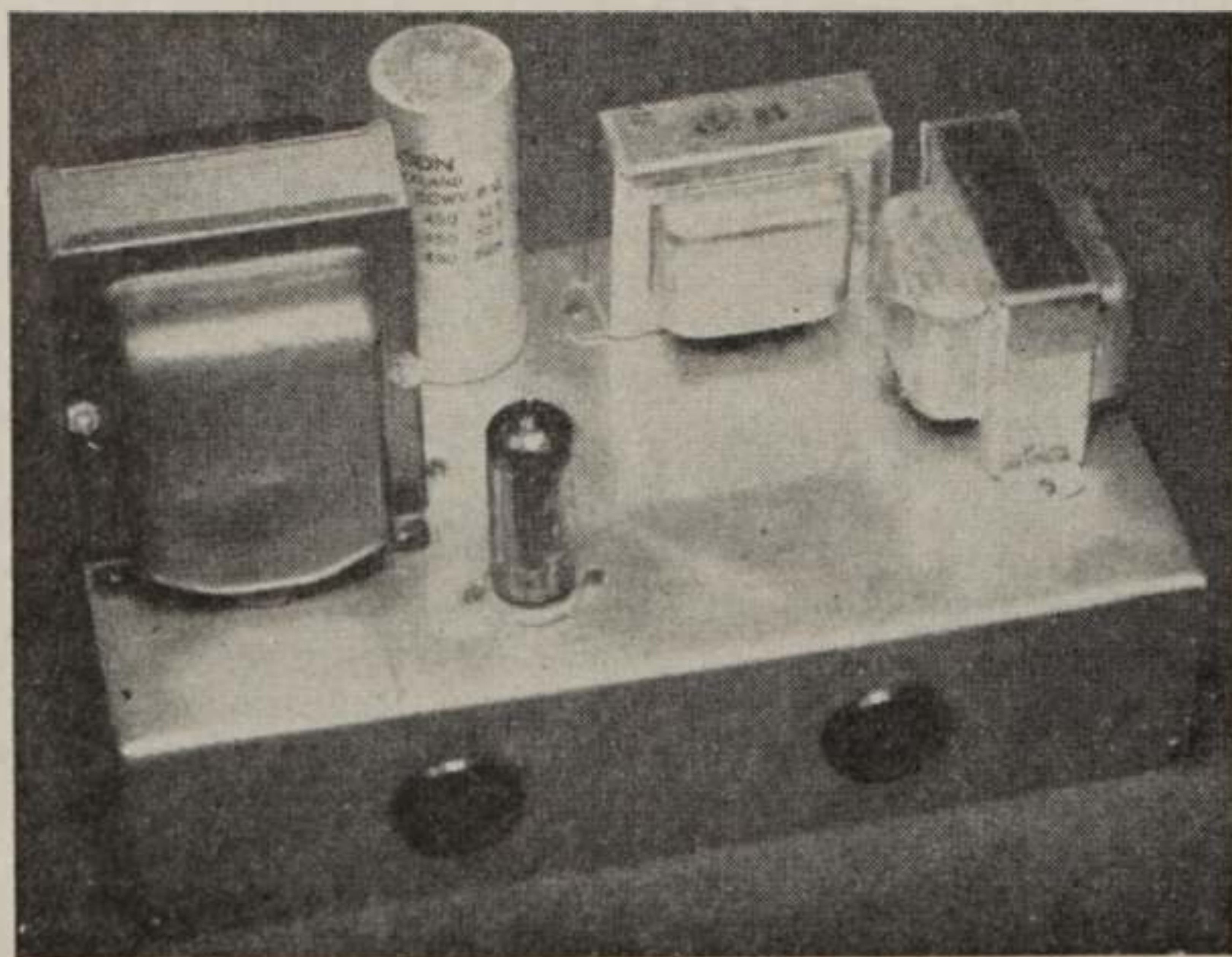
"I think we shall end up with three 'popular' services and in addition to them a very large-scale application of television to education. Alternatives for the third television network were: give it to the B.B.C., which I think the most unlikely; set up a competitive rival to the B.B.C. on B.B.C. lines; another I.T.A. service, either under the broad control of the I.T.A., or set up a second I.T.A."

Asked how a second I.T.A. network would be financed, Sir Robert replied: "I think the proportion of total British advertising expenditure is, in fact, sufficient to provide quite a reasonable margin to spare for two competitive nation-wide services."

A RECORDER-GRAM CIRCUIT

(Continued from page 27.)

type was being made. The somewhat piecemeal nature of the way in which the circuits have been presented in this series of articles at least has the virtue of emphasizing the fact. Indeed, provided the same number of valves was used, the same chassis design could be employed even though quite different circuits were used for the individual portions of the whole. A close examination of the under-chassis view will show that these portions have been wired as individual units, after which the appropriate input and output leads



View of the small power supply which provides H.T. for all tubes on the main chassis, and for the recording amplifier chassis. The two output sockets can be seen, and the three A.C. sockets are on the back of the chassis.

have been attached, mostly with the small-sized microphone cable that we prefer to use in place of ordinary braid-shielded hook-up wire.

Volume and Tone-circuit Unit

The tone control circuit has been hooked up using the control potentiometers themselves to provide most of the necessary tie-points. The input lead to this network comes from the relay, via the front wafer of the switch, to the beginning of the network, while the output goes through a short piece of cable to the input grid of the amplifier-cum-cathode-follower tube. This valve can be seen just to the left of the switch, and almost directly above the potentiometer nearest to the switch shaft.

(To be continued.)

Visit of Mr Costello

Mr R. G. J. Costello, an engineer of the equipment division of Mullard, Overseas Ltd., of London, paid a short visit to New Zealand in April last, and was the guest of Electronic Development & Applications Co. Ltd.

Among the telecommunication items in which Mr Costello specializes are telephone line carrier equipment, automatic telegraph switching and memory systems, telephone repeaters and amplifiers.

At the very short time at his disposal, Mr Costello was able to have interesting discussions with our local telecommunication engineers and explain many of the specialized equipments and projects on which his company are at present engaged.

It is hoped that on his next visit to New Zealand Mr Costello will be able to stay longer and meet a wider circle of our communications engineers, and perhaps even find time to sample some of our good trout fishing waters.

SPECIALISTS IN A

SPECIALIZED FIELD.

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MAGNETO-DYNAMIC PICK-UP*(Continued from page 22.)*

input circuit. Although the grid to cathode capacity of an amplifier valve might be small, feedback circuits, intentional or otherwise, might considerably increase the apparent capacity at the input of an amplifier stage. With piezo-electric pick-ups and with low-impedance pick-ups of the dynamic or magnetic type this is less critical and in general in a new installation designed especially for magneto-dynamic pick-ups no difficulties will be encountered but experimentists used to working with low-impedance pick-ups might have difficulties when changing over to high-impedance pick-ups, because of hitherto hidden imperfections of their installation.

JOHN GRAY'S RECORD PAGE*(Continued from page 35)*

enough about the music, which does include one or two rarely-played pieces of distinct interest. We hardly ever hear Alkan's "The Wind", and Mr L. D. Austin's "Valse Impromptu" is emphatically none the worse for being modelled in the style of composers whose pre-eminence he would be the first to admit.

Viking Records have added a feather to their cap with the production of a Caruso record which revives some of the very first, and consequently very rare, of the famous tenor's recordings, those made in Milan at the turn of the century, including one or two of

**THE GREAT
CARUSO**

the historic first batch made for the Gramophone and Typewriter Company, the publication of which was a landmark in gramophone history. The L.P. transfer, on Viking V 396-2, is freely admitted by its sponsors as being for the enthusiasts only—the great singer's voice emerges from a murky background uproar as though we were at the end of a crystal set picking up a broadcast from the other side of the world. I should scarcely recommend this to the uninitiated, but those willing to listen with the ear of faith may discern the dim shadow of what was the most famous tenor voice of this century and may possibly remain so. Arias from such well-known operas as "Rigoletto" and "Pagliacci" are alternated with those from Franchetti's "Germania" (an opera in which Caruso starred at the world premiere) and songs like Denza's "Luna Fedel" or "Non t'amo piu".

Good records for the time of relaxation continue to pour from all companies. Especially worthy of your attention

**MISCELLANY OF
ENTERTAINMENT**

are the Roger Wagner Chorale's "Folk Songs of the Old World", which roams over Western Europe on Capitol P 8388, Tarolf

Tollefsen's "Spotlight Accordion" (wizardry on a humble instrument almost akin to what Adler does with his harmonica, and featuring an astonishing variety of standard short classics, Columbia 33MSX 6007), and a rousing collection of Leroy Anderson orchestral pieces, played by the Eastman Rochester Pops Orchestra under Frederick Fennell (Mercury MG 50130). From Polydor come some Tyrolean tunes as played by ensembles from that district of Austria (LPH 45098) and a two-disc set of the best loved Gershwin melodies, very well done by Percy Faith and his Orchestra (Coronet KLL 553-4). Latest for the hi-fi fan is a Mercury by David Carroll's Orchestra entitled "Percussion in Hi-Fi", which features more percussion instruments than have perhaps been assembled previously for one recording, and including more different kinds of drums than most of us have heard of (MG 20166).

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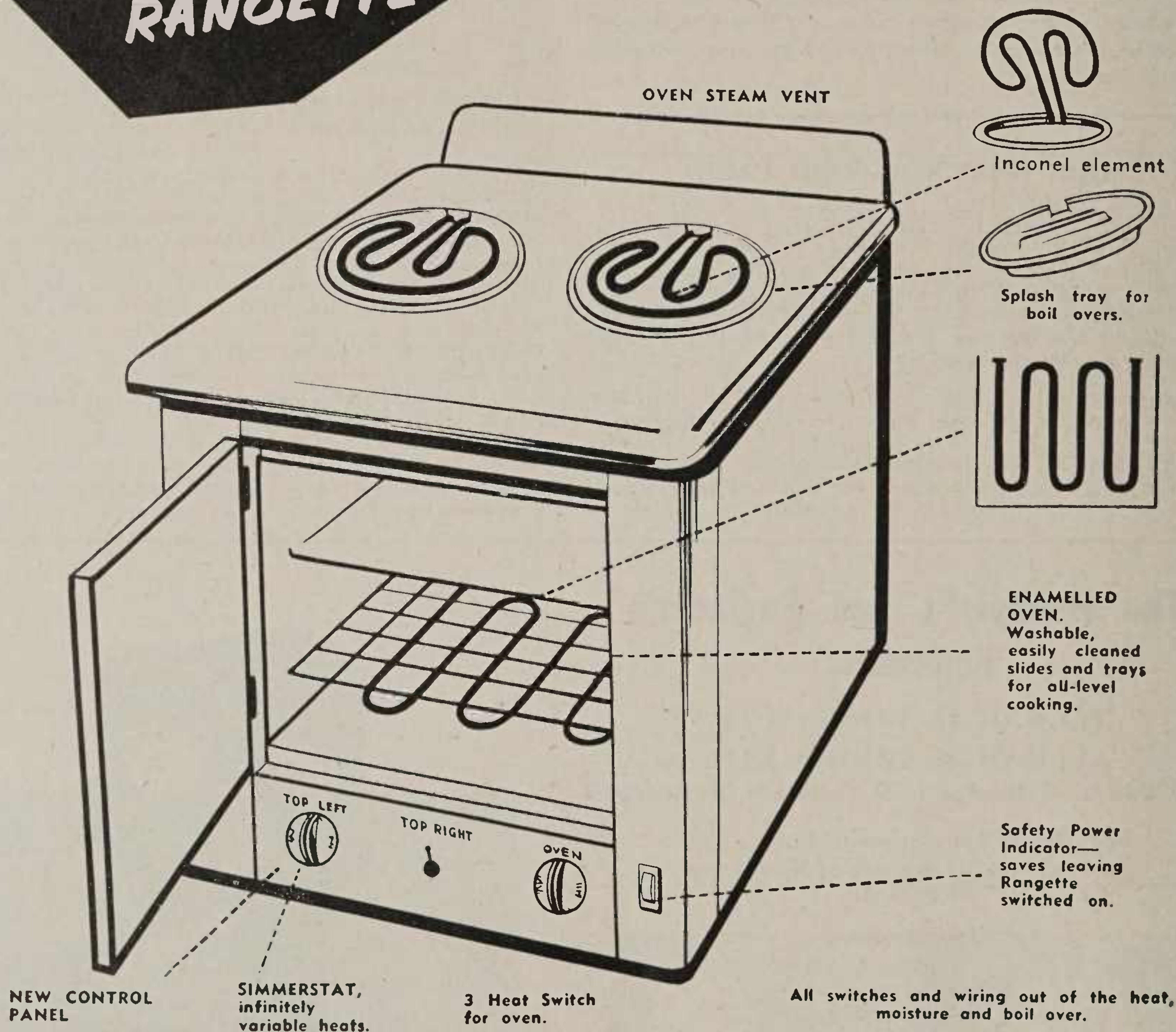
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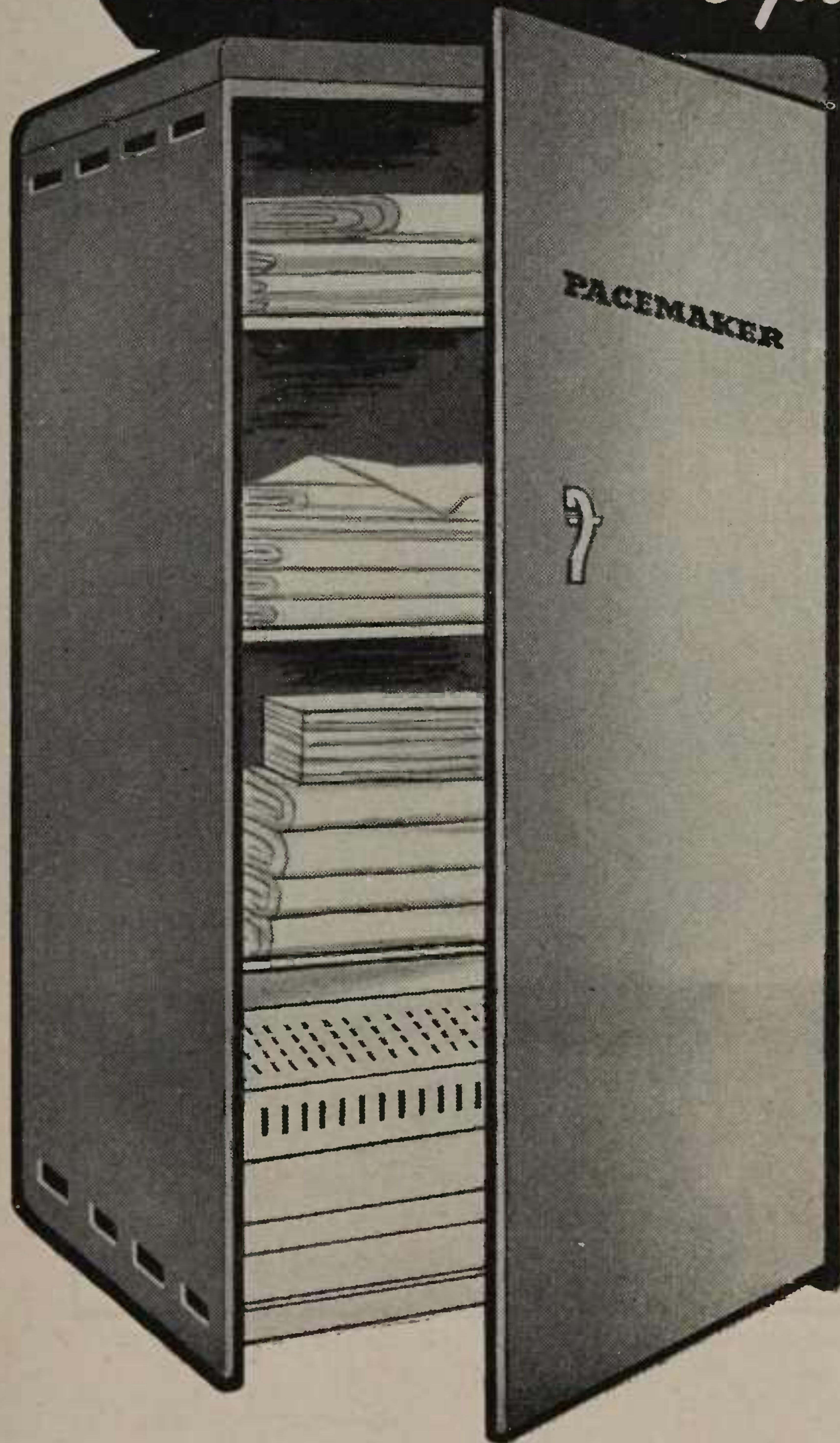
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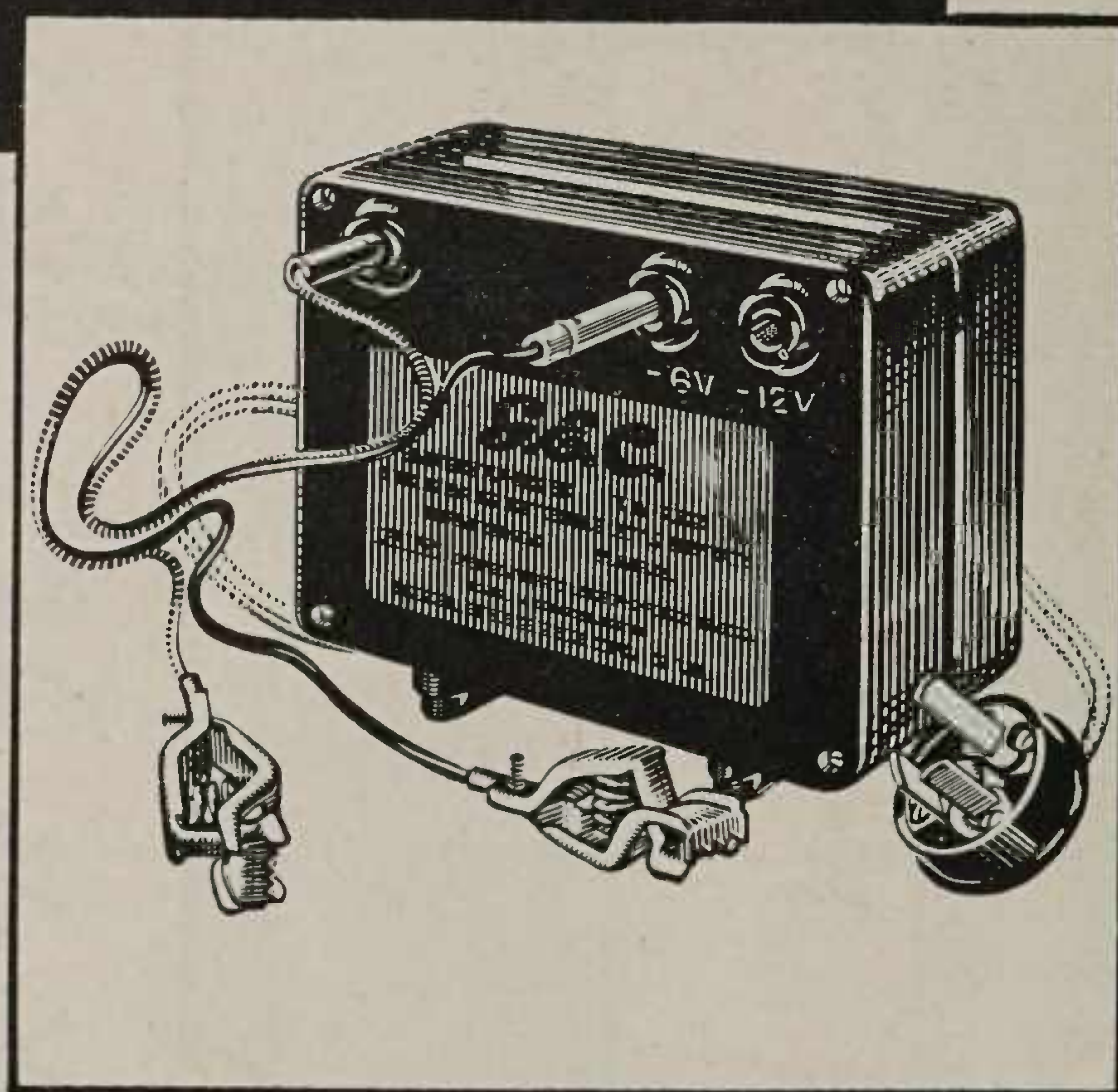
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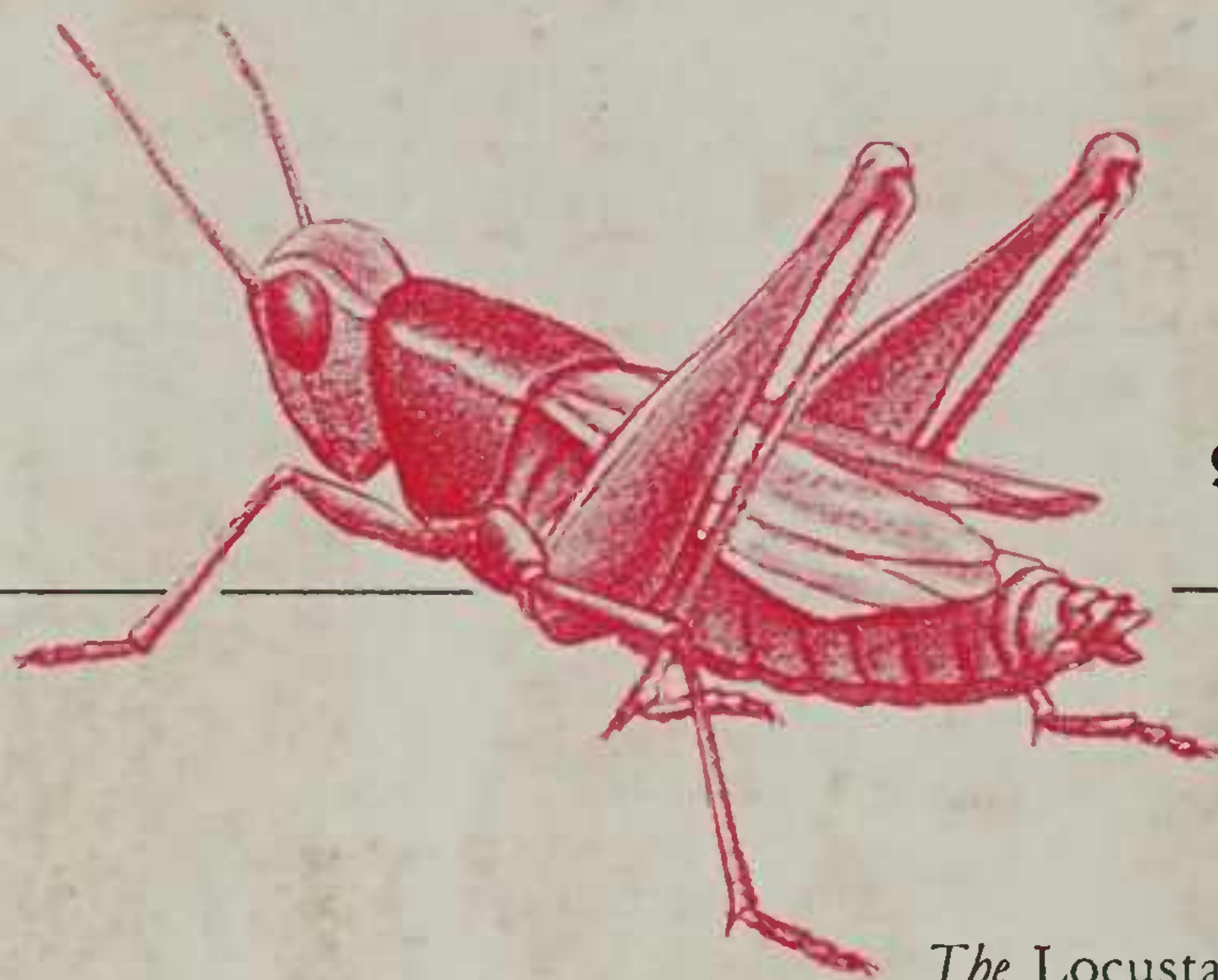


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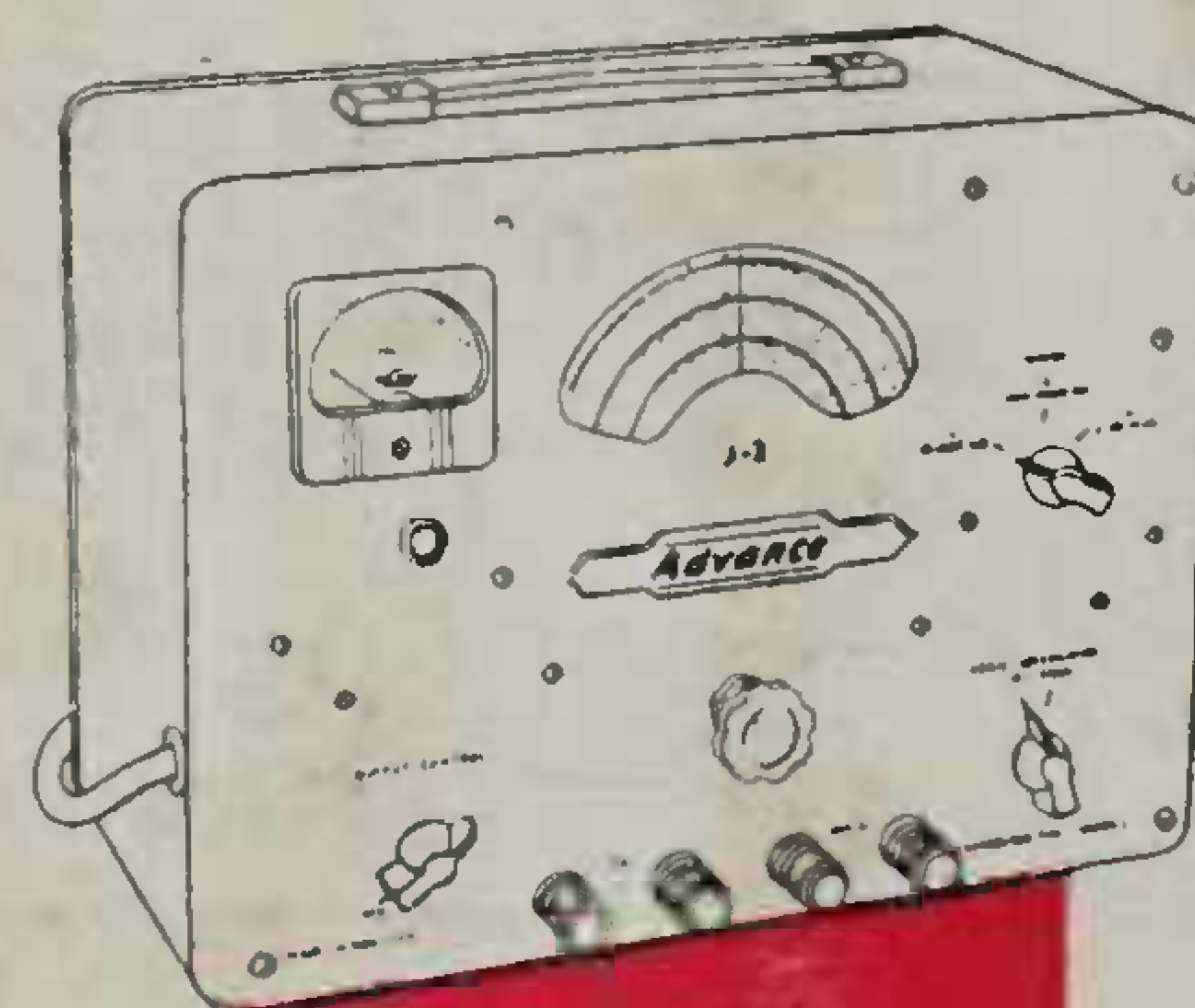
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