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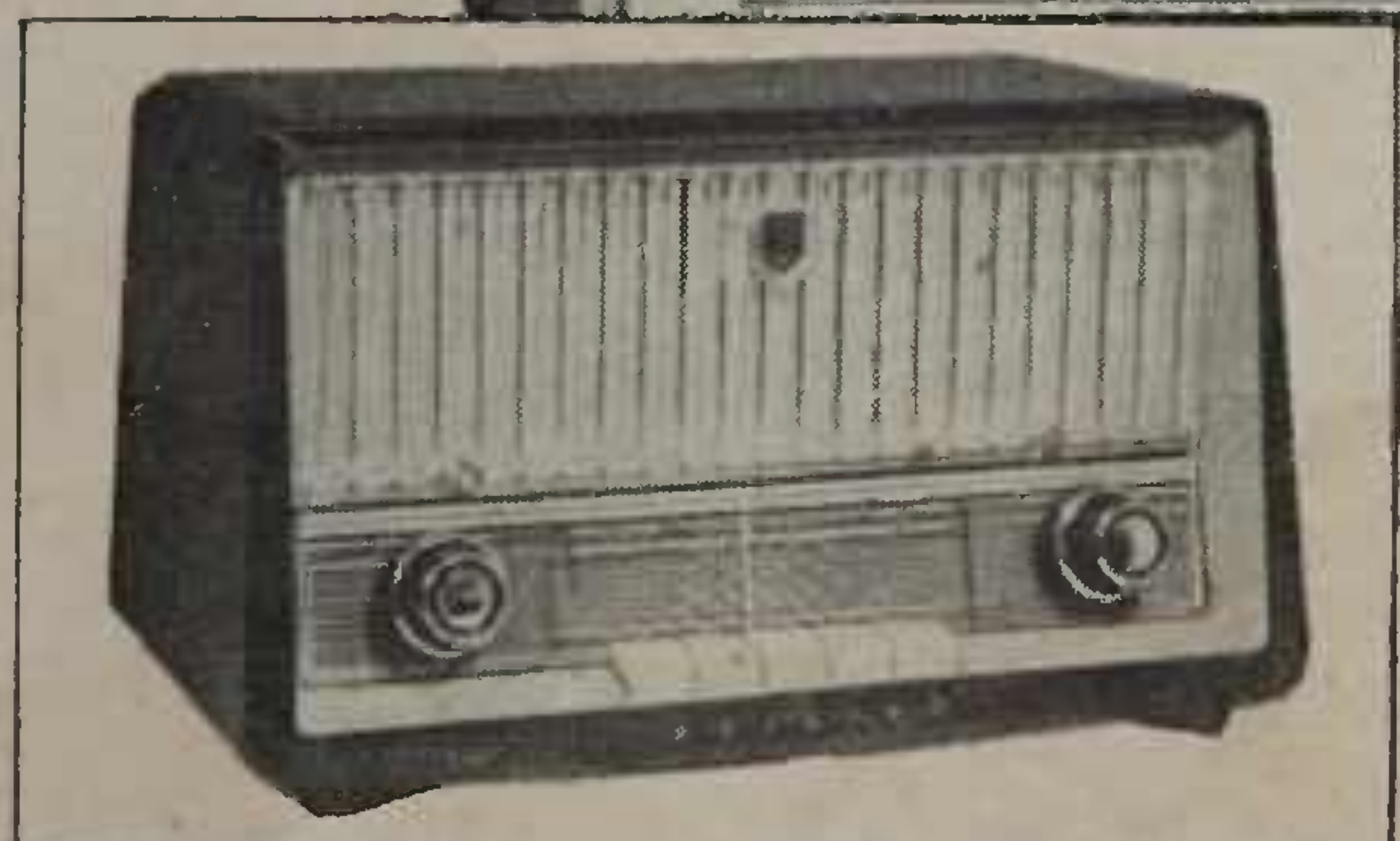
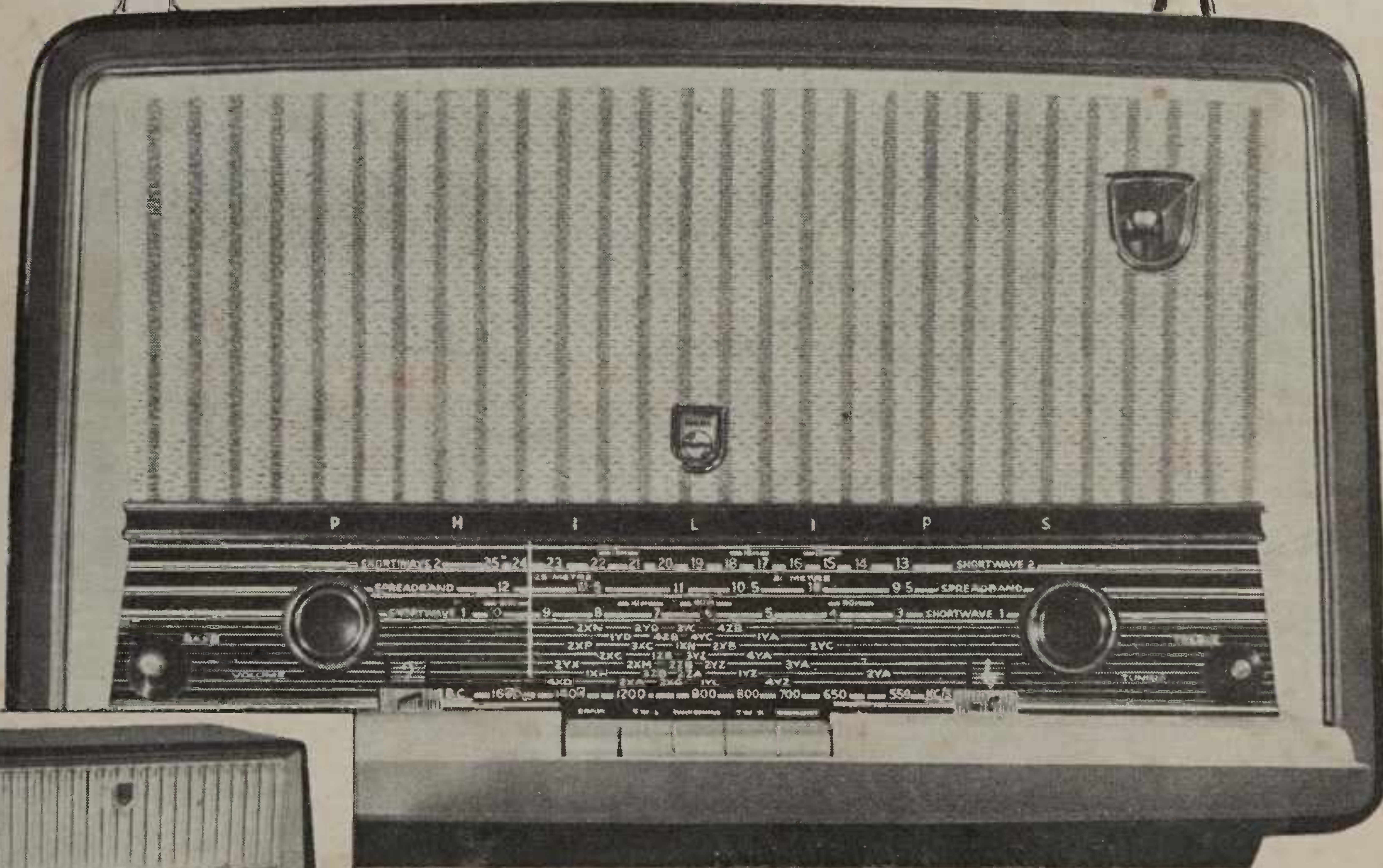
VOL. 13, No. 6

AUGUST, 1958

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Radio and Electrical Review

Vol. 13, No. 6

AUGUST, 1958

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Some Points for Radio Manufacturers

This journal recently attended the annual conference of the New Zealand Radio-TV and Electrical Traders' Association (Inc.) of Auckland, at which a great many matters of interest to the trade as a whole were aired. Among these was an item which appeared to us to be of more than a little importance, not only to the retailers who brought the matter up, but also to manufacturers of radio sets, who are also vitally concerned.

The question was that of the unserviceability of new sets, immediately, or very shortly after having been unpacked by the retailer. This has always been a problem to which no clear-out solution has been found. On the one hand, retailers may reasonably expect new goods, whether radio sets, or anything else, to open up in serviceable and saleable condition, while on the other, manufacturers may claim with equal reason that they already take adequate precautions to ensure that such is in fact the case. When a set is faulty on delivery, or develops a fault very shortly after being unpacked, the question then arises as to who should foot the bill, and this is a very difficult one to resolve satisfactorily, if only because of the ancient dictum that "circumstances alter cases". The room for argument is rather large, and one's arguments tend to depend on one's point of view, so we propose to sit on the fence on this aspect of the problem. What we are concerned with, however, is that from the Auckland retailers' submissions, it would seem that the unserviceability of new radio sets is on the increase. In the discussion at the conference, many dealers instanced their own experience, quoting cases of "dry" joints, improper fixing down of gramophone players, and other faults, none of which, it was maintained by the speakers, should occur in new equipment.

If dealers are correct in their contention that the incidence of such faults has increased sharply over the last twelve months, then the matter is one which will certainly cause concern to radio manufacturers. Everyone is aware that manufacturers employ final testing, after sets have been installed in their cabinets, in an attempt to obviate faults that have not shown up earlier on the production line, but if these procedures can be proved not to be sufficiently effective, then it is time that better test procedures were evolved, for there is no real excuse for new goods being faulty.

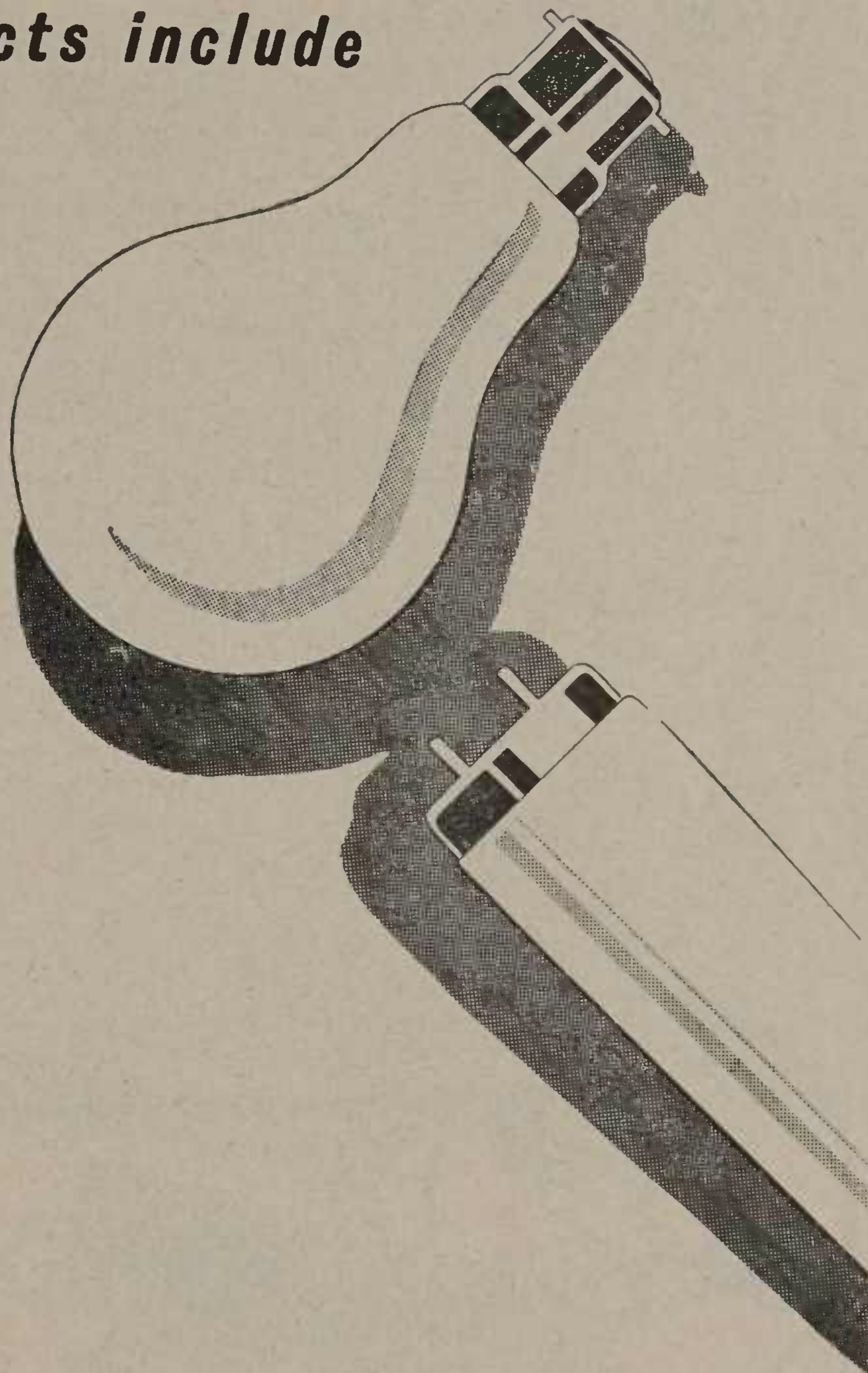
Not only final testing, but production checking may also be found to be involved, because some fault conditions, such as unsoldered or improperly soldered joints, will not always show up by mal-functioning of the set until after it has been shaken up somewhat during transport. Then again, there is the question of packing. This can be a highly specialized and scientific business these days, and some set makers may well find, on investigation, that their packing methods could be improved.

We believe that the Auckland Association is about to collate facts and figures on the problem with a view to laying these before the manufacturers. One noteworthy aspect of the discussion at the conference was that none of the major manufacturers of radio sets were absolved from blame. Thus, while figures have yet to be produced, it seems unlikely that dealers' complaints will be found entirely unjustified. The said complaints, emanating from a large number of dealers who were present in person, were too numerous to be discounted, even if a factual report has yet to be compiled. It is hoped, therefore, that manufacturers may take note, and may examine their own records and procedures, to see if the situation cannot be remedied. Anything that can be done in that direction can do only good to the industry, and to the general public.

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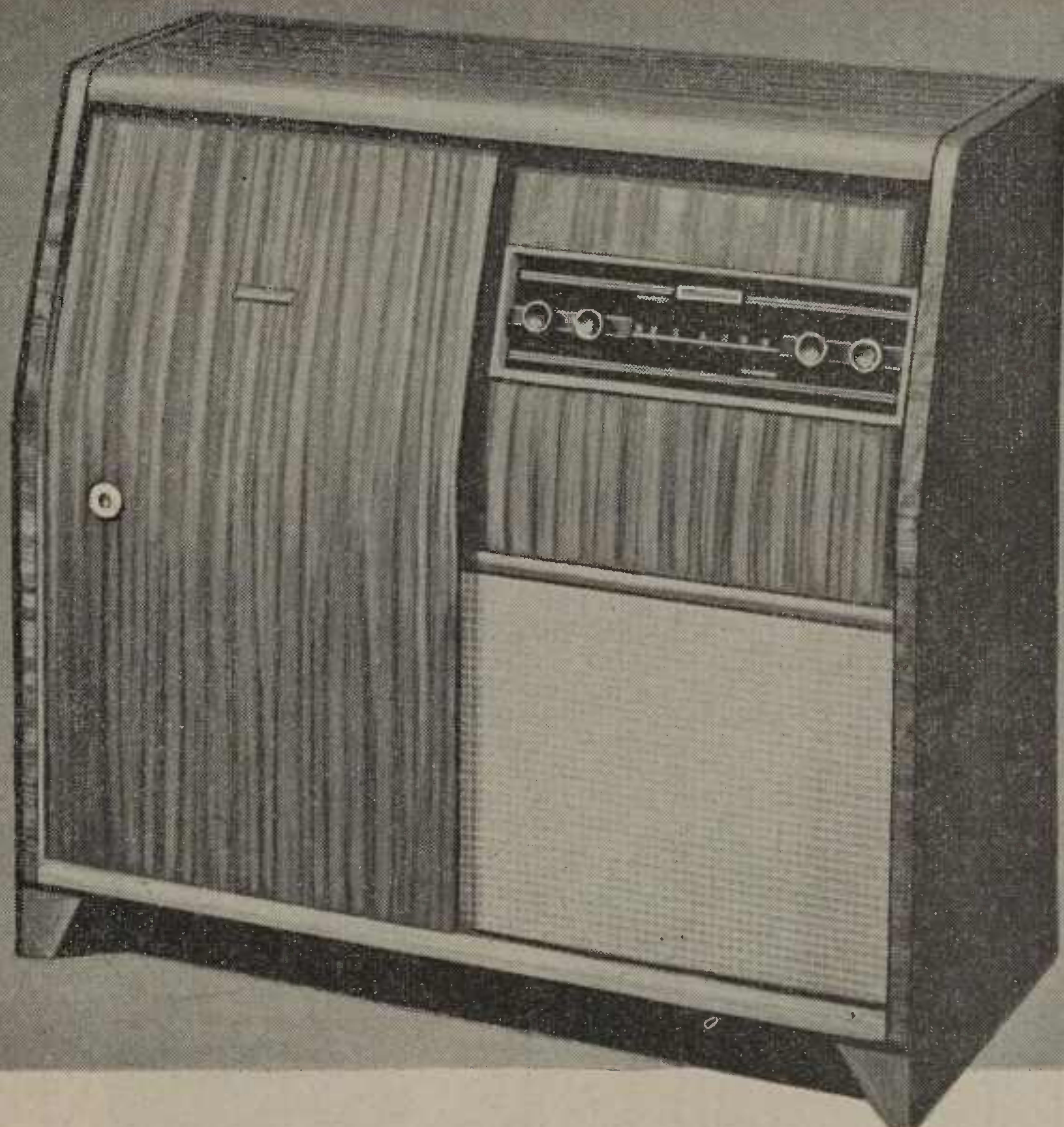
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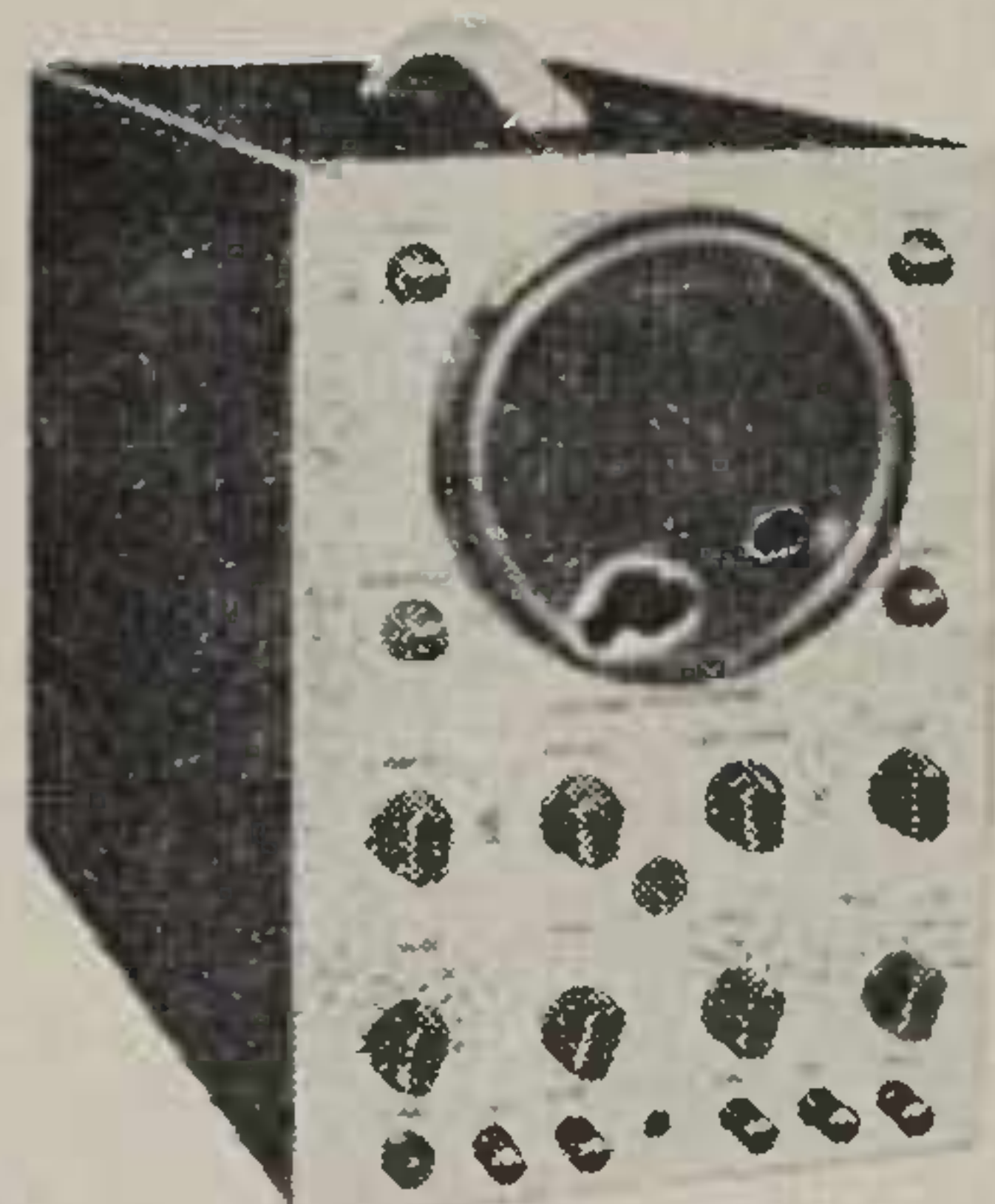
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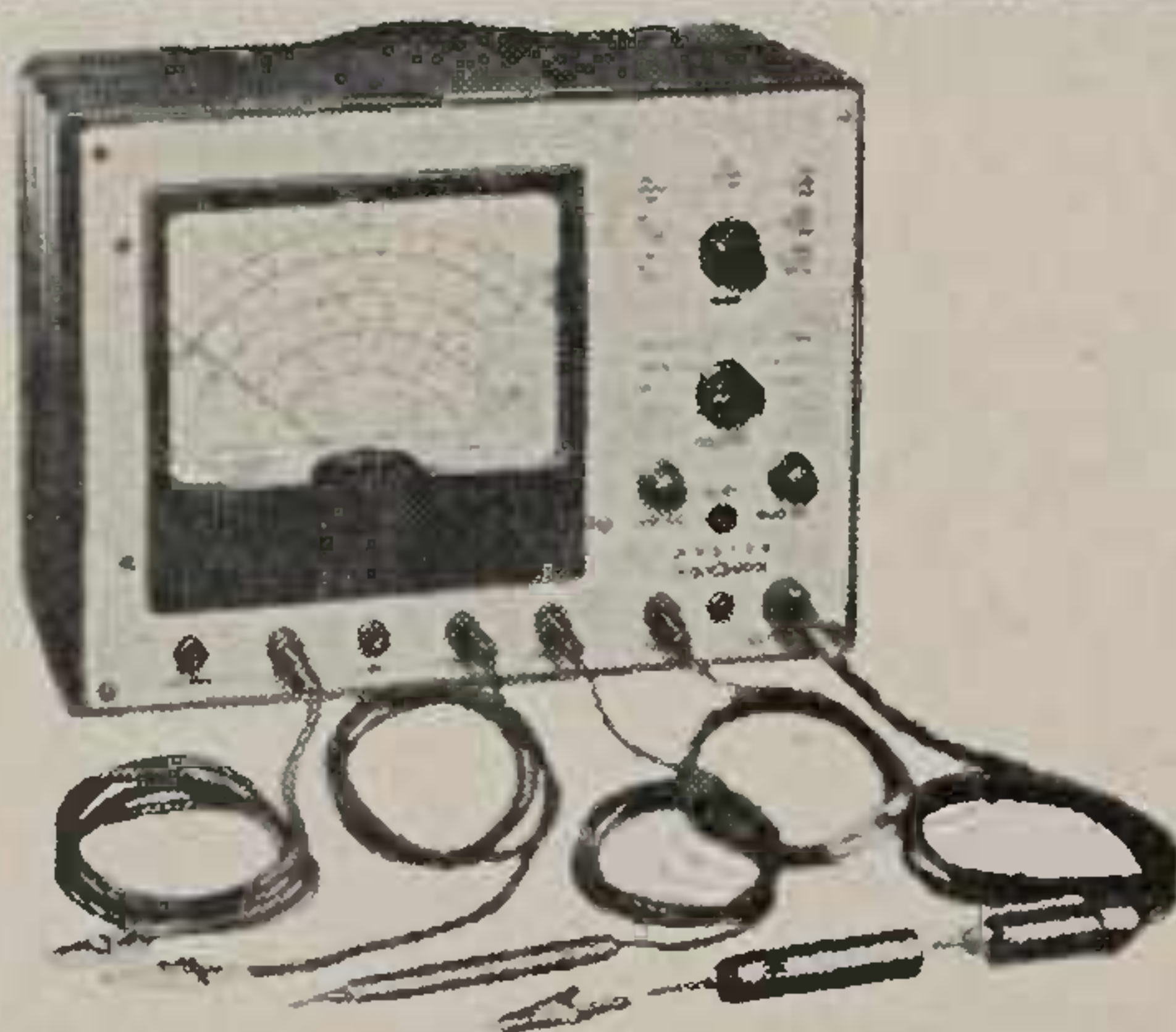
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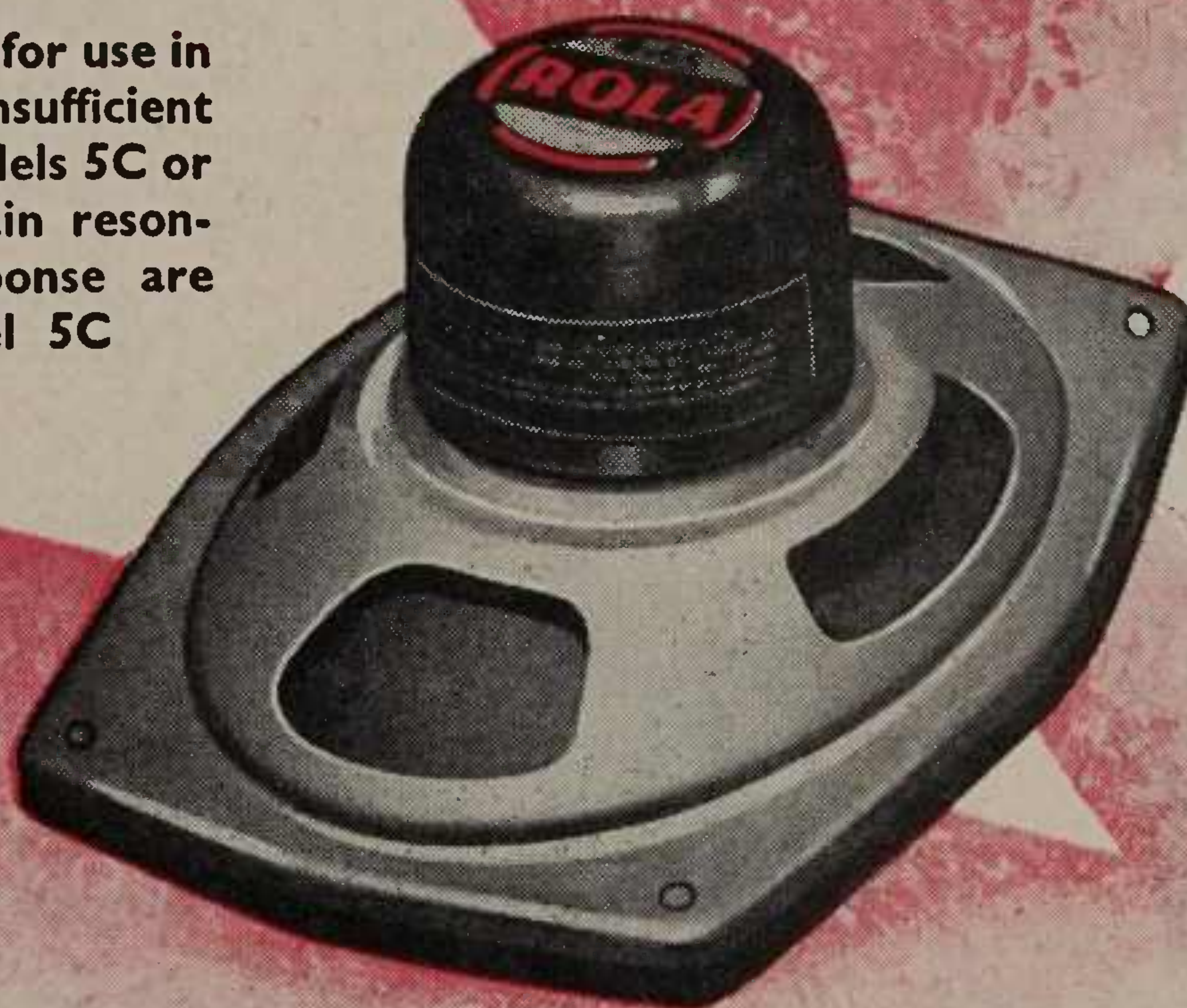
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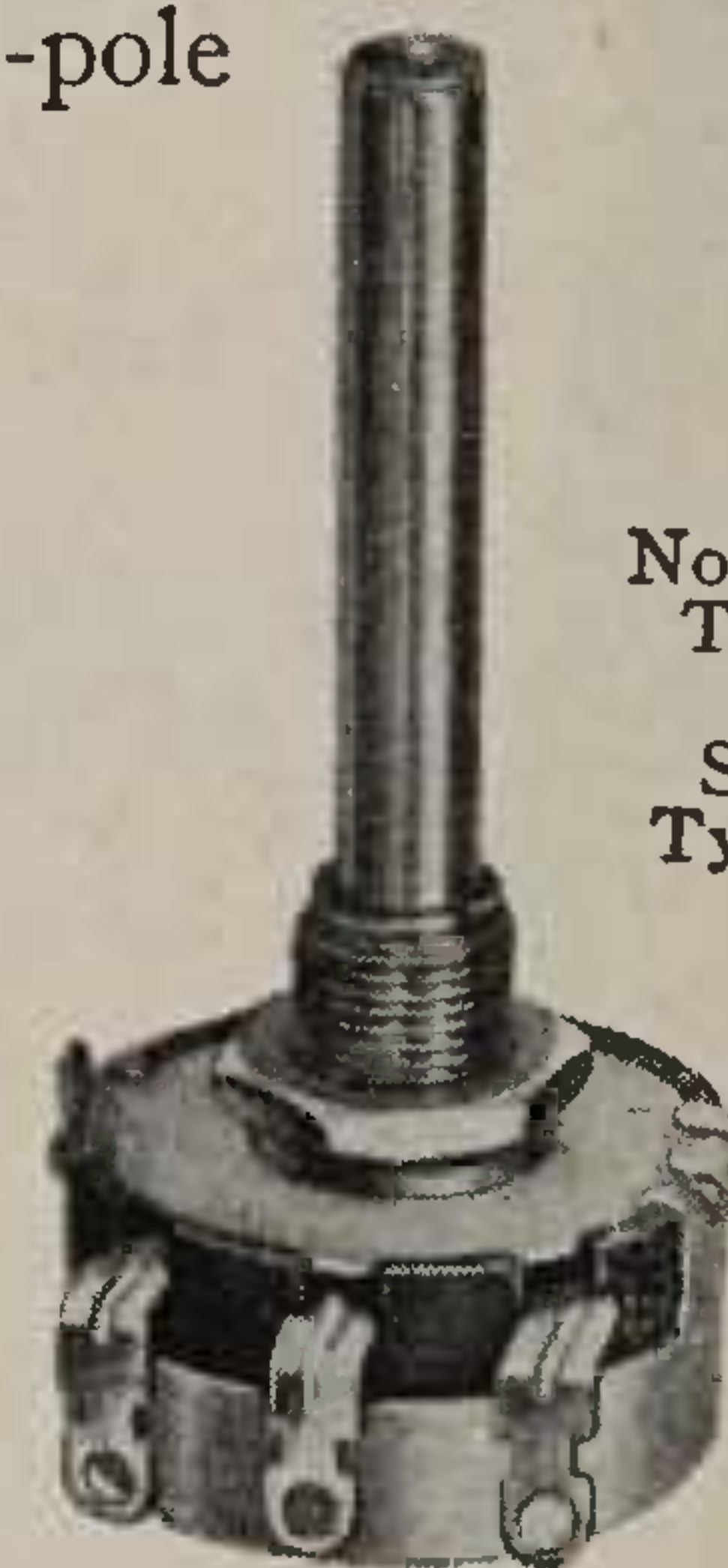
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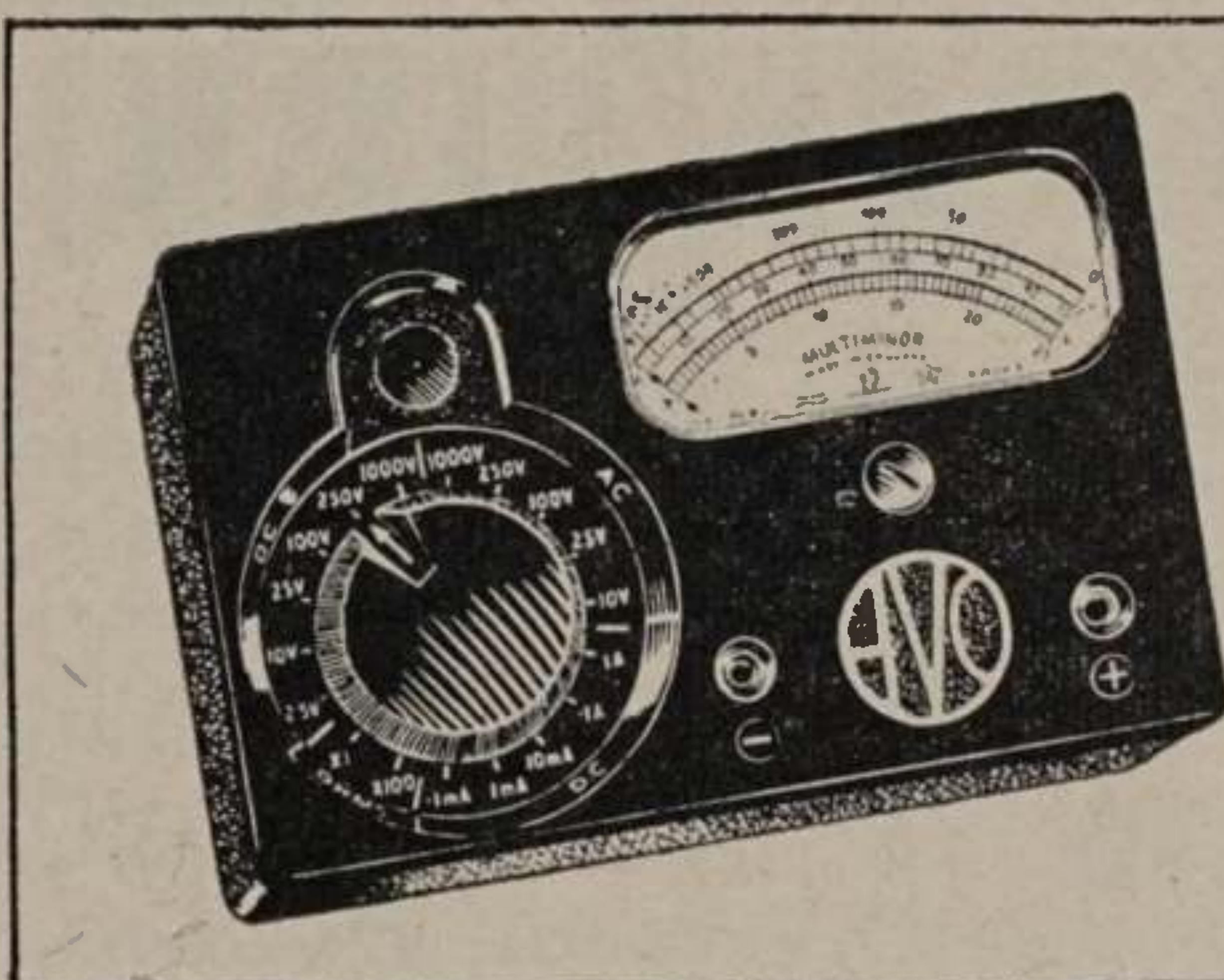
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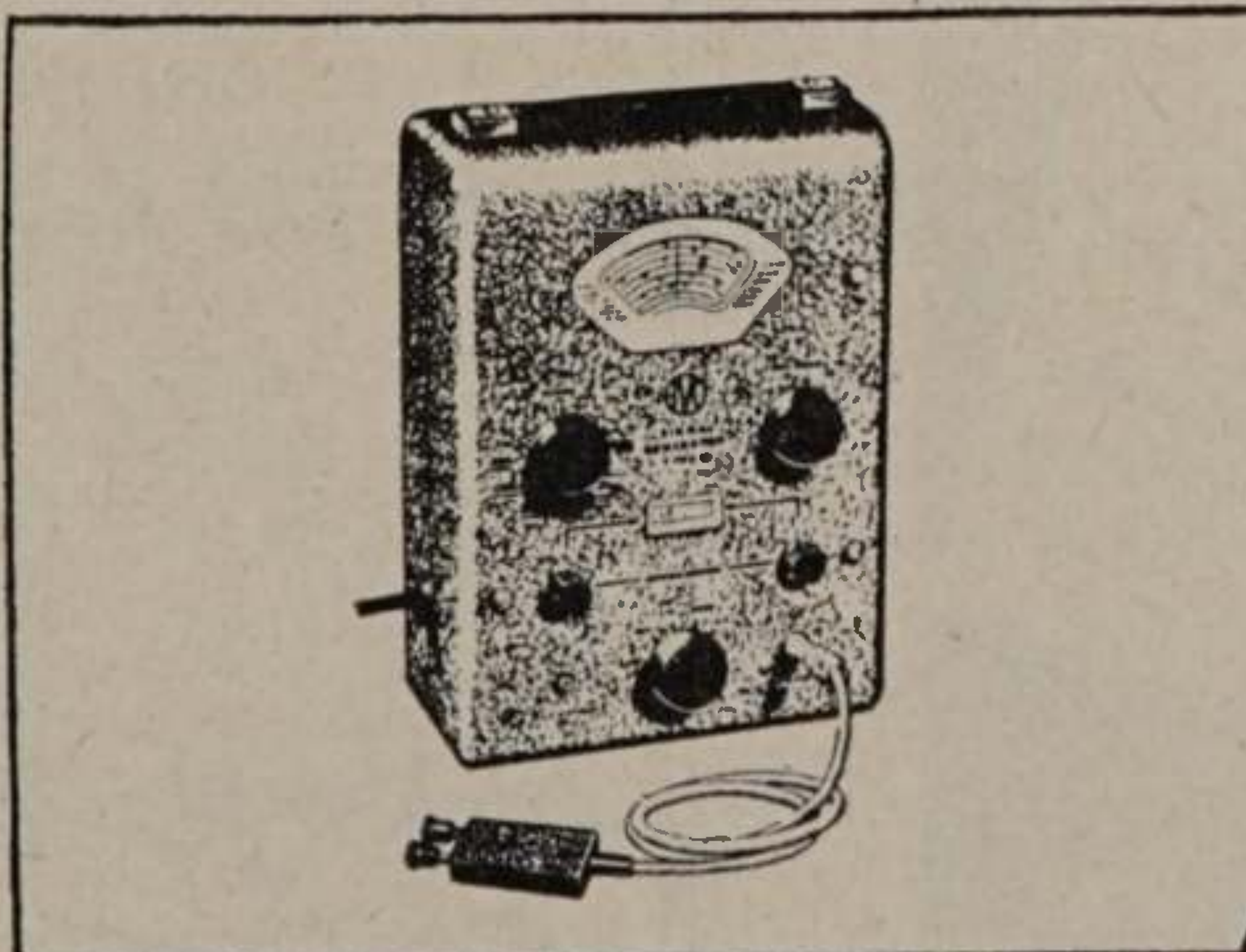
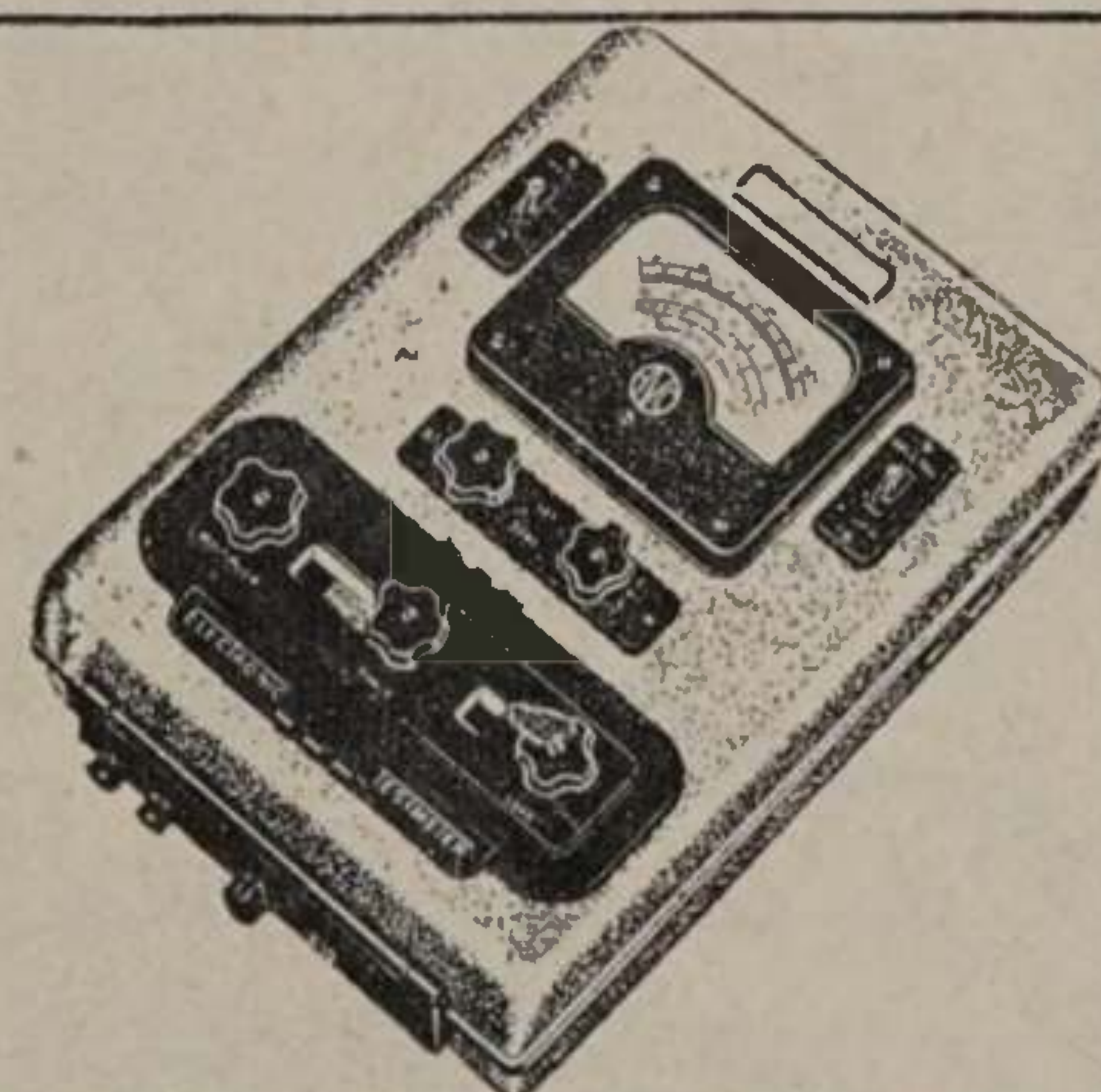
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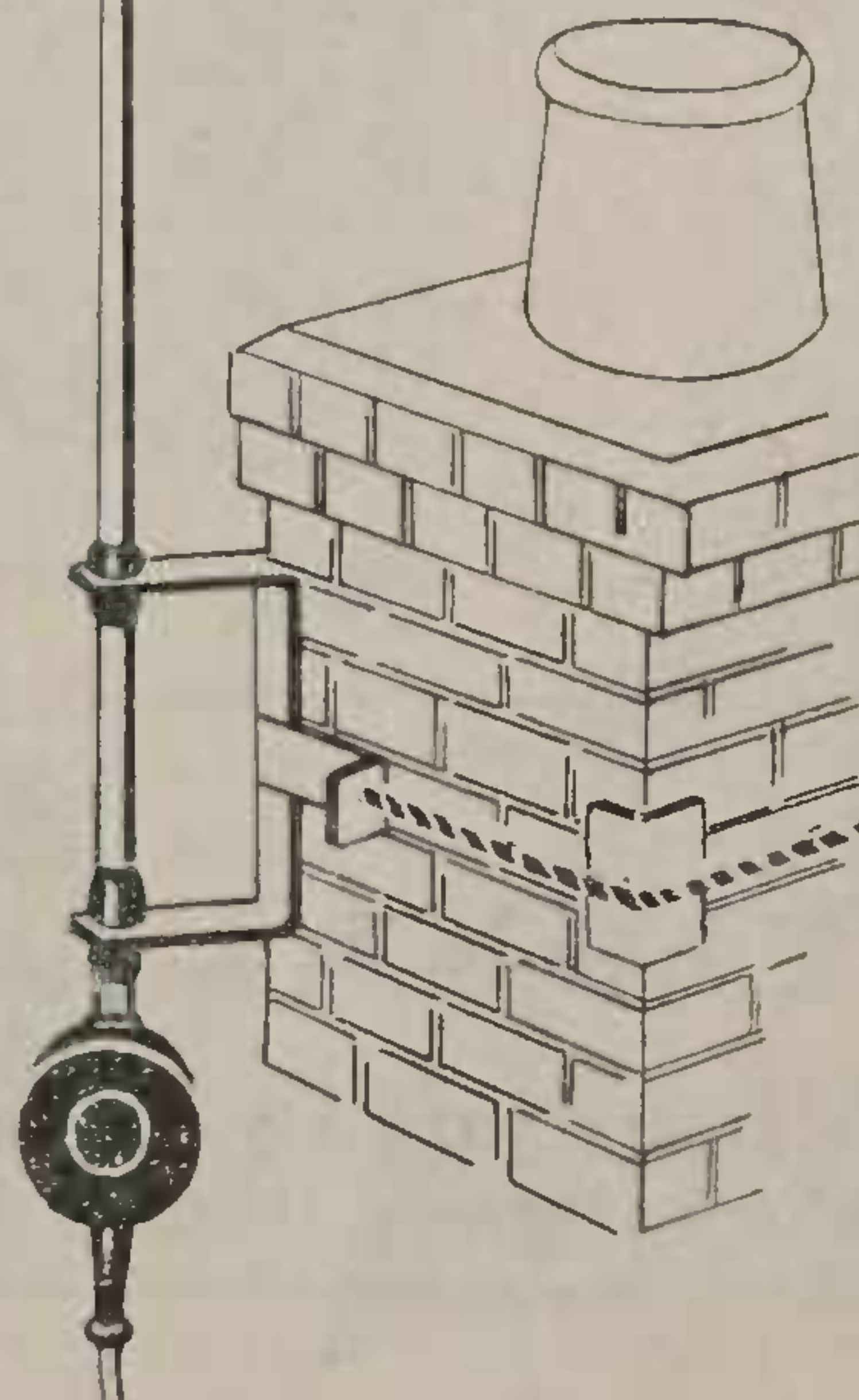
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THE EXSTAT PRINCIPLE



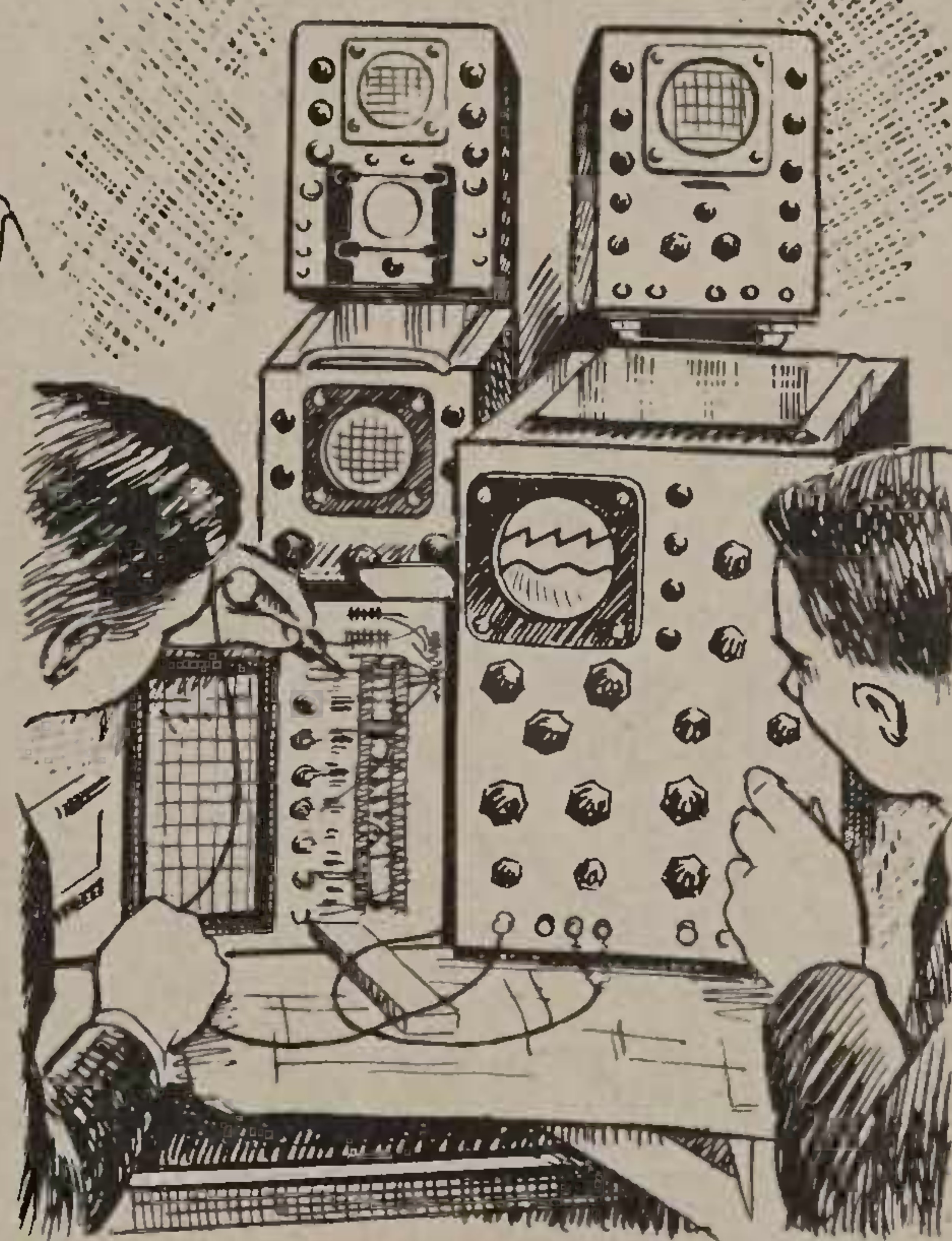
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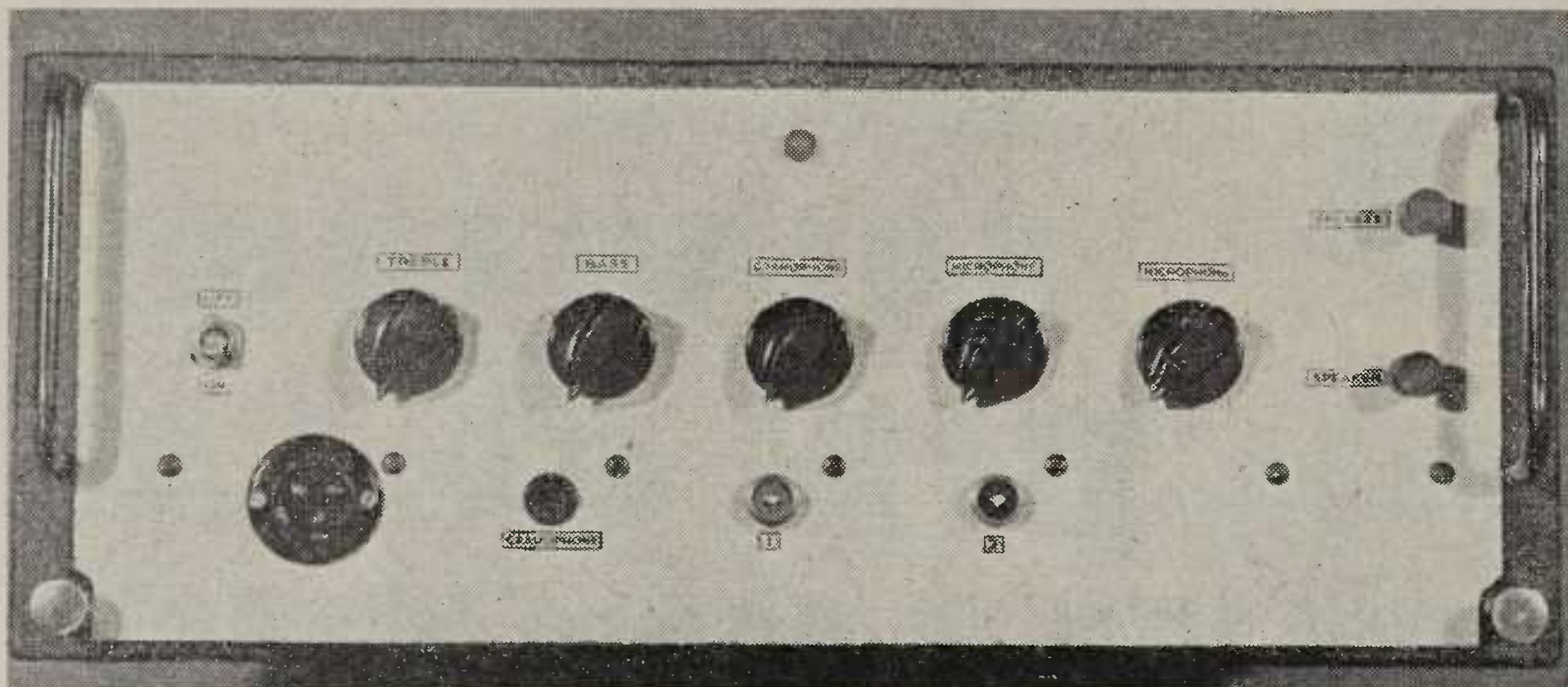
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CHRISTCHURCH
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AUDIO

A 10-WATT AMPLIFIER FOR PUBLIC ADDRESS



The amplifier described in this article is quite a conventional one in most respects, and has been designed for use as a small P.A. amplifier, having facilities for gramophone input, and two microphones, with built-in mixing and fading arrangements.

Introduction

Many users of public address equipment have a need for a small amplifier, of about ten watts output, and possessing facilities for more than one microphone, and at the same time for playing gramophone records. It is not economic to use commercial high-quality gramophone amplifiers for a purpose such as this, because their quality is generally unnecessarily high, and at the same time, they do not have built into them the necessary arrangements to enable microphones to be used as well as a gramophone turntable. In general, it is not necessary to use the "Hi-Fi" variety of amplifier; even if it were more suitable in other ways, and if one is bought to use as a P.A. amplifier, it is almost always necessary to provide a different pre-amplifier from the one supplied with it. This runs the buyer into further expense, so that he might as well have built a more suitably designed amplifier in the first place.

The amplifier described in this article was built with P.A. jobs specifically in view, and so is able to incorporate the facilities that really are needed for the job. It is not expensive to build, and uses a novel form of construction, and a chassis and cabinet that were obtained from war surplus sources. It is self-contained, with its own power supply built in.

Circuit Description

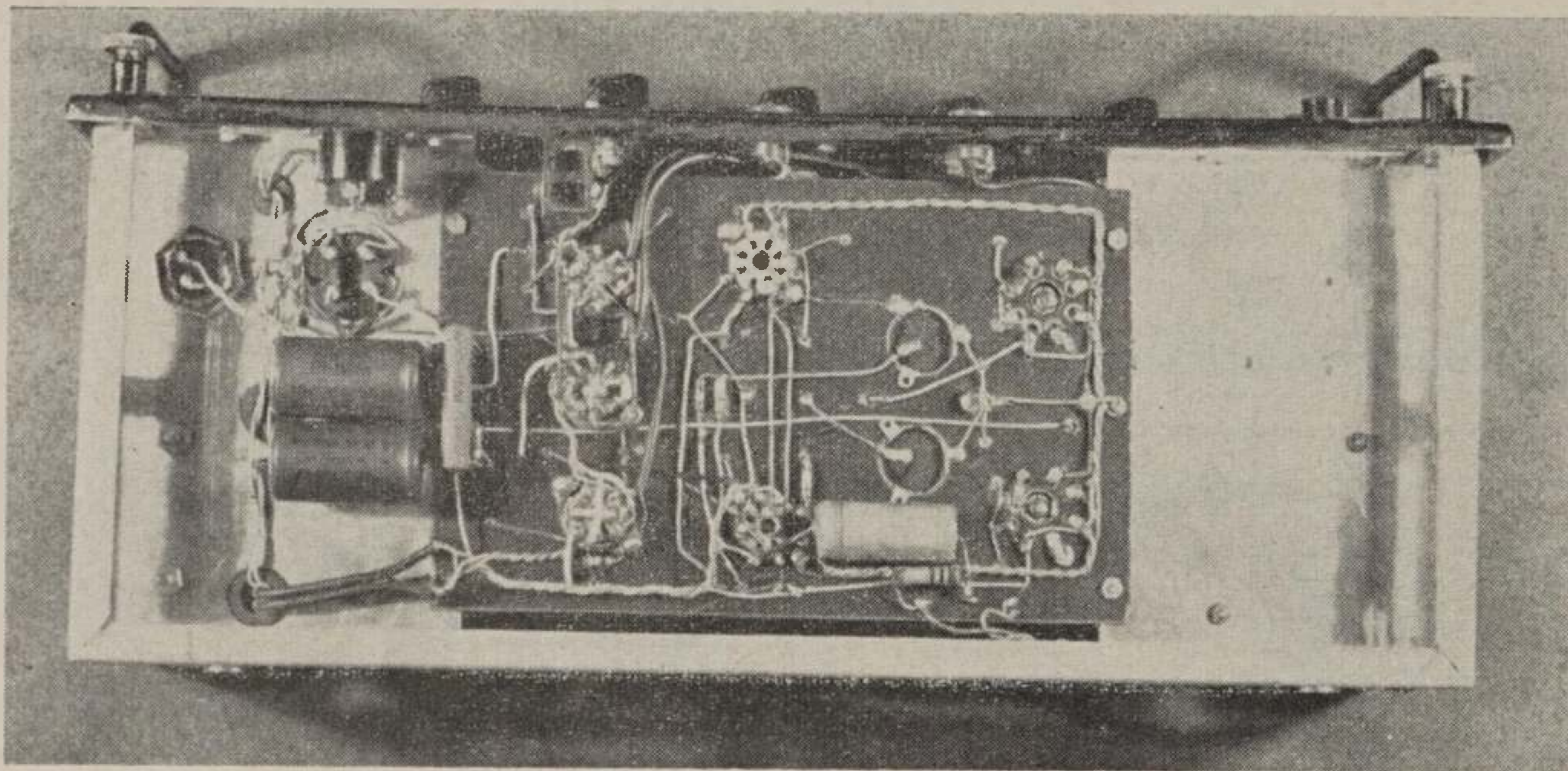
At the outset, it must be admitted that some of the valves chosen were used because they happened to be on hand. This method of picking tube types for an amplifier is commoner than one would think, and our own laboratory is no exception, although in this case

the choices were made with other people in mind too. Almost everyone has 6V6s available in one form or another, and for ten watts output, they are very suitable indeed. The tubes actually to be seen in the prototype are 7C5s, which are the loctal-based version of the 6V6, but are otherwise identical with it. They are pentode-connected, because for P.A. work, the extra efficiency of pentodes is rather more important than the somewhat lower distortion of triodes.

The amplifier proper is provided with negative feedback giving a gain reduction of some four times. This is enough to have a beneficial effect on the total distortion of the amplifier, and yet is not enough to cause difficulty with spurious oscillation. It is applied from the secondary winding of the output transformer back to the grid of the lower tube in the phase inverter circuit. This latter is somewhat unusual, as it employs two pentodes in a "long-tailed pair" arrangement. The valves have a large cathode resistor of 22k., common to both. This puts the cathodes at a considerable potential above ground, so that the control grids, too, have to be returned to a positive potential to ensure that the valves are properly biased. This is done in the following manner. The 1 Meg. grid leak resistors are joined together, and are bypassed to ground by a 16 μ fd. condenser. The junction of the two grid resistors is taken to a source of positive potential, through a further 1 Meg. decoupling resistor. The positive potential is obtained from the H.T. supply by means of a potential divider circuit. This comprises a 150k. and a 100k. resistor in series from the supply voltage point for the plates of the phase inverter tubes.

The signal is fed to one of the EF40 grids, and the self-balancing action of the long-tailed pair circuit ensures that a balanced output is obtained from the two EF40s, thus exciting the output tubes in balanced fashion. It will be noted that the grid of the lower EF40 is connected to a low-resistance potential divider which is across the output transformer secondary. This connection serves two purposes. First, it earths the grid as far as the driving signal is concerned, and secondly,

channels that are not being used. It is thus possible to mix the outputs of the three channels in any desired proportions. A further advantage of this system is that changing from one input to another, or from one combination of inputs to another does not involve the use of any plugs and sockets, or of any switches. Change-overs can thus be effected with the minimum of bother, and without any of the thumps and bangs often associated with switches.



Underneath view of the amplifier showing the form of wiring obtained when the circuit components are mounted on an insulating pane, as described in the text.

is uses this same grid as an input terminal for applying negative feedback voltage to the amplifier. If this grid were not being used for the latter purpose, the condenser would be directly earthed, thus ensuring that the grid of the lower tube is earthed for signal frequencies, while still being at the correct direct voltage above ground for correct biasing of the stage.

This somewhat unusual connection of the long-tailed pair form a means of balancing both the signal input and the negative feedback voltages, in the phase inverter itself, instead of having to apply the feedback voltage to a stage located before the phase inverter.

The use of two pentodes in the phase inverter circuit instead of triodes gives the stage somewhat more gain than most triode phase inverter stages have, so that the main amplifier will load fully from a signal of approximately half a volt, even with the negative feedback operating.

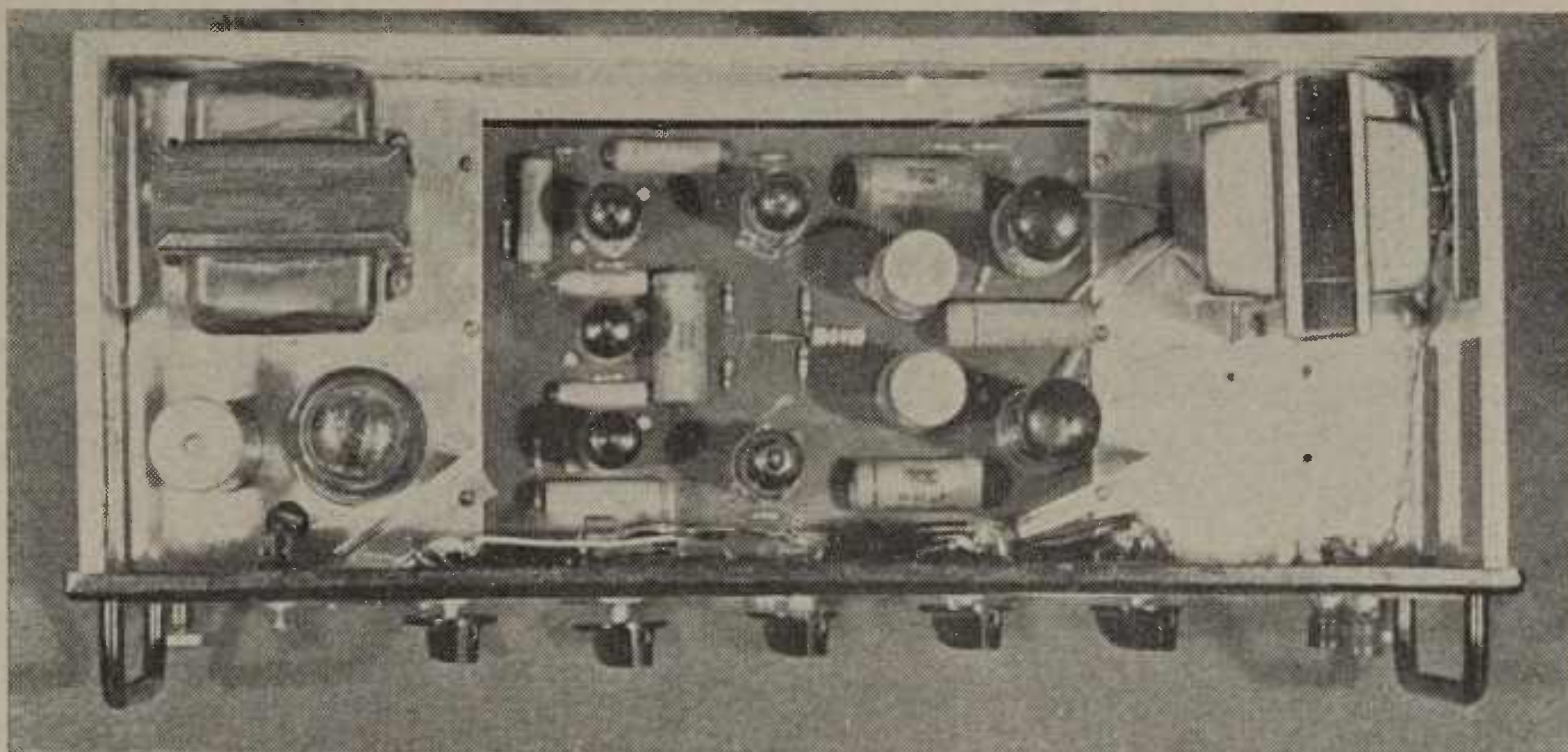
Input and Mixer Stages

Most P.A. jobs can be done with no more than two microphones, together with a gramophone channel, and it was decided to restrict the inputs to two, of high gain, for microphones, and one low-gain channel for pick-up input. With the circuit shown, all inputs can be mixed, simply by turning up the appropriate gain controls, and by turning down those belonging to any

To mix three inputs, two mixing circuits are used. The tube feeding the main amplifier is an ECC83. Its plates are strapped together, and are provided with a common load resistor of 50k. A common bypassed cathode resistor is used, and the inputs to be mixed are applied to the separate control grids. Mixing thus takes place in the plate load resistor, in proportions determined by the strengths of the signals applied to the two grids. When two triodes are connected in this way, the stage gain between each grid and the output terminal is approximately one half of the normal stage gain. Each half of the ECC83 therefore provides a gain of about twenty times as well as performing its mixing function. The gramophone channel does not need any more gain than this, even when an independent bass and treble tone control is inserted between the input terminal and the grid of the ECC83. The gramophone channel thus loads fully with a signal of approximately 0.4 volts which is sensitive enough to enable a good quality crystal pick-up to be used.

The amplifier as it stands has not enough gain for the microphones, so that separate pre-amplifiers for these are required. Two EF86s are used, and their outputs are mixed, as before, by strapping their plates and giving them a common plate load resistor. When this is done with pentodes, there is little or no loss of gain, because of the high plate resistance of the valves.

Above-chassis view. Here, the paxolin panel with the valves and their associated components can be clearly seen, as can the metal shelves at the ends of the chassis-frame, on which the heavy components are all mounted.



Construction

The form of construction used in building the prototype is quite novel, and appears to have some advantages, in spite of the fact that the chassis used was "second-hand".

The chassis is one taken from a piece of surplus gear of which a goodly number are probably still in the hands of experimenters and constructors! It was the AN/APN1—the war-time radio-altimeter. In its original form it boasted a number of large connector sockets along the front, and when these are removed, they leave large gaping holes that would be most unsightly if left to the public gaze. This is prevented, however, by covering the front with a single piece of formica. This not only covers up the holes, but also is strong enough to allow most of the front panel components to be mounted directly on it, clearing the large holes in the metal panel.

The ends of the space inside the chassis-framework are provided with two shelves on which are mounted, at the left-hand end, the power supply, and at the right, the power transformer. In this way, all the heavy parts are adequately supported, leaving a gap between them that is filled with the paxolin sheet on which the amplifier proper is built. This style of construction was borrowed from the transistor amplifier which was featured in these pages not long ago, and was used here, mainly to simplify the building. The framework that supports the chassis is integral with the front panel, and cannot be removed from it, so that a good deal of the wiring of the amplifier would have to be done while reaching somewhat awkwardly down into the interior. Also, it is doubtful whether it would be possible to insert a full-length metal chassis into the frame. Thus, the present method enables most of the wiring to be done on the insulating panel with the latter removed from the chassis, after which it is bolted into position.

The wiring of the tone control circuit is done almost entirely on the lugs of the potentiometers, and the input sockets are all wired to their respective input controls

before any connection is made to the amplifier circuit by means of lengths of shielded cable. After the tube circuits are all wired up on the paxolin sheet, and this has been fixed in position, these shielded leads from the controls are taken to the three input valves, and the shielding is earthed as closely as possible to the earth-point of its own input valve.

A glance at the under-side view of the paxolin sheet shows that only two or three of the condensers and resistors are mounted under the board, all the rest being placed on top of it, with their leads coming through sixteenth-inch holes, after which they join together, or to their appropriate valve socket tags.

One important advantage of this type of construction is that all small parts are very well supported, so that any equipment built on this principle should be capable of withstanding considerable shock or vibration. Unfortunately, the photograph does not show which wires under the chassis are insulated, since the latter were put in using small-sized P.V.C. insulated hook-up wire. Since all the wiring is so rigid, it is quite practicable in many cases to insulate wires which cross each others' paths, simply by making a loop with one bare wire, so that it does in fact "hop over" the wire it crosses, just as the circuit diagram symbol suggests. However, this method would have to be used very carefully, and it may be considered safer to slip pieces of sphagetti over a wire where it has to cross another.

One point worth noting about the mechanical design of this amplifier is that all connections, even including the A.C. mains, come in through sockets or terminals on the front panel. This makes it very easy to take off the cover which goes over the whole framework of the chassis, even while the amplifier is working. This is a very good principle to observe with equipment like this which is built to be used in the field, and not to look pretty in the drawing room, not only for the reason already given, but because setting up equipment is far easier if the operator does not have to grope round the back looking for the socket for this or that plug.

There is nothing hard and fast about the way in which the amplifier has been laid out. Indeed, this could probably be improved in one or two respects, while two aspects of the lay-out used made it necessary to add two small baffle shields. These can be seen in the view from above, one just to the right of the rectifier tube and the other in front of the front output valve. The former was needed because without it, a loud 100-cycle hum was produced electrostatically by the rectifier in the wiring of the tone-control circuit, which runs quite close to it.

The other difficulty was a high-frequency oscillation, which was found to be due to electrostatic coupling between the front output tube and the right-hand microphone input circuit. The baffle shield completely cured this trouble, which, by the way, had nothing at all to do with the negative feedback that the amplifier possesses. This was proved by disconnecting the feedback, whereupon the oscillation became stronger than ever. The fault was a very puzzling one until its cause was indicated by "exploring" with a piece of aluminium sheet while the amplifier was going. A metal output tube, or a shield round the glass one, would have cured the trouble equally well, but in both cases, the baffle shield was preferred because shields would increase the heating of the valves and would thus do them no good.

Different Output Loads

The values in the feedback network of the amplifier have been chosen for an output matching of 15 ohms. If transformers are used with different output matching, the proportion of output fed back will need to be changed in order to keep the degree of feedback the same as in the original. For a 3.5 to 4 ohm load, the 680 ohm resistor should be changed to 270 ohms, while for 8 ohm matching, it should be altered to 470 ohms. In all cases, the 1,500 ohm resistor remains the same.

If Gain Too High

It may well be found that the gain of the microphone channels is higher than required, and so results in too much hum and noise, since the whole gain of the channel comes after the volume control, which is at the input. If this is found to be the case, it is advisable to feed only a fraction of the output of the microphone pre-amplifiers to the ECC83 mixer tube. This can be done by making a voltage divider out of the 1 Meg. grid leak resistor in the grid of the ECC83 section fed by the microphone pre-amplifiers. Most microphones will not need more than a quarter of the available gain, so that a suitable divider would be made by replacing the 1 Meg. grid leak with 270k., and then connecting 820k. between the coupling condenser and the grid. Alternatively, a 1 Meg. potentiometer could be inserted at this point as a pre-set control, adjustable through a hole in the cover of the amplifier.

COLOUR-CODING OF LOW-VALUED RESISTORS

The other day this journal received an enquiry as to how the resistor colour code works for values below ten ohms. We were somewhat surprised to find that we did not know the answer to this apparently simple question. It was easily resolved by looking up the Radio-tron Designer's Handbook, but since values of this order are likely to come into fairly general use in transistor circuits, it was thought that readers might like to know the answer.

"Ordinary" Values

Everyone knows how the code works for values over ten, but in order to explain it for smaller values, we will state the whole system explicitly.

Modern resistors are always coded in bands of colour, the old system of "body, end, spot" having gone out of use some time ago. The resistor should be held with the coloured bands at the left, so that the correct order of reading the colours is then from left to right.

The first band indicates the first significant figure; that is to say, the first figure of the number represented. The second figure is represented by the second band. The third band then gives what should be known as the *decimal multiplier*. The usual explanation of the use of the third colour band is that "it tells you how many noughts to put after the first two figures." This

works quite well for numbers larger than ten, but breaks down for the smaller numbers that we are considering here. For example, a 47 ohm resistor would read "Yellow, Mauve, Black", the rule being stated that black means "no noughts". This appears to line up with the meaning of a black band when it is used as a significant figure, but it leaves no way of indicating that the number given by the two significant figures is to be *divided* by ten or by one hundred. This is where the term *decimal multiplier* is used.

Let us examine the following list:

Multiplier	Colour
$10^{-2} = 1/100 = 0.01$	Silver
$10^{-1} = 1/10 = 0.1$	Gold
$10^0 = 1.0$	Black
$10^1 = 10.0$	Brown
$10^2 = 100$	Red
etc.	

From this we see that as the decimal multiplier, black means 1, so that the number obtained from the first two colour bands must be multiplied by 1 to obtain the answer. If the third band is gold, therefore, the number obtained from the first two bands is to be multiplied by 0.1. Thus, a resistor reading Red, Red, Gold,

NEW ZEALAND HAS A TELEVISION STANDARD!

Biggest news in the radio world since our last issue is that New Zealand's television service (as and when it comes into being) is to operate on the C.C.I.R. 625-line standard, as used in Australia and in many countries throughout the world.

It will be remembered that back in 1952, Messrs N. R. Palmer and S. W. McDonald, two engineers of the New Zealand Broadcasting Service were charged with the responsibility of travelling overseas, examining closely all the then operating television services, and bringing down a report recommending which standard should be chosen for use in this country when television broadcasting eventually started. The report produced by these two gentlemen recommended the use of the British 405-line standard, as used by the B.B.C. At the time, it was felt that the recommendation was a very sound one. Indeed, at least one authoritative source in Britain remarked that Messrs Palmer and McDonald had put forward the best case ever advanced for the choice of the B.B.C. standard as against the 625-line C.C.I.R. standard.

At the time, operational data on the performance of the latter standard was virtually unobtainable, because there was not a single full-scale television service in the world which used it. Now, however, the situation is quite different. Practically the whole of Europe now has a television service, and by far the largest proportion of countries operating one are using the C.C.I.R. standard. Then again, quite near to home we have Australia, also operating this standard. It should come as no surprise, therefore, that a decision has finally been made in favour of the C.C.I.R. standard for use in New Zealand when a public service is instituted.

What is There in it?

Those technically interested in the subject will certainly want to know what, if any material differences will result from the choice just announced, as compared with the older recommendation. From the public's point of view, it may be said that the difference will not be great. Strange as it may seem, it is none the less true that the most significant improvement as far as the man in the street is concerned is the reduction in lininess of the picture, for a given size of display tube. In fact if any technical considerations can be said to have influenced the decision either way, this is probably the one carrying the most weight. At the time when the original recommendation was made, picture tubes were considerably smaller than they are today, and there was no firm ground for any prediction that they would get much larger than the fourteen-inch tube that was the most popular size at that time. Now, however, seventeen and twenty-one inch tubes are the most popular sizes, and it is this fact that has to some extent influenced the decision. There is no doubt about

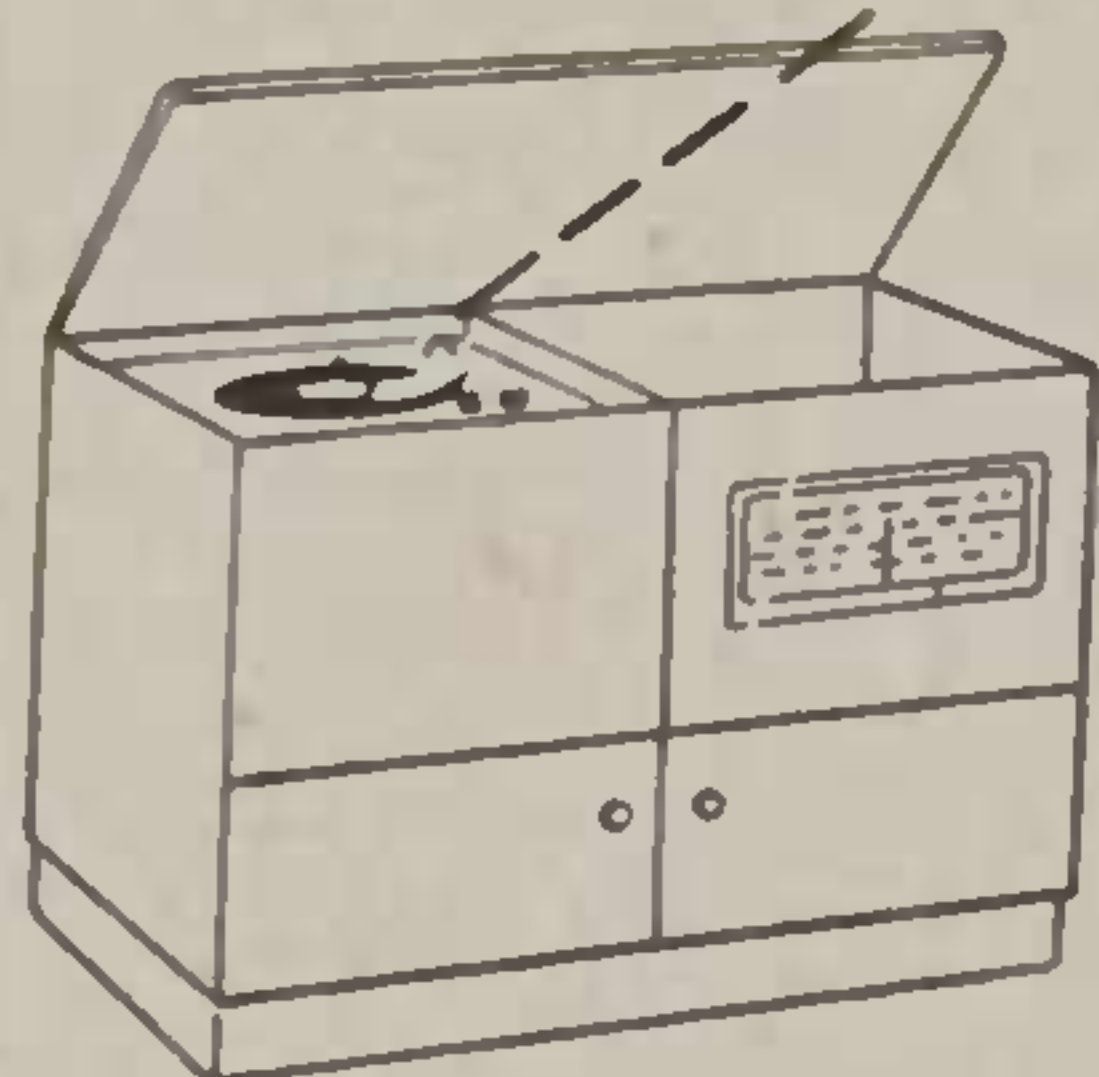
it, people do like large picture tubes, and they do not seem to like to be able to see the lines too readily. One way out of this is to get farther away from the tube, but this solution for some reason does not find favour with the public. The other way out is to put more lines on the tube, making them less visible, and this the 625-line standard certainly does.

Of course there is the argument that the resolution of the whole picture will be greatly improved by going to the 625-line standard, but this by no means follows. The truth of the matter is this. The use of a standard containing more lines **MAKES IT POSSIBLE** to produce a picture with greater overall resolution, and therefore with greater power of presenting fine detail, but it by no means follows that that is what the public will get. The public will in fact get a standard of resolution equivalent to what it is prepared to pay for, or alternatively, corresponding to what the set manufacturer is prepared to provide for a given price. *Nothing is more certain than that with the 625-line system, some viewers whose sets are cheaply designed in the first place, or who have good sets which have gone out of alignment, will obtain pictures that are much inferior to those obtainable from a good receiver working on a good 405-line signal.*

This statement is not offered as a criticism of the 625-line system. It is merely a presentation of one of the facts of life, in order to put the matter in proper perspective. The transmission standards alone can do nothing, on their own, to ensure that a high-definition picture is received. As always, the quality of the receiver comes into the picture (quite literally in this case) and all that the transmission standard can do is to ensure that a receiver engineered to the highest pitch of performance will give a better picture than would a similar receiver, built for a standard with fewer lines.

FM Sound and All That

The main differences between the two standards apart from the question of lines, concern the polarity of modulation and the type of sound modulation. In the British system, video modulation is positive, while in the C.C.I.R. standard it is negative. That is to say, maximum transmitter output represents the tips of the synchronizing pulses, 30% below maximum is the black level, and a little above zero output represents peak white. In the C.C.I.R. system, which uses the modulation polarity just described, the transmitter output is never allowed to go to zero, in order that there shall always be some R.F. signal present irrespective of the picture content. The purpose of this is to enable receivers to use what is known as the inter-carrier method of F.M. sound reception. This latter enables the sound portion of the receiver to be added much more cheaply, since it is not essential to have such a complex sound channel as is required for A.M. sound.



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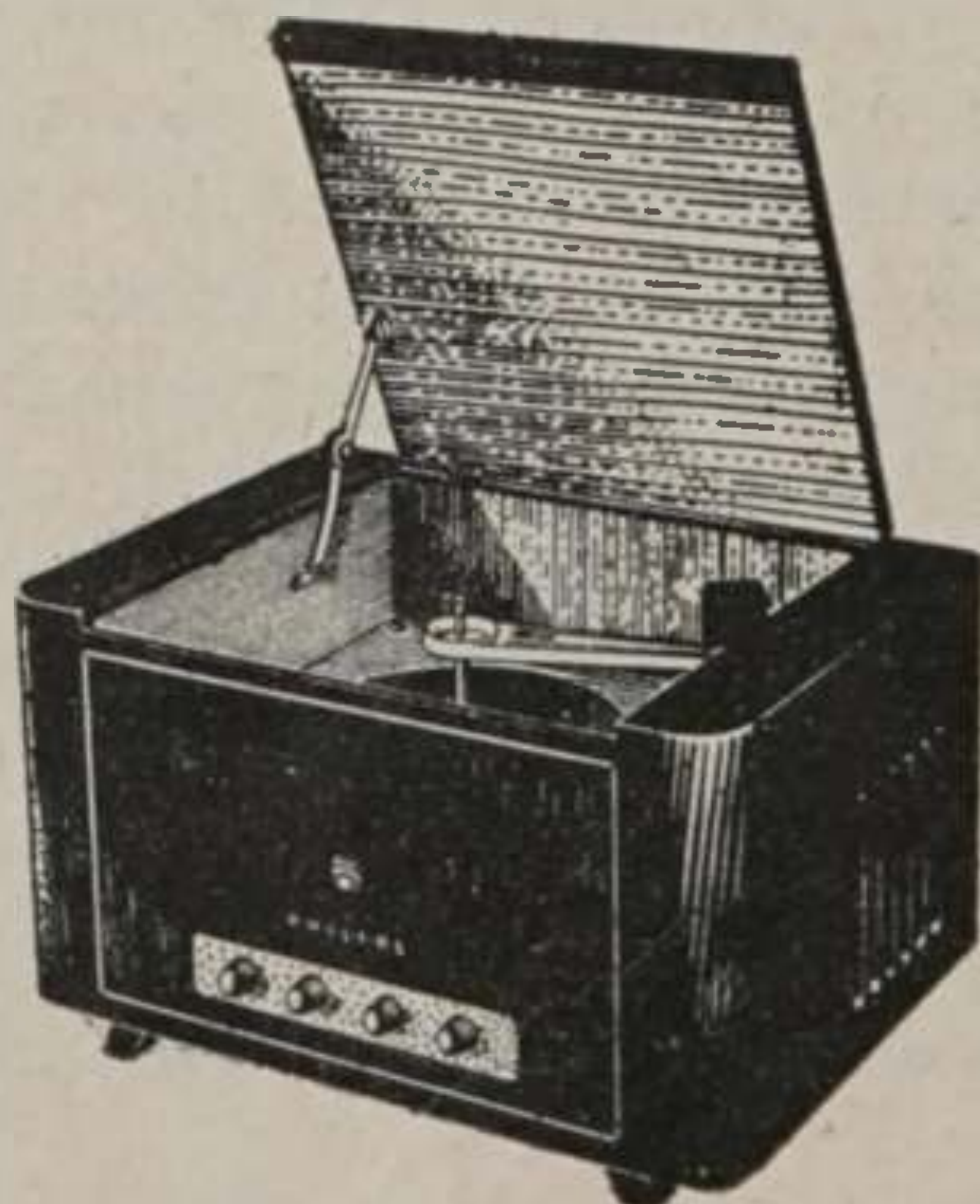
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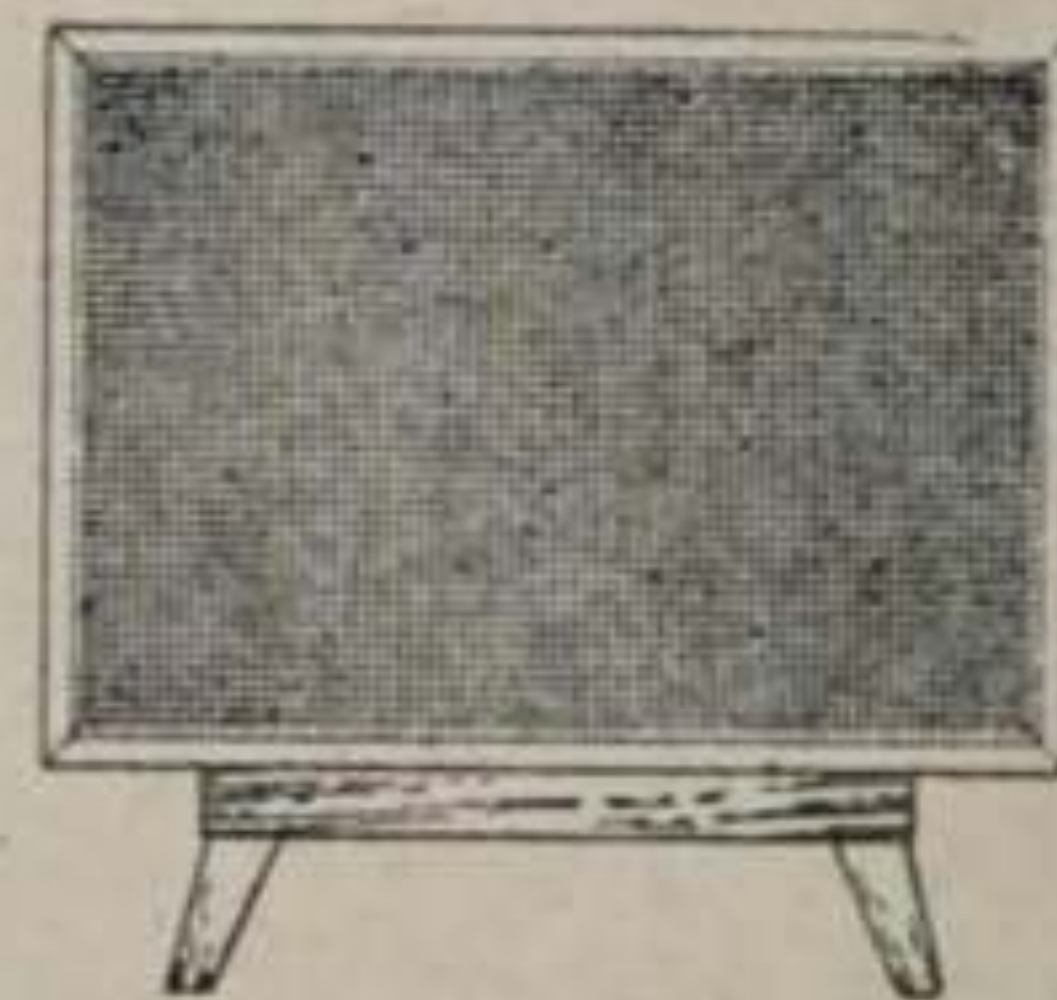
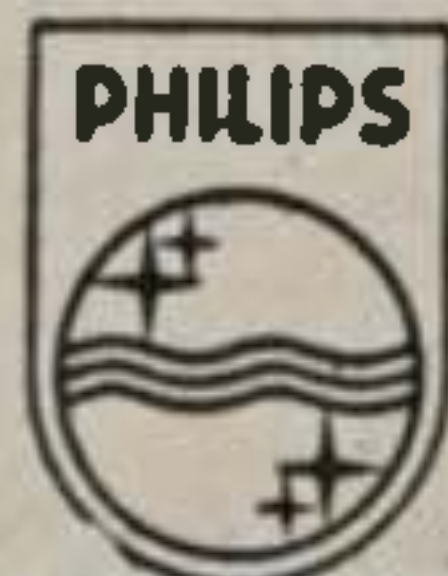
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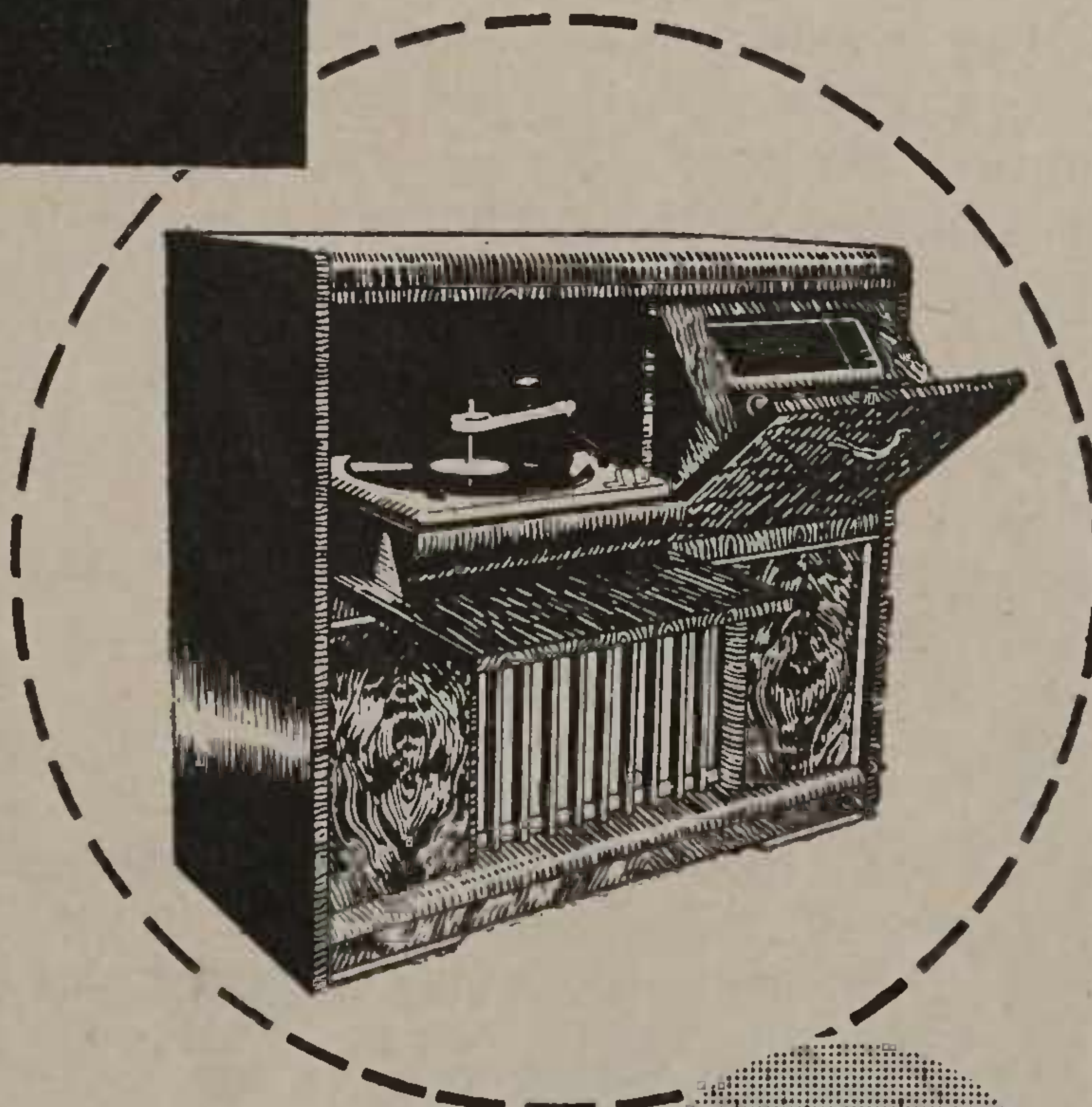
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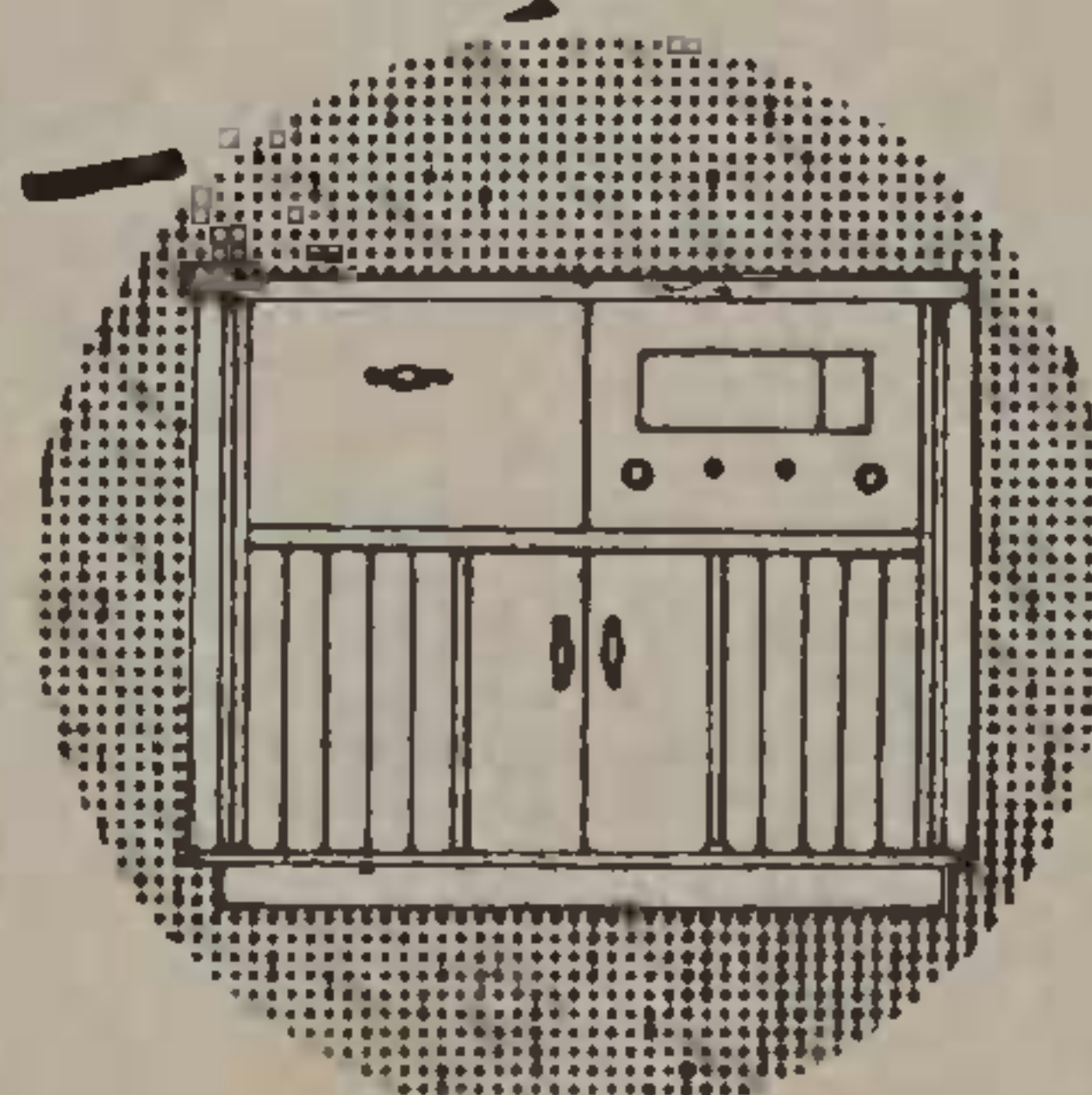
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AN AUTO-TRANSFORMER FOR PROVIDING ADJUSTABLE MAINS VOLTAGE

This article describes a simply constructed auto-transformer which enables the A.C. input voltage for light electronic equipment to be adjusted at times when the mains voltage is higher or lower than the statutory 230 volts.

Experimenters who live in areas where the mains voltage seldom, if ever, approaches 230 volts, frequently feel frustrated when it comes to adjusting the high-tension voltages and bias conditions for a new piece of equipment. It is most desirable that these be set correctly with the primary voltage at, or about 230 volts, otherwise there may be a danger of exceeding the voltage ratings of certain tubes. If, for instance, the plate voltage is set at 250, when the primary voltage is only 205, then, if the apparatus is subsequently operated when the mains voltage is 230 or more, the plate voltage will be much nearer 300 than 250. For many of the tubes in current use, this is dangerously high.

One way of overcoming this difficulty is to use a stabilized A.C. supply, but few amateurs could justify such an expenditure. However, there is a much cheaper, and quite satisfactory way out of the difficulty. This is to use a multi-tapped auto-transformer, giving increments or decrements of, say, 5 volts.

If one's junk-box does not boast a disused or burnt-out power transformer, one can usually be picked up fairly cheaply. Apart from this item, the cost of the completed transformer will not exceed fifteen shillings.

Designing the Winding

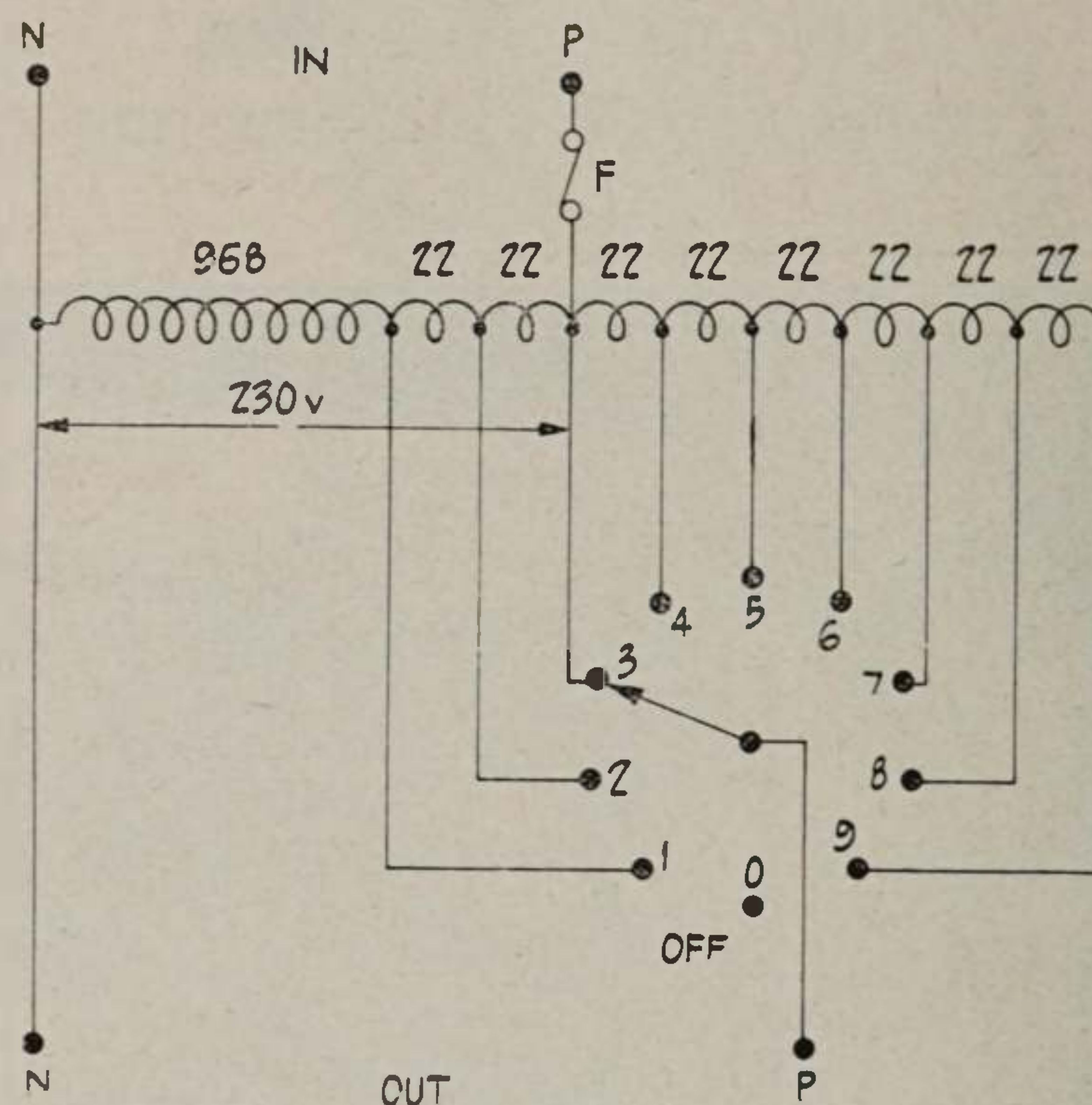
Most constructors will want to know just how many watts a certain core size will handle, so that they can estimate whether or not a core is large enough for their purpose. This is quite easy to do without going deeply into transformer theory, simply by applying a formula to be found in the Radiotron Designers' Handbook in the chapter on transformers. This states that the core area required for a power transformer is given by the formula

$$A = \frac{\sqrt{V.A}}{5.58}$$

where A is the area of the cross-section in square inches, and V.A is the required output in volt-amperes. Alternatively, the formula may be turned round to read

$$V.A = 33A^2$$

which will be much handier when you have a given core and want to know how much it will handle. Note that although a core of 1 square inch cross-section will handle, according to this formula, only 33 watts, one



Circuit of the auto-transformer, with the numbers of turns that suited a particular core size. These numbers would not hold for all cores, but a method of working out the required turns-per-volt is given in the text.

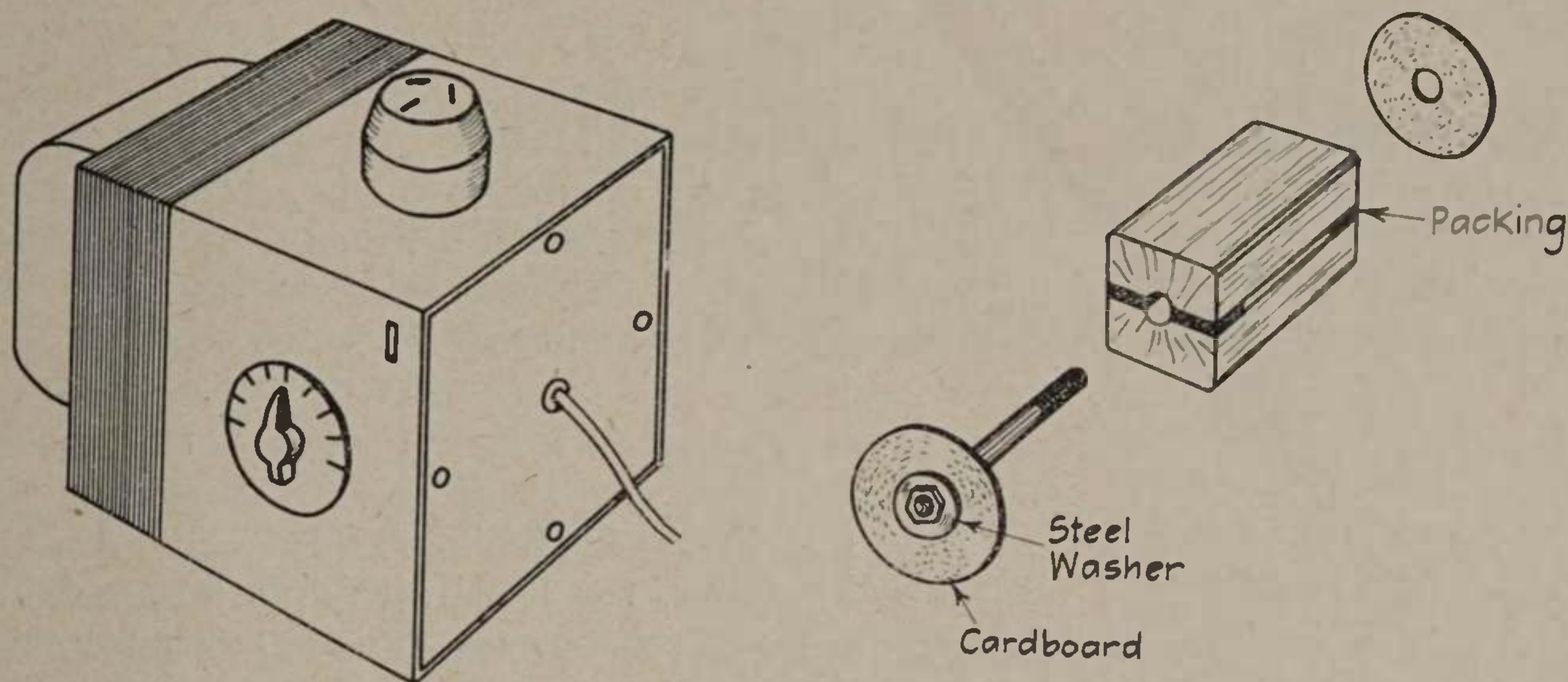
of 2 square inches will handle four times this, or 128 watts. It will be noted, too, that commercial transformers usually have a good deal less iron in them than this formula recommends, but this is for economy's sake, and allows a much greater temperature rise than is advisable when transformers are hand-wound at home, without benefit of impregnation plant, and sometimes, of proper insulating materials.

Having decided this much, it is important to know, before commencing to wind, how many turns should be put on the primary. To find this, another formula can be used—

$$N = \frac{1780}{A}$$

where A is again the core area in sq. in.

This is for a 230-volt primary, at 50c/sec., which is the only case of interest at present. It can be seen that a larger core, as well as increasing the power-handling ability of the transformer decreases the number of turns needed, which in turn increases the size of wire. It should be mentioned at this stage that the power formula quoted above assumes that the window of the core is



Illustrations showing one method of mounting the transformer, with a box containing the adjusting switch, and at the right, the method of making a winding mandrel.

full, and that only a reasonable amount of insulation is used. For example, if a large core is used in the expectation of building a transformer capable of handling a good deal of power, this power will not necessarily be realized if the wire size used manages to get the required number of turns on the core, while still leaving room for as many more again!

For estimating how many turns should be put on each of the small windings, it is quite sufficient to assume that the voltage ratio will be exactly equal to the turns ratio. This is strictly true only when the transformer has no losses at all, but the error is very small in the case we are considering, and can be ignored.

The formula giving the number of turns includes a factor for the voltage applied to the winding, as one might expect, and can be re-arranged to give the number of turns per volt applied to (or obtained from) the winding in question. The figure yielded by our formula is

$$\text{Turns/Volt} = \frac{7.74}{A}$$

where, as before, A is the core cross-sectional area. Thus, if the core is one of 2 square inches, the windings would all have $7.7/2 = 3.87$ turns per volt.

Thus, if 1-volt steps were required on the adjusting winding, taps would be bought out every 4 turns. The steps would then be slightly greater than 1 volt, but this could not be helped.

Before undoing the bolts which clamp the laminations together, measure the thickness of the stack. Then disassemble the transformer, noting the way the laminations fit together. The old winding is discarded, although a study of its construction may help one when it comes to making the new winding.

Make a wooden former to fit the bobbin of the old winding, or, if making a new bobbin, make the former about one-sixteenth of an inch wider and thicker than the core of the transformer, and about the same amount shorter than the length of the "windows". Drill a hole

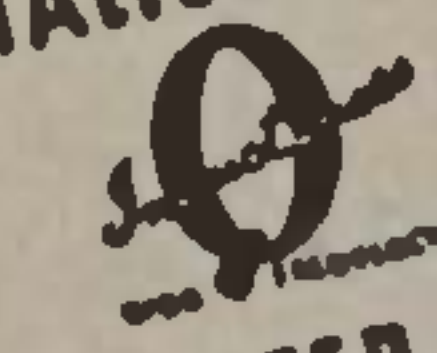
on the longitudinal axis of the former, to take a $5/16$ in. or $3/8$ in. bolt. When the former and cheek plates are assembled, the bolt should have about one inch of thread projecting beyond the nut. Since this portion is gripped in the chuck of a lathe or drill when winding the coil, care should be taken to drill the hole accurately, otherwise the former will wobble badly.

Next split the former along the hole, and remove a small amount of wood from each half. Four pieces of packing are used to restore the former to its original width. Removal of these packers enables the former to be collapsed and removed from the finished winding. It is also necessary to sand the former to a smooth finish to facilitate its removal.

LOW-VALUED RESISTORS (Continued from page 18) would mean 2.2 ohms, while Red, Red, Silver would mean 0.22 ohms.

Gold and Silver for Tolerances

The use of gold and silver to represent tolerances is quite well known, and the use of these colours for indicating $\times 0.1$ and $\times 0.01$ need not cause any confusion, for when the gold or silver band represents a tolerance, it is the fourth band. Thus, a resistor reading Yellow, Mauve, Gold, Silver, would be 4.7 ohms, 10% tolerance.

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*Public Address***FEEDING SPEAKERS FROM LONG LINES**

P.A. operators sometimes do not realize just how much amplifier power can be wasted in heating up long lines used to feed the speakers. This short article gives some facts and figures for various conditions of operation of speakers.

Resistive Losses in Lines

When speakers are connected to their amplifiers through long lines, as they often have to be in public address installations, it is not always realized that the resistance of the lines can soak up an appreciable part of the power fed to the input end. Indeed, it is not too much to say that this loss has often been the cause of "inexplicable" failure of a P.A. set-up to provide quite as much noise as was originally intended. Needless to say, the effect is worse the longer the lines, and the lower the impedance of the speaker or speakers attached to the far end. For example, suppose it is required to feed a $3\frac{1}{2}$ -ohm speaker. If we assume for the sake of simplicity that the speaker impedance is truly resistive, a simple calculation shows that if the line resistance is equal to the speaker impedance, only a quarter of the expected power will be delivered to the speaker.

If the loss in the line is to be no more than ten per cent., which represents a loss of only 1db. in speaker output power, *the line resistance must be not greater than 0.054 times the speaker impedance.*

This means that for a 3.5-ohm speaker, the line must not have a resistance greater than 0.18 ohms, while for a 15-ohm speaker, the line resistance must not exceed 0.81 ohms.

Of course, if greater losses than these can be tolerated, the line resistance can be higher, but this is a good figure to work to, because no one wants to provide audio power, which after all is expensive, solely to throw it away again as heat in some lines!

From the wire tables, it is not difficult to calculate the lengths of line, of various wire sizes, that can be used for given speaker impedances.

The Same for Lines Feeding Transformers

One way out of the line resistance difficulty is to use a line of fairly high impedance, with a transformer at each speaker or group of speakers. If this is done, the rule given above holds just as well if the line impedance is substituted for the speaker impedance. Thus, *for a 500-ohm line, the allowable line resistance for 1db. loss is 0.054×500 , or 27 ohms.* Incidentally, it can be seen that the allowable line resistance is inversely proportional to the impedance of the load at the far end.

Some Practical Cases

In actual practice, few P.A. operators keep a wide selection of wires suitable for running temporary or permanent speaker lines, so that it will be much more practical here if we quote actual figures for a few commonly used types of wire. In all cases, the amount of wire considered is twice the distance run, since a 1,000 ft. line contains 2,000 feet of wire, so that readers need have no fear that we have slipped in our calculations by a factor of two! We will take the following sizes.

- (1) 23×36 gauge tru-rip flex.
- (2) 3×0.036 V.I.R.
- (3) 7×0.029 V.I.R.
- (4) 1×18 gauge bell-wire.

Working out from the wire tables, we find that the resistances of lines made from the above four types of wire are:

- | | |
|----------------------------------|---------------------------|
| (1) Tru-rip Flex | 15.3 ohms per 1,000 feet |
| (2) 3×0.036 V.I.R | 5.24 ohms per 1,000 feet |
| (3) 7×0.029 V.I.R. | 3.71 ohms per 1,000 feet |
| (4) 18g. Bell Wire | 10.12 ohms per 1,000 feet |

In the table below, we have worked out the lengths of these lines that can be used with various speaker impedances, and with a 500-ohm line, on the assumption that the loss in the line shall not be greater than 10 per cent. of the power fed into the line.

Table 1.—Length of line allowable for various load impedances and wire sizes, for a maximum loss of 10 per cent. (1db.) Lengths are given in feet run.

Wire size	Load impedance (Ohms)						
	3.5	4.0	8.0	15	30	45	500
(1) Tru-Rip	12	14	27	53	106	159	1765
(2) 3×0.036 V.I.R.	34	40	80	155	309	464	5152
(3) 7×0.029 V.I.R.	48	57	114	218	436	655	7278
(4) 18g. bell wire	18	21	42	80	160	240	2670

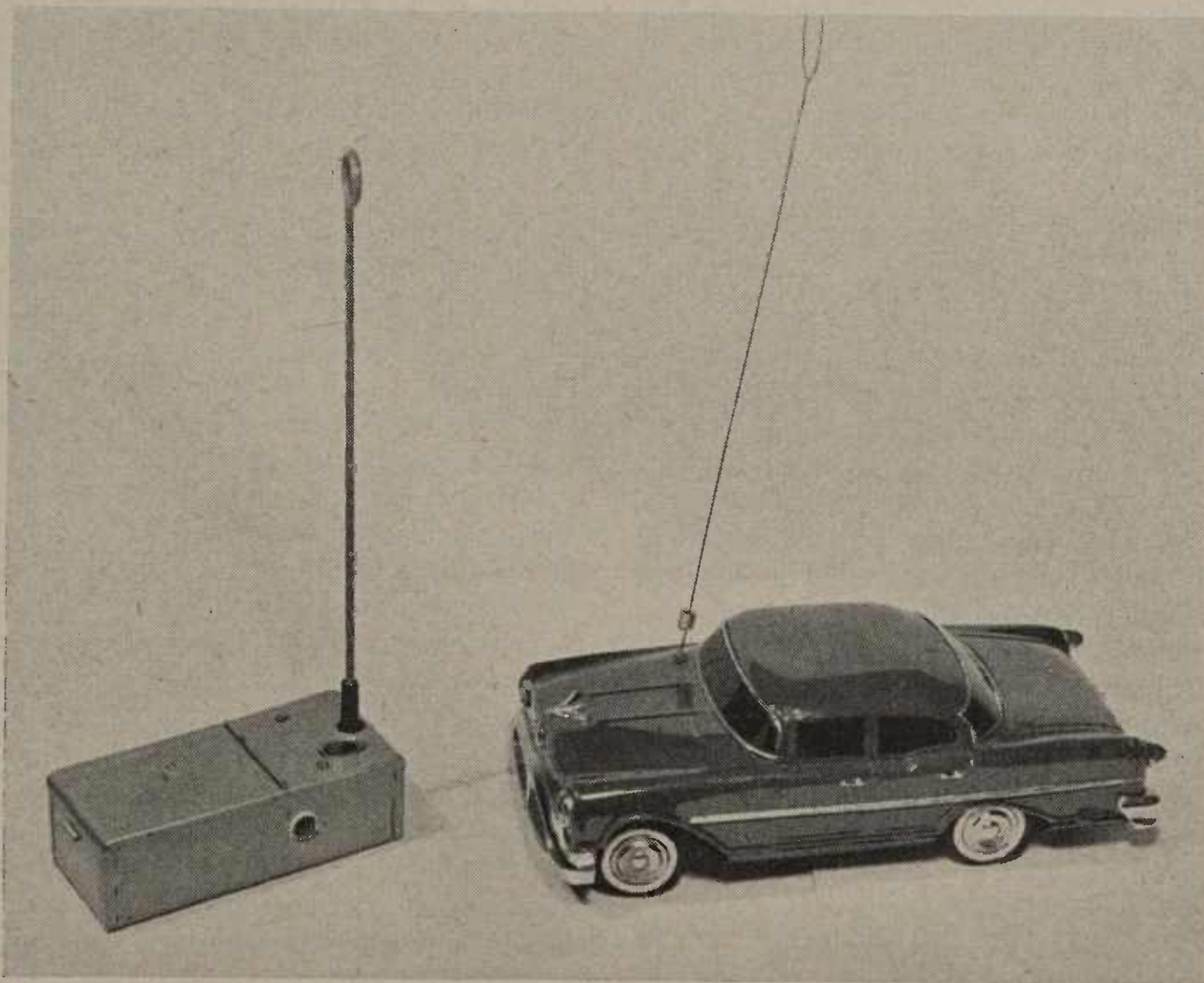
Other Applications

It can readily be seen from the above that when impedances are low, very heavy wire is needed to carry the high line currents without too much loss. This is a factor which may need taking care of in situations other than public address installations. Intercom. wiring, for instance, is a case in point. Here, the speakers (also used as microphones) are usually of very low impedance, and so the designer of a system must choose between fairly high power available per speaker, and low line resistance. In cases where the power available is higher than is essential for the speakers, a good deal of loss can be tolerated, and the cheaper answer may well be to wire for much greater loss than the above table suggests. Since 10 per cent. loss is almost exactly 1db., three times the lengths shown will give a loss of

3db., or half the power fed into the line. Thus, for a simple intercom., in which no high noise levels are encountered near any of the speakers, and in which only one speaker at a time has to be fed, line loss would scarcely be a problem. The amplifier is probably capable of 3 watts output, so that a loss of 3db. in the line would still make $1\frac{1}{2}$ watts available for the most distant speaker. A loss of even 6db. could probably be tolerated, the only nuisance being that with a fixed setting of the gain control, the closest speaker could receive this much more than the farthest one. This could be fixed, however, by inserting intentional loss into the near speaker's line so as to equalize the levels.

Each case should be examined on its merits, however, and large intercom, or announcing systems need to be carefully planned in terms of line resistance as well as in all other respects.

Radio-Controlled Car!



This model car was made in Japan, and was bought in Hong-Kong for the equivalent of £4 10s. 0d. in New Zealand currency. It is controlled by radio, with a stated maximum range of ten feet, and an actual range of about six feet. The most surprising thing about it is not that it is controlled by radio—that is fairly commonplace today, but that the techniques used go right back to the very earliest days of radio. The receiver uses a coherer as a detector, while the transmitter is an induction coil with a buzzer interrupter on the primary side and a spark gap in the secondary! An amazing amount of control is provided by means of a stepping selector, which starts, stops, and steers the model in a pre-arranged sequence of operations. It is quite possible, however, to manoeuvre the model in any desired way, provided enough space is available. A major disadvantage is the rate at which the car shews up No. 950 cells, three at a time.

DBM. AND DBV.—WHAT ARE THEY?

Most of us are quite familiar with the decibel notation for expressing power levels, and quite a large number of people may be heard blithely using the term Decibel, or "dee bee" (for db.) even when they do not really know what it means! It is quite understandable, under these circumstances that when books and periodicals use such variations as dbv. or dbm., a good many of us are privately somewhat confused, even if we won't admit it to anyone else, because the said books always seem to assume that everyone reading them are fully aware of what they mean.

The Decibel a Power Ratio

The decibel is merely a convenient means of expressing NOT an absolute power level in watts or milliwatts, but a *ratio* of powers. It is not proposed to go fully into the theory of the decibel in this short article, because very complete explanations are to be found elsewhere, as in the "Radiotron Designer's Handbook", Chapter 19. What we should emphasize is that the decibel is *only* a ratio, and unless we already know, through having been told, what power is represented by zero db., it is impossible to say what any other figure, such as -6db. , or $+3\text{db.}$ represents in terms of actual power. For example, a change of $+6\text{db.}$ is almost exactly a ratio of four to one, while a change of -6db. is a ratio of one to four, or one quarter. If the reference level is the maximum power output of an audio amplifier, and we have a curve of power output versus frequency, with the power output scale expressed in decibels, it is usual to let 0db. on the scale represent the maximum power output. Then, departures from this output, as the frequency changes will always be in the direction of less than the maximum, and the scale will read downwards, and the divisions should be marked with negative numbers, representing "db. down", as the usual jargon has it. In a case like this, the graph is useful as an indication of amplifier performance, even if the maximum power output in watts has not been stated, because it still tells us the *relative* performance of the amplifier at all frequencies covered by the graph. But unless the actual power at maximum output is stated, we can still not say how many watts will be delivered by the amplifier at any particular frequency. If maximum output is given as six watts, however, we know that where the curve shows the output to be -3db. , the output is one half of the maximum, or 3 watts, and where it is -6db. , the output is only $1\frac{1}{2}$ watts.

Telephones the Origin

The origin of the decibel is to be found in telephone work, where even in the early days it was essential to

have some means of specifying the signal level on a line. Since then, broadcasting and other activities have found a similar need for specifying signal levels, and the decibel has come into very general use. For this sort of work, a number of standard reference levels have been proposed and used, but today, the most widely used one is a power level of 1 milliwatt. In order to indicate briefly that a particular figure is given with 1 milliwatt as reference level, it has become conventional to add the letter m to the abbreviation for the decibel, making dbm. Thus, whenever one sees a signal expressed as so many dbm. , one knows immediately that the reference level is 1 milliwatt, so that if desired, it is immediately possible to translate this figure into actual power. For instance, $+10\text{dbm.}$ means 10 milliwatts, while -20dbm. means 0.01 milliwatts, or 10 microwatts.

Decibels of Voltage Gain

In spite of what we have said above, it has become common practice to use the decibel as a ratio of voltage, instead of one of power, in certain circumstances. This is a pity, because it has been the cause of much confusion, even among the most knowledgeable. It will still be done, however, because of its convenience, so that a special term has been invented called "decibels of voltage gain", and abbreviated dbvg. This term should be used when the decibel is used to express voltage gain, as in voltage amplifiers, where actual power relationships mean very little. For instance, if a valve has a stage gain of 100 times, it can be said to have a gain of 40dbvg. , thus indicating to the reader that the decibel is being improperly used merely to indicate the ratio of voltages at two points in a circuit, irrespective of real power levels.

Microphone Outputs

Considerable difficulty and confusion reigns in the matter of specifying the output levels of microphones, pick-ups, etc., and to help clear up this, the abbreviation dbv. has been coined. It *always* means output relative to 1 volt as the reference level, once again, with power being ignored. An output given in dbv. therefore means the ratio of the output being specified to an output of 1 volt. It is usually used only with devices such as crystal microphones, for which the impedance of the load is very high, and where matching of impedances is never used.

In conclusion, while this short article is not intended as a treatise on the use of the decibel notation, it may help to clear up some misunderstandings, and to enable readers to interpret some of the figures that are often seen quoted in advertisements and articles.

ELECTRONICS AT FARNBOROUGH

Electronic engineering is now a vital, integral part of aeronautics. Like the new atomic industry, aviation is completely dependent on electronics for its day to day operation, its safety and its future progress.

Air defence, at its new speeds of operation, requires a controlling brain that must work many hundreds of times faster than the nimblest human brain; the factors of civil flying control are now so complex that they require electronic simplification before they can be passed to a human controller for decision; parameters of aircraft and missile design call for calculations that can no longer be done by slide-rule, pen, and paper.

Even the economics of commercial flying and the strategy of war call for electronic computers while the down-to-earth business of building aeroplanes and engines relies increasingly on machine tools that have become mechanical slaves that carry out the orders of electronic masters.

This importance of electronics in the air is impressively shown at the Society of British Aircraft Constructors' Flying Display and Exhibition at Farnborough (September 1 to 7) where 21 firms belonging to the Electronic Engineering Association and 22 members of the Radio and Electronic Component Manufacturers' Federation are exhibiting.

The guided weapon display is a major feature of Farnborough this year. Every missile that can be seen is dependent on electronic control and each called for the extensive use of electronics throughout its design, building, and flight-testing phases. A missile without electronics would be as dangerous to the enemy as a muzzle-loading cannon.

Major Trends

There are two major trends in electronic development to be seen. One is the way in which the industry is solving the problems of controlling the crowded airways of the jet-driven future. The other is the quite spectacular advance in reducing weight and size of airborne equipment while increasing its robustness.

Both these factors will not only greatly increase flying safety but lead, obviously, to more economic operating techniques. In other words, safer and cheaper flying.

From the point of view of the control of flying a main feature is simplifying the work of the controller by allowing electronic equipment to "consider" all the available information on a situation and passing on to the human controller only the relevant information. One control system, for instance, shown by Marconi's, includes what is known as F.P.I.—future position indicator—which enables the controller to determine the time of arrival of an aircraft at a given point

or alternatively to see where an aircraft will be at a given time. This enables an immediate assessment to be made whether a conflict of two or more aircraft tracks is likely to arise in the near future. In other words, it gives warning of possible collision dangers in crowded air spaces in plenty of time for the aircraft tracks to be altered.

Civil Aviation Data Handling (Marconi's) is another new technique produced as an answer to the increase of traffic density and operating speeds. It is a method of storing flight information electronically and presenting it to the controller on demand.

The Decca Radar Company shows at Farnborough several comprehensive display and operations room installations which they are building for civil use in conjunction with various surveillance radars. The use of high-power, long-range radar equipment is complicating the problem of handling radar information in the traffic control organizations and it stresses the urgent need for the new electronic equipment that can integrate information from more than one source.

Several manufacturers have produced and will be showing display systems that are much more comprehensive yet much more easily comprehensible in presenting information. The Decca Interscan system, for example, provides for the addition of extra information such as the position of runway extension markers, beacons, the identity of each aircraft shown, all of which is added electronically to the screen. Cossors will be giving a working demonstration of secondary radar, the system in which the radar beam triggers off a small transmitter in the aircraft to give a more powerful response.

E. K. Cole feature an air guidance system which is at the other end of the scale. They claim that it is Britain's lowest-priced VHF automatic direction-finding equipment. It employs new methods of deriving bearing and sense from an Adcock aerial, permitting an installation of great simplicity and reliability.

Smaller and Tougher

This year there is an outstanding, one can say dramatic, development in the miniaturization of electronic equipment for aircraft by using transistors instead of valves. The importance here is that transistorization brings with it two factors of paramount value in aviation—rugged reliability and a very great saving in weight of equipment and the amount of power needed.

An example: Standard Telephones and Cables have applied this technique to their VHF airborne communications and navigation equipment. An intermediate frequency amplifier will be on show that is *one quarter* the weight of its valved counterpart and consumes only

one-twentieth of the electrical power from the aircraft's supply system. Another S.T. & C. exhibit using transistors is a remarkably accurate radio-altimeter which can indicate the height of an aircraft above the ground to less than hedge-hopping altitude—two feet. This instrument is a vital necessity in the new techniques of pilotless flight which have been developed by the Ministry of Supply and the Royal Air Force. Many hundreds of automatic take-offs and landings have been made and the electronic industry has developed equipment of remarkable accuracy and reliability to make this possible.

Another interesting weight-saving example is airborne teleprinter equipment shown by Standard Telephones and Marconi's. This transistorized apparatus is able to receive and print out in plain language continuous weather reports at 100 words a minute. It is in experimental use by, among others, B.O.A.C. on the Atlantic route. The complete Standard Telephones equipment weighs only 45 lbs and consumes only 1.5 watts of power—about one-fiftieth of the energy needed to operate a domestic television set.

Transistors are featured in some of the Pye Telecommunications equipment and particularly interesting is an overspeed and rotation indicator which is designed for the Rolls-Royce *Conway* engine. It was potted component "bricks" on printed circuit bases for increased reliability. Warning of engine overspeed is given by flashing lights at the flight engineer's or pilot's panels and Pye believe it to be the first application of transistors in airborne control apparatus.

Several firms are showing how space and weight can be saved by transistors in amplifiers for making passenger announcements and for communication to crew stations. Murphy Radio are showing a 40-watt amplifier which weighs only 8 lbs and measures 18 in. by 8 in. and 2½ in. Ultra Electric show a full transistorized communication control system designed for B.O.A.C.'s Comet aircraft. The same firm features a transistorized jet pipe temperature control amplifier.

Guided Weapons

The electronic industry has done outstanding work during the year in control and guidance systems for missiles. Of this, unfortunately, little can be said for security reasons. At government level, however, the opinion has been given that British weapon control systems now being built and others in development are significantly ahead of anything else in the world. A degree of reliability which seemed impossible two or three years ago has been achieved. Here, again, transistors have been introduced to help in the three important fields: space-saving, economy in weight and reliability.

E.M.I. Electronics have obtained permission at the last moment to show some of their most advanced telemetry equipment which is used to radio vital informa-

tion from rockets and guided missiles while in flight. The components used in this apparatus have to pass elaborate and violent tests to ensure that they can withstand the fierce acceleration forces and vibration that arise in rocket flight. E.M.I. will show how these tests are made in the laboratory.

"Sting-Ray" radar, from the British Thomson-Houston company, is the latest defensive radar to go into production and for the first time the Ministry of Supply has given permission to reveal at least restricted information. "Sting-Ray" is an essential element in Britain's surface-to-air weapon system. It is a mobile target-tracking and target-illuminating radar and its job is to locate the target, track it and at the same time "illuminate" it with sufficient radar energy to enable the Bloodhound or Thunderbird missiles to home on it.

Seaslug, the Navy's first ship-to-air missile will be part of the weapon display and the Sperry Gyroscope Company, as one of the three main contractors responsible for it, will show a test vehicle for the Seaslug as well as the ship-borne test equipment which is part of the weapon system.

"Electronic" Thinking

There is now such wide use of electronic computers in aviation, both on the ground and in the air, that it is only to be expected that they are well represented at Farnborough. Among the many control and calculating instruments shown by Elliott Brothers (London) Ltd. is an interesting air data computer which is a miniature "brain" that collects, collates, and disseminates continuous information about the atmosphere through which an aircraft is flying. Through transistor and magnetic amplifiers the information is passed to cams and servo-operated gearboxes and thence to the autopilot and presentation units. The computer deals with factors such as indicated air speed, true air speed, Mach number, height rate of climb.

A computer on quite different lines is a new piece of equipment being shown for the first time by Solartron. This is the "Minispace", one of the smallest and cheapest analogue computers yet made. The firm calls it an electronic slide rule, for it is no larger than a small radiogram and can be used at the side of a desk or a laboratory bench. It enables actual system performances to be set up and proved electronically in a few hours, eliminating months of work and the expense of prototypes. As the cost of electronic brains is often believed to be enormous, it is worth recording the price of the "Minispace"—£1,500.

A new method of presenting a 5-foot picture of radar situation is demonstrated by Kelvin Hughes. The radar picture is photographed on cine film which passes immediately through an automatic developing, fixing, and drying process. This is so fast that the film can be

(Concluded on page 37)

ELECTRICAL AND TRADE SECTION

TRADE WINDS

Stereo Discs Released in Britain

Latest news on the stereo-disc front is that July saw the first release in Great Britain of stereophonic discs. These were from the Pye Group, under the Pye label, and comprises eight L/P records on which is represented a wide variety of programme material.

The records include a demonstration disc, consisting of a series of excerpts from the first releases, but which also provides tones from 40c/sec. to 15kc/sec. for alignment of amplifiers, a 440c/sec. tone for balancing of the two channels, instructions for setting levels, and other matters of interest to the newcomer to stereophonic reproduction.

The musical offerings range from an organ recital recorded in the Royal Festival Hall, and several large works played by the Halle orchestra, to a record of Larry Adler playing, among other things, the Rhapsody in Blue, and a collection of Sullivan overtures.

Stereophonic Playing Equipment Offered

Stereo discs are, of course, not much use unless the appropriate playing equipment is available too, but British manufacturers appear to be well "on the ball", since a number of them are offering equipment of one sort or another. For example, Rogers Developments are advertising a stereo control unit, and pairs of ten and twenty-watt amplifiers. Pamphonic are advertising a stereo amplifier, comprising twin power amplifiers and control unit all in the same box. Sound Sales Ltd. have a control unit for stereo listening, which has a wide variety of playing characteristics, as well as pre-amplifiers for tape playback, direct from the head, for both the C.C.I.R. and N.A.R.T.B. replay characteristics. It even has provision for inputs from two tuners, to take care of the possibility in the future of stereophonic broadcasts. Wright and Weaire are cashing in on the market (if any) for stereo tape reproduction by offering stereophonic versions of the Ferrograph tape recorders.

A Notable Omission

The one thing that strikes the observer at this stage is that there are no stereo pick-up heads advertised. It is known, of course, that Ronette have one, but whether it is in full production or not is a moot point. Other well-known makers of pick-ups seem to be keeping very silent at the moment, from which one can conclude that they are in the throes of development still; obviously, until a reasonable range of pick-up heads is available, it will not be of much use to advertise stereophonic discs, as Pye have done already!

No Comparison With New Zealand

It is natural that all of us who are interested both in the techniques of gramophone reproduction, and in music itself will look forward eagerly to hearing British stereo discs for the first time, but we would like to issue here a word of warning. It by no means follows that the records and their playing equipment will be available here in the near future. Nor is this merely a function of the import restrictions. Record companies here will clearly examine the stereo situation in Britain very carefully, for some time, before any decision is made to market them here. Undoubtedly a few sample discs and pick-ups will creep in and be used mainly by those technically interested, but that is a far cry from general availability. It looks as though we will have to contain our souls in patience for some time yet, or else takes a trip to the United Kingdom!

* * *

New Post for R. J. Gibbs

Pye Limited take pleasure in announcing that Wing Commander R. J. Gibbs, O.B.E., has joined the Pye Organization, with his headquarters in Wellington. Wing Commander Gibbs will be specializing in Telecommunications sales, and his wide experience in communications matters will be available to present and future customers for telecommunications equipment.

Wing Commander Gibbs was, at the time of his retirement from the Air Force, Director of Signals, R.N.Z.A.F., and subsequent to his retirement was Adviser on Telecommunications to the Police Department in New Zealand for the purpose of compiling a report on police telecommunications requirements.

His experience in telecommunications generally has embraced many countries, and prior to his retirement from the R.N.Z.A.F., Wing Commander Gibbs was Chief Signals Officer of the Fighter Group responsible for the air defence of the South of England.

* * *

New R.I.A.A. Member

The spotlight of the recording industry stage, focused brightly on Chicago, U.S.A. recently, with announcement that Irving G. Green, president of the Mercury Record Corporation was elected to the highly respected position of president of the industry's guiding-council, the R.I.A.A. (Record Industry Association of America. Inc.).

In the U.S.A. recording companies who are active members of the R.I.A.A., constitute almost 98% of the

total volume of the rapidly approaching \$500,000,000 industry.

The Mercury Record Corporation, which Mr Green ably heads, is the only major phonograph record producing company with headquarters in an area other than the east or west coast of the States. Mercury, a Chicago firm, has risen rapidly in the 12 years since its inception to achieve the coveted position of being rated as one of the top five companies in overall volume, the others being R.C.A. Victor, Columbia, Capitol, and Decca.

Mr Green decided to devote himself exclusively to the highly-complicated field of phonograph manufacturing, and has headed Mercury since the company's beginning. Under his leadership, the firm has grown into international importance with affiliates and licensees located throughout the world.

Foreseeing the need for a governing group, Mr Green has been active in the R.I.A.A. for many years now. Prior to being upgraded to the post of president, Mr Green had previously served as a member of the board of directors.

His election expands the horizons of the recording world toward Chicago, and greatly enhances the position of his own company, Mercury Records, as one of the recognized leaders in the industry.

* * *

Appliance Dealers' Association Formed in Auckland

Worried that the buying public is not always getting fair treatment, a group of Auckland home appliance retailers has just formed a co-operative "give service" association. Its main aims are to ensure that customers are given full after sales servicing and complete assurance of quality and responsible trading.

The group has been concerned particularly some inferior products have been getting past the retailer, with the result that an atmosphere of customer suspicion of home appliance dealers generally is being created. Today, members condemned some appliance dealers for their "nonchalant attitude toward customers who have completed their purchases, even though some items bought represent a considerable investment."

Executive members of the new association hope to achieve their objectives through establishing:

- (1) A product testing panel.
- (2) A buying guide panel to advise association members.
- (3) A co-operative or group buying programme.
- (4) A mutual customer service for repairs.
- (5) A customer-to-benefit programme.

Chief benefits to the public, executive officers claim, will be in the form of product guarantees; more competitive product prices; adequate pre-sale testing of

products; easier and cheaper after-sale repairs and service and customer assistance plan such as an inter-shop credit and incentive systems.

The new group has just registered (July 31) as the Appliance Dealers' Association, with an initial capital of £10,000. Initially it will be a closed group, but it is intended to extend the association's membership and activities eventually to every part of New Zealand. The first chairman of the association is Mr I. McLeod, of Avondale, who has had a wide experience in the formation and control of this type of dealer organization. Mr McLeod was associated with the founding of the Four Square organization and helped this group through its early period of growth. He said today that the pooling of technical and business knowledge by appliance dealers must guarantee a better service to customers.

Mr McLeod said: "Every article sold by members of the association will bear the letters A.D.A.—the symbol of the Appliance Dealers' Association. We intend that this will become a symbol of quality and of our concern for the buying public. We are not being entirely philanthropic, but we are convinced that by looking after customers we will create a more pleasant trading atmosphere and benefit ourselves through increased sales.

"Products bearing our symbol will be serviced at lower rates and by any member of the association, regardless of whether the item was bought from a member of the association in Tamaki or Takapuna. A customer credit plan will offer our customers automatic credit facilities at all association stores from the moment that the customer first registers with one member. The cumbersome and embarrassing system of individual credit checks at each store will be abolished. The public will be protected from inferior products by the product testing panel. This panel will include the ablest technical members of the association and in some cases outside experts in a field outside the experience of the panel. Exhaustive tests will be made of every product before members are advised whether or not to stock it. The panel will not hesitate to reject products which do not satisfy its standards, or which do not carry an assurance of adequate after-sales service or replacement of parts. The association will help members by ensuring that they offer their customers integrity and honesty in their dealings."

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

SALES CONFERENCE DE LUXE

The following report of a sales conference held in Paris by Mercury Records in conjunction with their French subsidiary gives some idea of the "super-colossal" scale on which such things are sometimes done overseas. An obvious query would be "Does it all pay?" We would suggest that it must, hard-headed American business men being what they are!

Mercury recently held its second International Division Conference in Paris. The meetings began with a seminar held with representatives from 32 countries. The main purpose of this initial conclave was a discussion on how the foreign market might be brought into closer alignment with the American bailiwick through closer alliance and surveillance at both ends of the recording cable. Another portion of the meeting was devoted to a review of the gigantic strides made by the International Division in its relatively short history. Finally, the conference ended for the day with David Carroll and Bob Shad, Mercury state-side artist and repertoire executive, describing the firm's recording plans for the future.

The second day began with a sparkling luncheon at the famed Eiffel Tower restaurant. The delegates then re-assembled at the Mercury-Barclay recording studio in Paris, where the first stereo demonstration on the Continent was presented to the delight and enlightenment of the convention. It was necessary to extend the demonstration to four hours in length, at the request of those present, who were completely enchanted by their first introduction to the supreme sounds of stereo tape and disc.

The "coup de grace" was applied when a huge stage show featuring recording artists of the Mercury and Barclay (Mercury's French affiliate) labels was held at the Salle Playel before a capacity crowd. Included in the audience were more than 1,500 of France's record dealers who were the honour guests of the convention. The Platters, who recently were voted the number one American recording act to have visited France last year, received a standing ovation for their performance in headlining the show. Among the other artists to appear were Eddie Constantine, the "American in Paris"; Eddie Barclay and his Orchestra; and Dalida, who currently is the proud performer on the number one best selling record in France. This was on a radio broadcast during the show—Radio Europe No. 1, throughout Europe.

The business formalities over, the delegates were invited to spend a day relaxing on a boat trip up the legendary Seine River. At one of the stops on the boat-outing, a special courier arrived with a first pressing of the soundtrack of the previous evening's stage show, which will be recorded and released on the Mercury-Barclay label in France. This initial copy

was presented to Irving Green, duly inscribed, to commemorate the memorable conference.

Upon returning to Chicago, president Green was quite ebullient about the outcome of the convention. He was particularly enthused about the fine hosting and handling of the affair by Madame Nicole Barclay and her staff, and somewhat amazed at the rapid progress that the French production methods have achieved in the last year. Said Mr Green, "It seemed like an impossible task to produce a finished pressing in the brief period of time between Friday evening and Saturday afternoon, yet none the less, I have that first copy of the album to prove it. Advancement in production standards and rapid techniques of manufacture like this indicate that the horizons of the recording industry are rapidly expanding into a position of great international prominence and it is inspiring to us to come to realize that the Mercury organization is playing an important part in this pioneering period."

Mercury personnel from the United States attending the conclave were: Irving B. Green, the firm's president; Wilma Cozart, vice-president and director of the classical division; David Carroll, album artist and repertoire director; and Bob Shad, artist and repertoire executive, as well as other Mercury representatives from all over the world.

PRINTS OF PHOTOGRAPHS

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

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

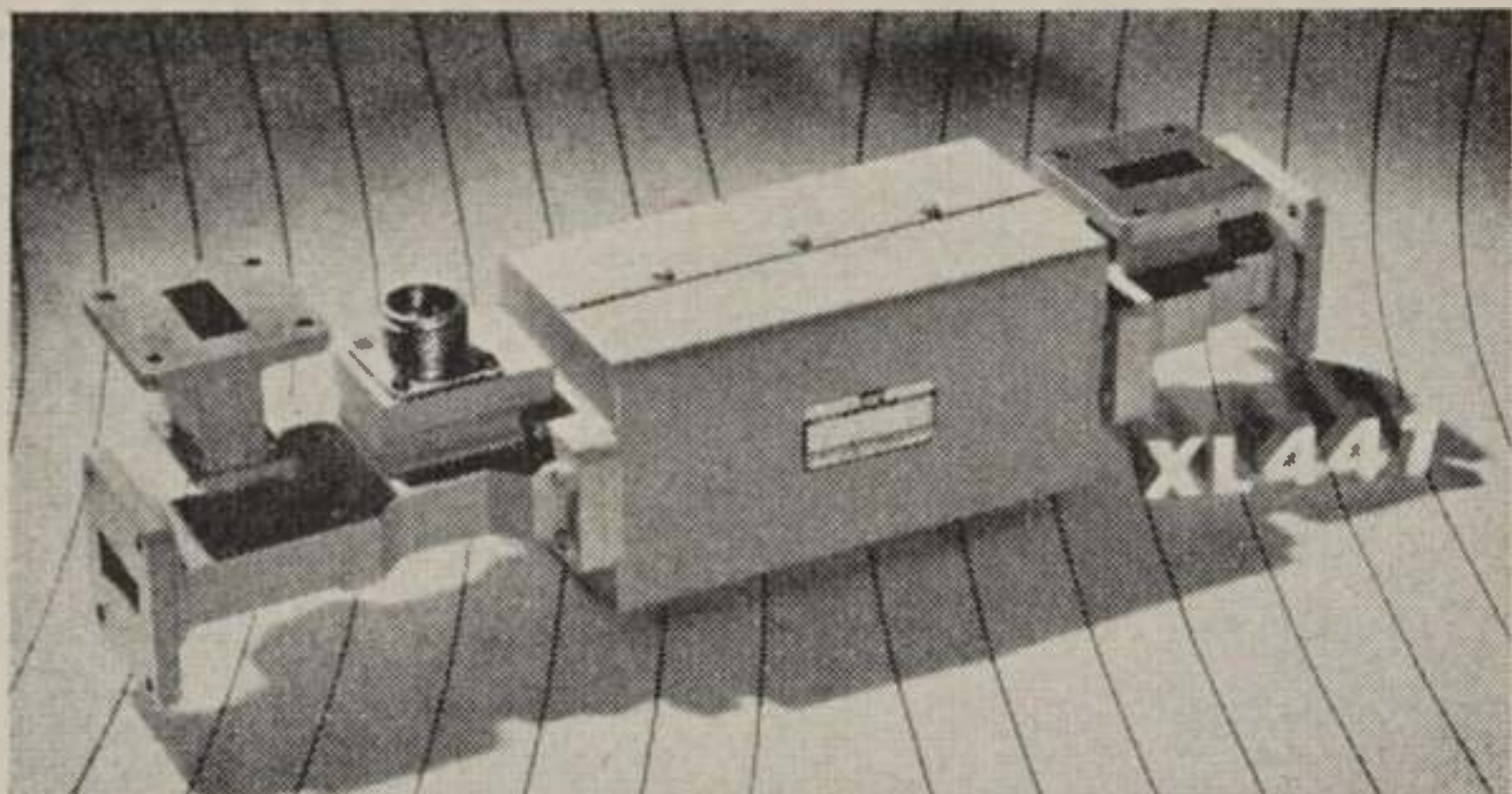
NEW ZEALAND ELECTRONICS INSTITUTE INC. OTAGO BRANCH **SCHOOLS ELECTRONICS COMPETITION — 1958**

Entries are invited from Otago Secondary School pupils for the above competition.

- ★ Four classes of entries.
- ★ Substantial Prizes for each class.
- ★ Exhibition of entries in November.
- ★ Entry forms, including full particulars, required to be in by *October 15* (entries by *October 22*) may be obtained from the Secretary.

T. de GRAUW,
P.O. BOX 504, DUNEDIN.

LATEST OVERSEAS DEVELOPMENTS



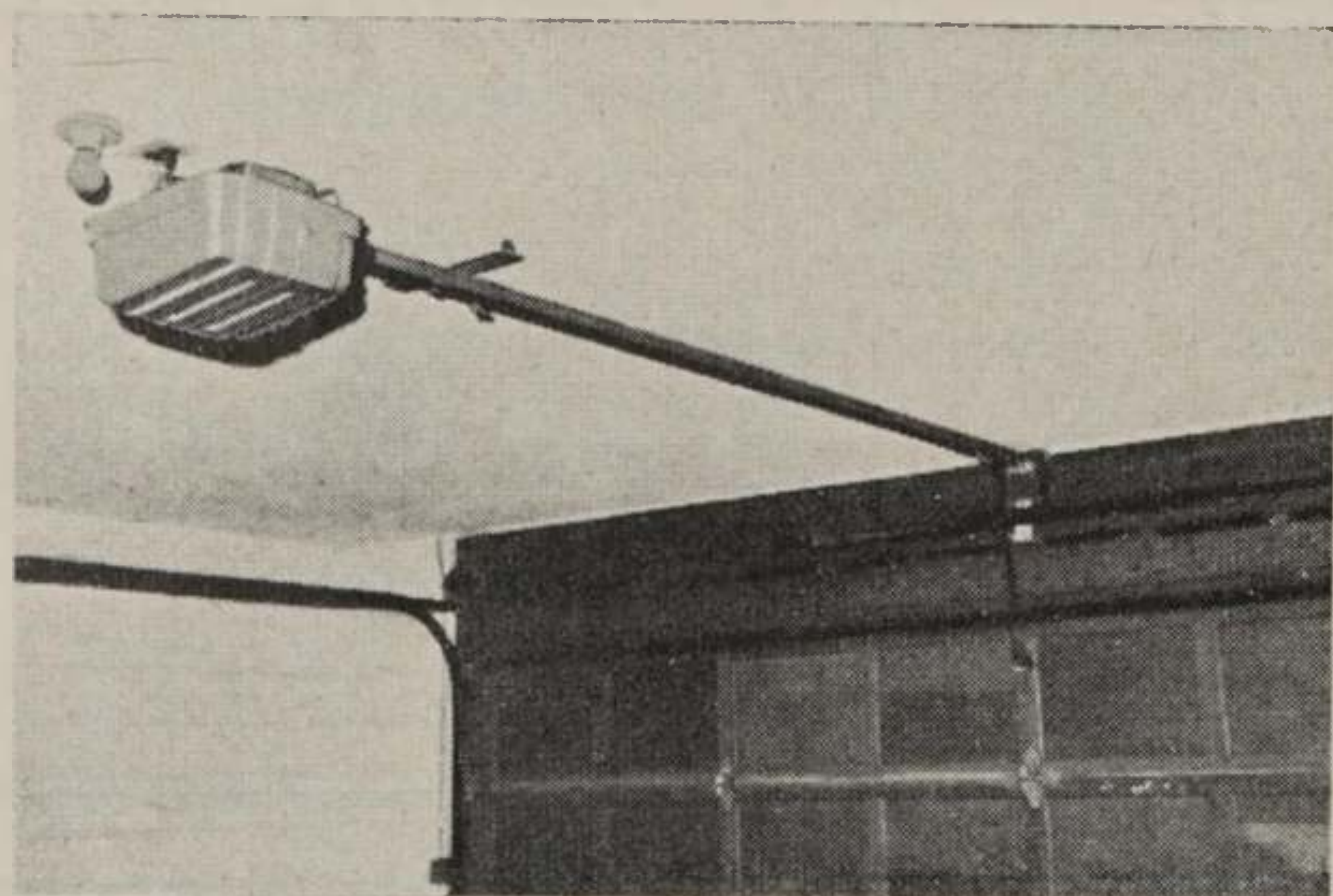
FERRITE DUPLEXER SWITCH

This excellent photograph shows a piece of the most modern microwave "plumbing", which uses special properties of ferrites in a duplexing unit for an aerial system.

* * *

New Radio-controlled Electronic Garage Door Opener

Announcement has just been made of this unique electronic unit, by the Wells-Gardner Company. Its simple operation requires only a touch of a button on the dashboard of the entering automobile—to open, close, and lock the garage door. At the same time, the light inside the garage goes on with the opening of the door, and goes off with the closing of the door.



Some of the important features: permanently lubricated, requiring no maintenance; can be controlled with push button or radio even while door is in motion; door automatically stops when coming in contact with an object, and travels in opposite direction when restarted; screw drive assures positive action not obtainable with chains or cables; full $\frac{1}{4}$ h.p. motor has built-in overload protection and automatic reversing; power plus to lift any door up to 20 feet wide and 8 feet high; requires only 2 inches of clearance between top of door and ceiling; convenient push buttons can be installed in any room, so that operation

can be controlled from inside the home; operates on 110 volt, 60 cycle; powered by a $\frac{1}{4}$ h.p. motor in conjunction with a screw and nut.

Complete details and prices are available from Ad. Auriema Inc., 85 Broad Street, New York 4, New York.

* * *

Improved RCA Types 2N301 and 2N301-A Deliver 85 per cent. More Power Output

As a result of an intensive development programme, the maximum dissipation capabilities of the audio power transistors, 2N301 and 2N301-A, have been increased from the original value of 5.5 watts (at a mounting-flange temperature of 71° C) to 11 watts (at a mounting-flange temperature of 80° C)—a 100 per cent. improvement. As a result, these transistors can now provide in class A service at a mounting-flange temperature of 80° C or below an audio-frequency power output up to 5 watts—an increase of 85 per cent. over the original class A power output of 2.7 watts. The improved 2N301-A is the same as the improved 2N301 except that the former is rated to withstand higher maximum dc and peak collector-to-base voltages.

Providing excellent thermal conductivity made possible by an improved and more compact internal structure, these transistors are specially recommended for use in class A and class B push-pull power output stages of automobile radio receivers, and in other audio applications where high power efficiency, low distortion characteristics, linear current gain over the full range of the collector current, and high reliability are primary design considerations.

* * *

Hospital Fights Germs with TV Camera

The medical student's observation galleries in the operating theatres of Crown Street Women's Hospital will soon be completely deserted.

Instead, students and newly graduated doctors will watch Caesarian and other operations on television receivers remote from the operating theatres.

First Hospital in Australia to Install TV

The Crown Street Women's Hospital is the first in Australia to purchase and permanently install such a closed circuit TV camera chain and the decision to do so resulted from a successful series of demonstrations carried out by technicians of Amalgamated Wireless (Australasia) Limited for the hospital authorities.

Keeps Germs out of Operating Theatre

Apart from its undoubted value as a teaching aid, the TV installation will remove a possible source of germs because doctors have found that certain germs have developed a resistance to modern anti-biotics and that despite germicidal precautions, there is a risk of people carrying germs into the theatre during operations.

Eyes, Lights, and Camera Lens Work Together

The camera will project through the centre of a special light fitting and the doctor's eyes, the beam of light, and the camera lens will all be focused on the same area at the same time, thus giving a clear unobstructed view of the actual operation as witnessed on the television screens.

An audio system is linked with television system and the operating surgeon can describe his techniques to the TV viewers as he proceeds with the operation.

Pulse Transformers*Medium- and High-power Ratings Available*

A Gap-Firing Pulse Transformer from the new transformer facilities of Levinthal, Electronic Products, Inc., Stanford Industrial Park, Palo Alto, California, is being produced. This unit is recommended for application in crowbar protective circuits to 100 kv. It is rated for a secondary peak voltage of 135 kv., a maximum pulse width of $0.5 \mu\text{sec.}$, and a maximum duty of 0.002. The turns ratio is 1 to 15, step-up polarity-inverting.

Available in a series of models to meet individual requirements, these components can be made with wire sizes from AWG 35 to AWG 6, with foil conductors of various types, with coil weights to 100 lb and with overall dimensions as large as $3\frac{1}{2} \times 5\frac{1}{2} \times 8$ ft. Units can be supplied to meet specification MIL-T-27A. A special crowbar data sheet is available.

* * *

High-Resolution Scintillation Transducer Now Available in Two-inch Diameter Size

Combining a high-clarity Levinthal thallium-activated sodium-iodide crystal optically joined to a standard 2-inch photomultiplier tube, the Model NST2 Levinthal Scintillation Transducer offers the combination of maximized pulse height and optimum resolution.

These integrally packaged detection units, housed in overall anti-magnetic shield, are available with crystal diameters of $1\frac{1}{2}$, $1\frac{3}{4}$, and 2 inches, and lengths up to 3 inches as desired by the user. Further variations, including truncated conical ends, drilled wells, or other configurations, can be provided.

In addition to simplifying installation and application, the integral mounting of the crystals and photomultiplier avoids an interface of glass otherwise conventional. Because of this, there is maximum optical contact between the crystal and the photomultiplier.

For low-energy work, extra-thin gamma-ray windows of 5 mils or 10 mils thickness are available. Crystals so mounted have higher detection sensitivity and exhibit improved peak-to-valley ratios.

To provide uniform response to gamma rays intercepted throughout the volume of the crystal, the specially produced thallium-activated sodium-iodide material is given the greatest possible uniformity of thallium distribution. For the transmission of maximum light to the photomultiplier tube, special attention is given to optimum clarity and minimum absorption, particularly in the blue and ultraviolet.

* * *

Ferrite Circulator X-Band, Four-Terminal, High-Power

Providing the function of transmitting input power from one of the four waveguide terminals to the next in sequence, the new Cascade Model X442A Ferrite Circulator covers the frequency band 8.5 to 9.6 kmc.

Applications include the replacement of a conventional duplexer in a radar system. The new unit isolates the transmitter from the receiver t-r tube by at least 20 db and in most cases 25 db, with antenna reflections only, directed to the t-r tube. In such an application, the at-r tube is eliminated completely.

Giving forward insertion loss of 0.5 db, the Model X442A exhibits a vswr of 1.20 with all arms terminated and is capable of 250 kw peak transmitted power, 250 watts average transmitted power. Operating temperature range is from -55°C to $+125^{\circ}\text{C}$. Having a length of 8.4 inches overall, the device has a list price of \$365.

Specification

Equivalent capacity, 1,250 p.f.

Output (at 1,000 c.p.s.) at 1.2 cm/sec., 0.15 volts.

Response, using latest N.A.B. curve — Flat within ± 4 d.b. up to 12,000 c/s.

Load resistance per channel, 1 Megohm.

Weight of cartridge, 12 grams.

Stylus pressure, 6 to 9 grams, depending on tone arm construction.

Designed to track when used with average as well as high-fidelity pick-up arms and, at the same time, give adequate protection to the finest microgroove recordings.



John Gray

JOHN GRAY'S RECORD PAGE

The above intimate "revue", as presented by vocal and piano team Michael Flanders and Donald Swann, is still packing them in at the Fortune Theatre in London. The recorded version by these same artists (Parlophone PMCM 1033) has aroused intense interest and is warmly recommended to those enjoying very easily assimilable satire. Among the songs of topical interest is one about the hi-fi craze, and the whole performance is done with a decidedly refreshing and simple approach. There are other "entertainment" discs of differing nature this month; Robert Farnon's latest orchestral offering, for instance, is called "Pictures in the Fire" (Decca LKM 4190). There is the new Julian Slade musical show, "Free as Air", in which the popular "Salad Days" composer could well have "done it again"—this is an original cast recording and is on Oriole MG 20016. Even Arthur Askey is back in high fidelity. He is on MG 20017 and no one will fail to recognize the title, "Hello Playmates!" He is still telling us of bees, moths, worms and pixies and seems to have lost none of his old enthusiasm. The latest "Perfect for Dancing" record by Tony Kinsman's orchestra is Oriole MG 10017. We are told this is "royalty's favourite dance band" and this is the third disc to be made by what is obviously a first-class dance combination.

AT THE DROP OF A HAT

Fernando Corena, the Swiss-born basso who seems to be stepping into the shoes of Salvatore Baccaloni in the interpretation of what we might call the Italian "buffo" parts, has made an extremely interesting disc of arias from Italian and French operas of the lighter type (Decca LXT 5307). There are three glorious Rossini arias of the patter type, the Drum Major's song from an almost forgotten opera "Le Caid", by Thomas of "Mignon" fame, and a delicious burlesque song from Offenbach's "Grand Duchess of Gerolstein". This is the sort of unhackneyed choice which reconciles us to these miscellaneous "recital" discs, and the artist himself is simply one of the best singing today, in or out of opera. Don't be put off by the unfamiliarity of most of the items on this extremely entertaining recording. But, if you hanker over something more familiar, there are further snippets from the Victoria de los Angeles "Madame Butterfly" set on HMV 7 ERM 5068, a 45-extended play record which gives the touching scene from Act 2, culminating in the "Flower Duet", wherein de los Angeles is joined by the mezzo soprano Anna Maria Canali.

A GREAT BASS SINGER

An interesting and touching result of the Hungarian uprising was the escape to the West of the young pianist Gyorgy Cziffra, who had been highly prized by the regime as their finest pianist and a number one cultural exhibit for Hungary. Shortly after his arrival in Vienna Cziffra gave a piano recital which caused a veritable sensation, and it is small wonder that the recording companies, now more than ever on the look out for saleable new talent, were queuing up for his services. He was speedily persuaded to sign a contract with the French Pathe-Marconi group, who are allied to the great HMV organisation, and hence his first record, recently made in Paris, is released here, with commendable promptness, on the HMV label (ALP 1455). Fortunately there is no need to welcome it simply on sentimental or sympathetic grounds, for on the strength of these renditions of Liszt's E flat piano concerto and Hungarian Fantasia, Gyorgy Cziffra represents a major talent and will obviously be very much in demand. Perhaps the more interesting item is the Hungarian Fantasia, less often heard than the concerto, and itself a re-working, for piano and orchestra, of the well-known Rhapsody No. 14 (or No. 1 in the orchestral setting of the Rhapsodies). Cziffra has a wonderful time and does not hesitate even to elaborate on Liszt's already complex score; the result is a riot of old-time display pianism which only the most severe listener could resist. The recording is outstandingly brilliant and the pianist has fine support from the Paris Conservatoire Orchestra under Pierre Dervaux.

The latest Tchaikovsky "Romeo and Juliet" comes from Columbia and is played by the Philharmonia Orchestra under Alceo Galliera (33CX 1328); the backing is, by way of a change, Strauss's "Death and Transfiguration", another of his deeply felt symphonic poems which critics persist in condemning and the public is equally emphatic about enjoying. Another work which has become something of a hobby for both record companies and the hi-fi fans who buy their products is Moussorgsky's "Pictures at an Exhibition", in the glittering orchestral setting by Maurice Ravel. The latest version, by the Philharmonia Orchestra under Herbert von Karajan, causes the whole work to spread over two sides of a twelve-inch disc (33CX 1421) with no fill-in item, and this is in many ways a distinct advantage. The ample space prevents distortion in the tremendous final pages and this now surely takes its place as the preferred version of the music, even though Karajan's interpretation may lack the blazing excitement of Kubelik's.

MISCELLANEOUS ORCHESTRAL

Standard classics will always be acceptable in new versions and Philips have a number of desirable issues lined up. It would be hard to assemble a more thoroughly acceptable group of favourites than that on Sir Thomas Beecham's record, Coronet KLC 622. One side is worthily given over to a superb performance of Tchaikovsky's "Nutcracker Suite" and on the reverse are Chabrier's "Espana", the well-loved "Dance of the Hours", and a rousing performance of Suppe's "Morning, Noon, and Night" overture. As Philips happily observe, Sir

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PHILIPS CLASSICS

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“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 23rd AUGUST, 1958

Title	Artist	Position last week	Record make
1 When	Kalin Twins	1 ..	Brunswick
2 All I Have to Do is Dream/Claudette	Everley Brothers	2 ..	London
3 Return to Me	Dean Martin	3 ..	Capitol
4 Endless Sleep	Marty Wilde	6 ..	Philips
5 Tulips from Amsterdam/You Need Hands	Max Bygraves	5 ..	Decca
6 Hard-headed Woman	Elvis Presley	4 ..	R.C.A.
7 Carolina Moon/Stupid Cupid ..	Connie Francis	25 ..	M-G-M
8 Rave On	Buddy Holly	8 ..	Coral
9 Fever	Peggy Lee	15 ..	Capitol
10 Big Man	Four Preps	7 ..	Capitol
11 Patricia	Perez Prado	9 ..	R.C.A.
12 Splish Splash	Charlie Drake	11 ..	Parlophone
13 Poor Little Fool	Ricky Nelson	14 ..	London
14 Yakety Yak	Coasters	22 ..	London
15 Think it Over	Crickets	10 ..	Coral
16 Little Bernadette	Harry Belafonte	18 ..	R.C.A.
17 Volare	Dean Martin	— ..	Capitol
18 Sugar Moon	Pat Boone	12 ..	London
19 Splish Splash	Bobby Darin	27 ..	London
20 Who’s Sorry Now?	Connie Francis	13 ..	M-G-M

Thomas “Has the ability of transforming war horses into sprightly young fillies”. There are also three Beethoven symphonies in the latest batch of releases. The sixth (Pastoral) symphony is beautifully played by the Vienna Symphony under the Dutch maestro, Willem van Otterloo (Philips A 00176) and an economic coupling of the fifth and eighth is that offered on S 04611 by the Cleveland Orchestra under Georg Szell. Both the Liszt piano concertos are done by Cor de Groot and Willem van Otterloo on S 04001. In contrast, and in fact in a class by itself, is the disc of Janacek’s “Diary of a Young Man who Disappeared”, on a ten-inch record, A 00731. This is an extraordinary cycle of songs by the famous Czech composer who died in 1928. The basis of it is quite fascinating and concerns an actual incident which took place about 1917. A young man of good family disappeared without trace from his home in a Czech village. He left behind a collection of poetry telling of his seduction by a gypsy girl and his decision to go off with her. He was never seen again, but the publication of his poems caused intense interest. Janacek set them largely for tenor voice, with a short interlude for contralto and a small female chorus. As has been pointed out if the original young man is still alive he would be in his sixties, and could conceivably turn up and demand copywright fees on his poetry! Meanwhile the cycle is superbly presented by the tenor Ernest Hafliger and mezzo Cora Canne Meyer, three members of the Netherlands Chamber Choir provide the choral interlude, and the pianist is Felix de Nobel. I hope the record is accompanied by the little booklet of words, as was the previous pressing under an English number.

Marconi Activities in South America

Despite the keenly contested nature of the Latin-American electronics market, Marconi’s are having considerable success in this field. Recent orders from Venezuela include one for a complete Band III television station and one for a medium-frequency sound broadcasting transmitter.

The television station, which has been purchased by Radio Valencia, comprises a 2 kW vision transmitter Type BD.357A, a 1 kW sound transmitter Type BD.305, programme input equipment, a quadrant aerial array, a vidicon telecine unit, vision and sound links, a 3-camera outside broadcasting unit, and studio lighting equipment.

The medium-frequency sound transmitter has been supplied to Radio Continente, also of Venezuela. This is a 2 kW equipment Type BD.210C, and is designed for unattended working.

Other Marconi orders in South America have included a £1,000,000 telecommunications contract in Ecuador, a high-power broadcasting station in Argentina, another complete television installation in Venezuela, radar and R/T installations for the Venezuelan and Chilean Navies and a considerable quantity of air radio equipment.

News from Government Departments

Skiers at Mount Ruapehu now have their own telephone office. At a height of 5,500 ft above sea-level, this is the highest telephone office in New Zealand.

Opened on the 1st July, the Mount Ruapehu telephone office will fill the need for "on the spot" communications for the hundreds of skiers visiting the 30-odd huts in the vicinity during the skiing season. In addition to those sleeping on the mountain, there are, of course, the many weekend visitors coming up the mountain from the Chateau, four miles below, who will be making use of the new telephone facilities.

Situated in the canteen at the top of the mountain road, Mount Ruapehu telephone office provides toll service, through the operator at the Chateau, to anywhere in New Zealand. Later, the ski huts scattered on the ski slopes will probably be linked in to the telephone service.

When accidents occur and rescue and search operators have to be given instructions, the telephone office on the mountain side will be invaluable, and of course, there is the personal service for skiers—those who want to ring home when they triumphantly graduate from the nursery slopes or those who, tempted by the continuance of fine weather, decide to extend their holiday above the snow line.

* * *

"Whistlers" Discovered in the Antarctic

The latest news from the New Zealand party wintering at Scott Base is that they have for the first time observed "whistlers" in the Antarctic. These strange radio signals have the lowest known frequencies to be propagated over long distances, and they are actually within the audio range. A receiver for them consists of nothing more than an aerial, to which is attached a high-gain audio amplifier. The important thing about their observation at Scott Base is that present theory does not predict their reception in polar areas. It can thus be seen that the New Zealand party have made a discovery which will certainly be of major scientific importance, and which is clearly a feather in this country's scientific cap.

BACK NUMBERS OF "R. & E. R."

Back numbers are available from

S.O.S. Radio Ltd., 283 Queen Street, Auckland.
S.O.S. Radio Ltd., 1 Ward Street, Hamilton.
Webb's Radios Ltd., 11 Wellesley Street E., Auckland.
Tricity House Ltd., 209 Manchester Street, Christchurch.
Ken's Ltd., 142-144 Stuart Street, Dunedin.
Fear's Radio & Cycle Co. Ltd., 31 Willis St., Wellington.
The Radio Service Co., 83 Guyton Street, Wanganui.
Technical Book and Magazine Co., 295-299 Swanson Street, Melbourne, Australia.

MISSING AND STOLEN RADIOS

Auckland:

Autocrat 5-valve car radio. Grey colour, new condition, number 46-567, no speaker. Value £22 10s. 0d.

Pye car radio, tuner unit, model P.Z.501/2, painted cream, 6-volt short wave. Serial number 96429.

Clipper radio, portable battery and electric, grey plastic cabinet. Serial Number 73271. Value £19.

Pye portable radio, light brown colour, licence No. PZ125BQ. Serial No. 120213. Value £18 3s. 8d.

Bell portable transistorized radio, pink plastic case. Serial No. 60259. Value £25.

Autocrat 6-valve car radio, 12 volts. Serial No. 63144.

Pye car radio, black varnished front, new condition. Serial No. 9358.

Autocrat transistorized push-button car radio, 12 volt, black case. Serial No. 43644. Independent speaker, "Rola".

Autocrat 6-valve car radio, 12 volt, chrome front, glass dial. Serial No. 63144.

Bell personal portable radio, ivory plastic case, battery power. Serial No. 62739.

Blenheim:

Ultimate "Troubador" portable model, maroon colour, 7 valves. Value £34 10s. 0d.

Portable battery electric radio, brown plastic case, model 5650AB. Serial No. 97970. Value £39 12s. 6d.

Christchurch:

Philips radio, dark brown cabinet, 5-valve model, poor condition. Value £12.

H.M.V. car radio, brown case. Serial No. 41975. Model R524. Value £35.

Philco battery-electric radio, 5 valve, pale blue plastic case. Value £13.

H.M.V. portable radio, green-blue plastic case, battery model. Value £19 19s. 0d.

Hamilton:

Aerial portable radio, battery-power model, cream plastic case. Serial No. 24862. Value £25.

Hawera:

Gulbransen table model radiogram, wooden cabinet, 6 valve. Serial No. 19152. Value £40.

Invercargill:

Philco model 201, black or dark brown case, 5 valves. Serial No. 24356.

Lower Hutt:

Philips 5-valve radio, red plastic case. Serial No. 5834. Model 269.

Philips "Philette Siesta" mantel radio, model 267, dove grey coloured plastic case. Serial No. 8829.

Manaia:

Ultimate radio, painted brown, new condition, 6-volt radio. Value £15.

Matamata:

H.M.V. car radio, 8 valve, black in colour. Serial No. 16977. Value £45.

Nelson:

Clipper 5M4 5-valve model, dark walnut colour, bakelite case. Value £15 15s. 0d.

(Continued on page 38)

ELECTRONICS AT FARNBOROUGH

(Continued from page 27)



projected only six seconds later than the actual radar presentation.

Machine Control

In the aircraft industry the electronic control of machine tools is of great value. Frequently a complex part is required but not in sufficiently large numbers to make mass-production tooling-up economic. Electronic control enables a design to be taken from the drawing board and fed directly to the machine system either in the form of punched cards or tape. No master-model is required and one set of punched cards or tape, prepared directly from the design measurements by a computer, can control more than one machine simultaneously or can be used time after time. A small design change can be incorporated by adding fresh instructions. Ekco Electronics show a new control system that can be fitted to existing as well as new machines. E.M.I. Electronics, who are fulfilling substantial American orders for machine controls, will demonstrate their new electronically controlled rotary positioning table.

What is the Vibron Unit?

Designed and made by **ELECTRONIC INSTRUMENTS LIMITED**

Richmond, Surrey, the VIBRON is a precision vibrating capacitor which forms the heart of the E.I.L. range of electrometers. It is also supplied separately for those wishing to use its unexcelled characteristics in the design of their own equipment for measuring very minute voltages or currents.

For purposes such as this, the VIBRON replaces the conventional input valve, and by virtue of its design and construction allows instruments to be built having a zero stability of from ten to twenty MICRVOLTS over a period of one hour.

Some of its features are:

Construction: To achieve the above degree of stability, the electrodes are gold-plated, and the whole unit is sealed in an atmosphere of inert gas.

Ease of Application: It is built similarly to a metal-enveloped valve, and is furnished with a standard octal base for ease of wiring into its circuit, and for ready replacement.

Ultra-High Input Resistance: Instruments using the VIBRON have an input resistance as high as ten million megohms, or 10^{13} ohms, while, for more stringent applications, an input resistance one thousand times higher than this (10^{16} ohms) can be achieved.

Write for complete
technical specifications to

W. G. LEATHAM LTD.

43 TARANAKI STREET, WELLINGTON
TEL. 53-460. P.O. BOX 1284.

MISSING AND STOLEN RADIOS

(Continued from page 36)

New Plymouth:

Clipper "Sportster" portable radio, fawn grained leather case, 4 valves, battery operated. Serial No. 110565. Value £14.

Palmerston North:

Courier 5-valve mantel radio, white plastic case. Serial No. 182125.

Clipper 5-valve, 6-volt, two-unit car radio. Model CR55. Serial No. 67880.

Waihi:

Bell radio (S.M. Colt), white plastic case, 5 valve. Serial No. 17807. Value £13 19s. 6d.

Wellington:

Bell radio, 5 valve, A.C.-D.C., deep maroon bakelite cabinet. Serial No. 120060. Value £13 19s. 6d.

Six Ultimate portable radios, cream plastic cases. Serial Nos. 201612, 201616, 201619, 201664, 201436, 201414. Value £25 each.

Philips "Town and Country" portable radio, plastic case. Serial No. 4005. Value £27.

Philips "Town and Country" portable radio. Model No. 4764. Serial No. 157889. Value £26.

Philco mantel model portable radio. Serial No. 38153/W. Value £19 10s. 0d.

Do You Want a Copy of "MY FAIR LADY"?

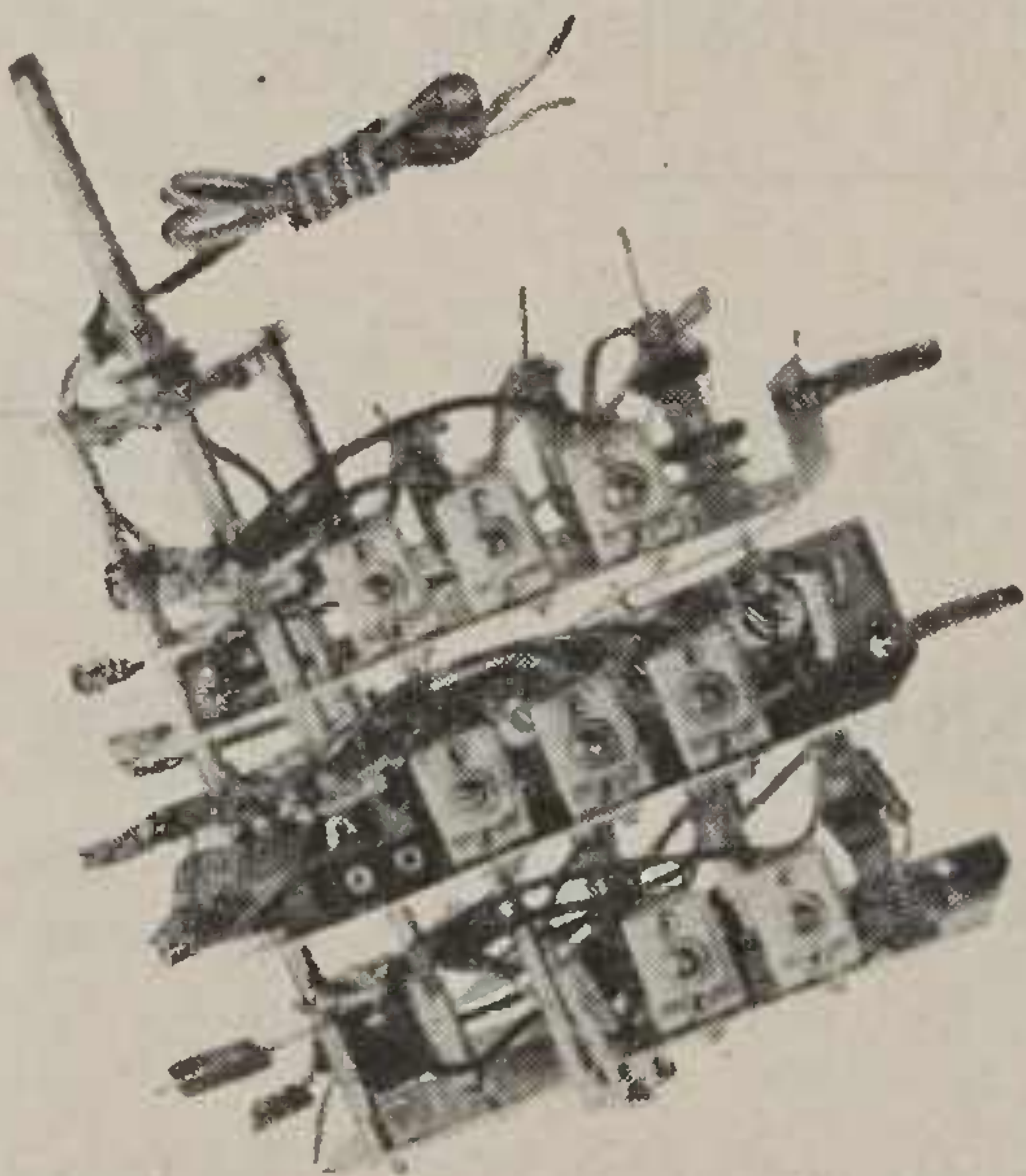
The one and only Broadway original cast recording, with Julie Andrews, Stanley Holloway, Rex Harrison, etc.

THE NEW ZEALAND L/P CLUB is accepting advance orders for this record, for delivery in the second week in December.

Whether or not you are a member of the New Zealand L/P Club, you can secure your order by sending only 5s. deposit to

THE NEW ZEALAND L/P CLUB
P.O. Box 8028, Wellington

N.B.—Full price will be advised on delivery.



BAND

S-P-R-E-A-D

BASIC KIT—TYPE 9

Completely assembled, wired, and tested up to converter tube.

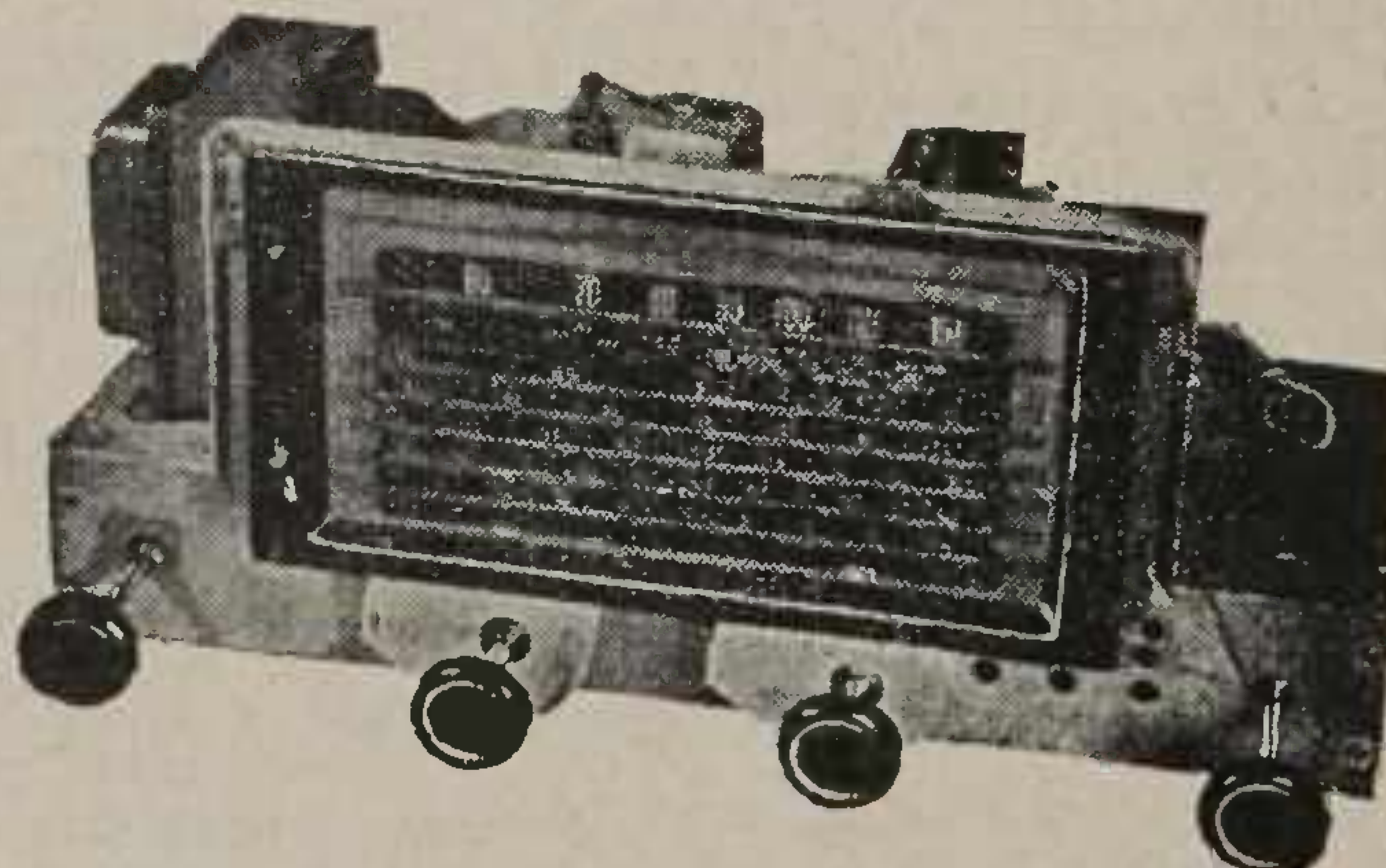
Fitted to sturdy 8/9 valve, plated steel chassis.

Accurately aligned to dial calibration.

You merely add I.F. and audio stages.

The spread on shortwave makes shortwave tuning easier than broadcast.

IDEAL as base for really high-quality RADIOS,
TUNERS, RADIOGRAMS, etc.



Details:

49, 31, 25, and 19-metre bands, plus broadcast. Extremely accurate calibration and frequency stability. Split stator tuning condenser and temperature compensated oscillator. Only three simple adjustments necessary to completely align each bandspread band. Handsome floodlit dial scale. Effortless tuning from high ratio 24/1, ball-bearing spin wheel drive. Gang isolated from mechanical and electrical vibration and noise. Bandspread calibration linear and marked in 100 k/c divisions and fractions thereof. A 0-100 logging scale also provided. "BAND", "TONE" and "GRAM." indicators fitted. Special A.V.C. system provides shorter time constant on shortwave to rapidly compensate for fading signal. Polystyrene low-loss adjustable slug coils throughout. Full instructions and suggested I.F. and audio circuits.

Price:

£16/19/7 (retail), less valves, plus packing, and postage.
(Valves, £1/5/6; packing, 6/6; postage, 6/6, approx.)

See them at our Stockists, or write direct for full particulars.

INDUCTANCE SPECIALISTS LTD.

157 THORNDON QUAY :: :: WELLINGTON

NOTE I: Special assembly type B10 available, covering amateur bands 15/13, 20, 40, 80, 160 metre, plus broadcast.

NOTE II: A limited number of completely constructed receivers incorporating B/9 Basic Kit and including in the I.F. channel variable bandwidth transformers and the well-known Mullard 5/10 High Fidelity amplifier, are available for direct sale. Inquiries invited.

You no doubt know

OHM'S LAW Which states;

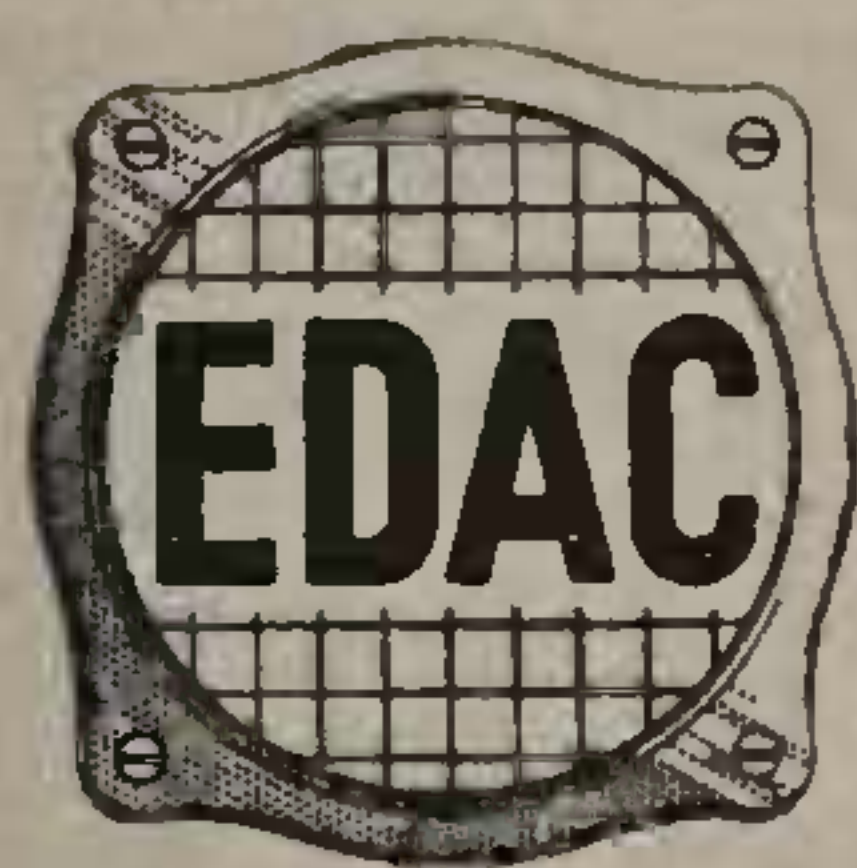
"When a steady current is flowing through a conductor the potential difference between its ends divided by the current is a constant, provided that the physical condition of the conductor does not change."

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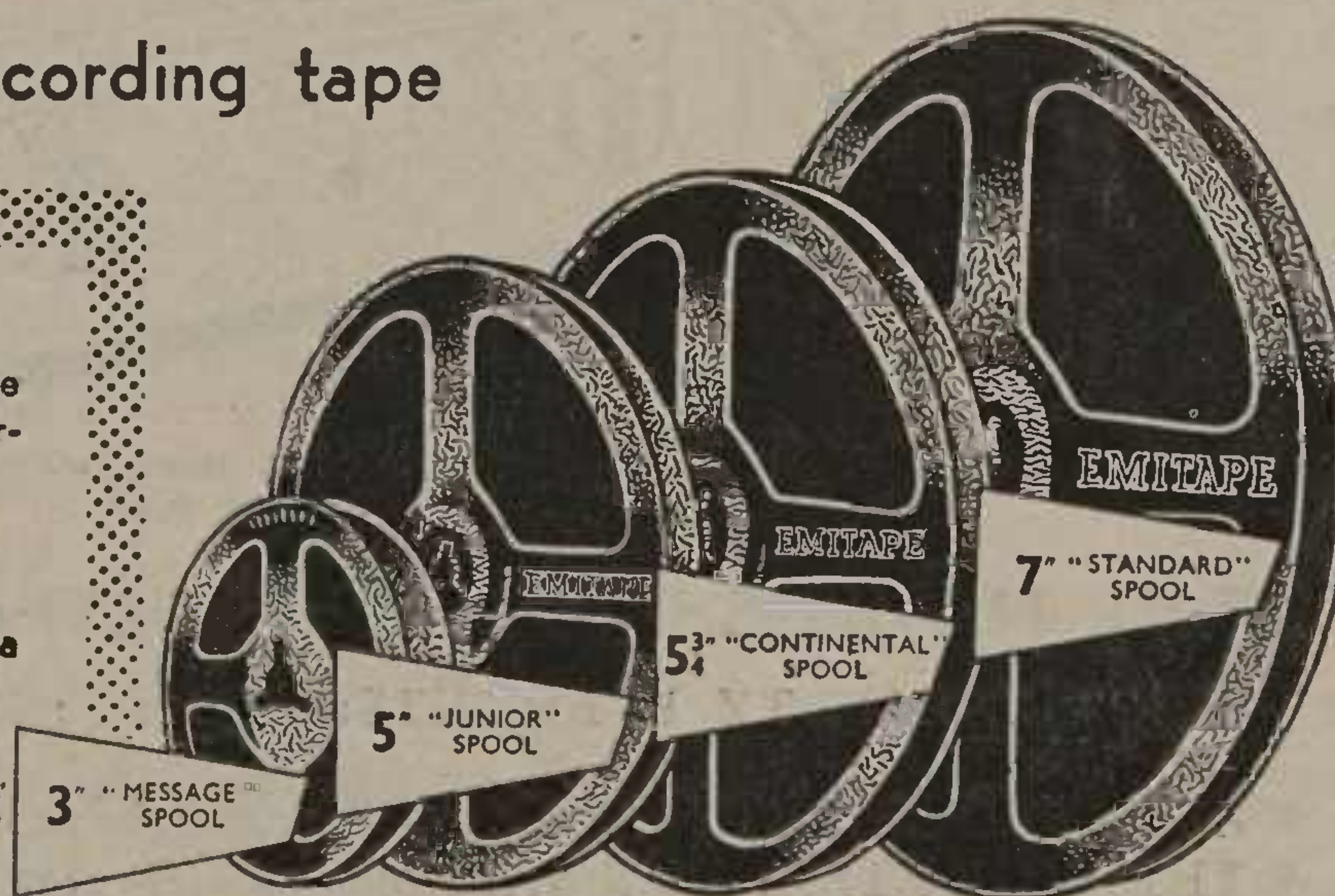
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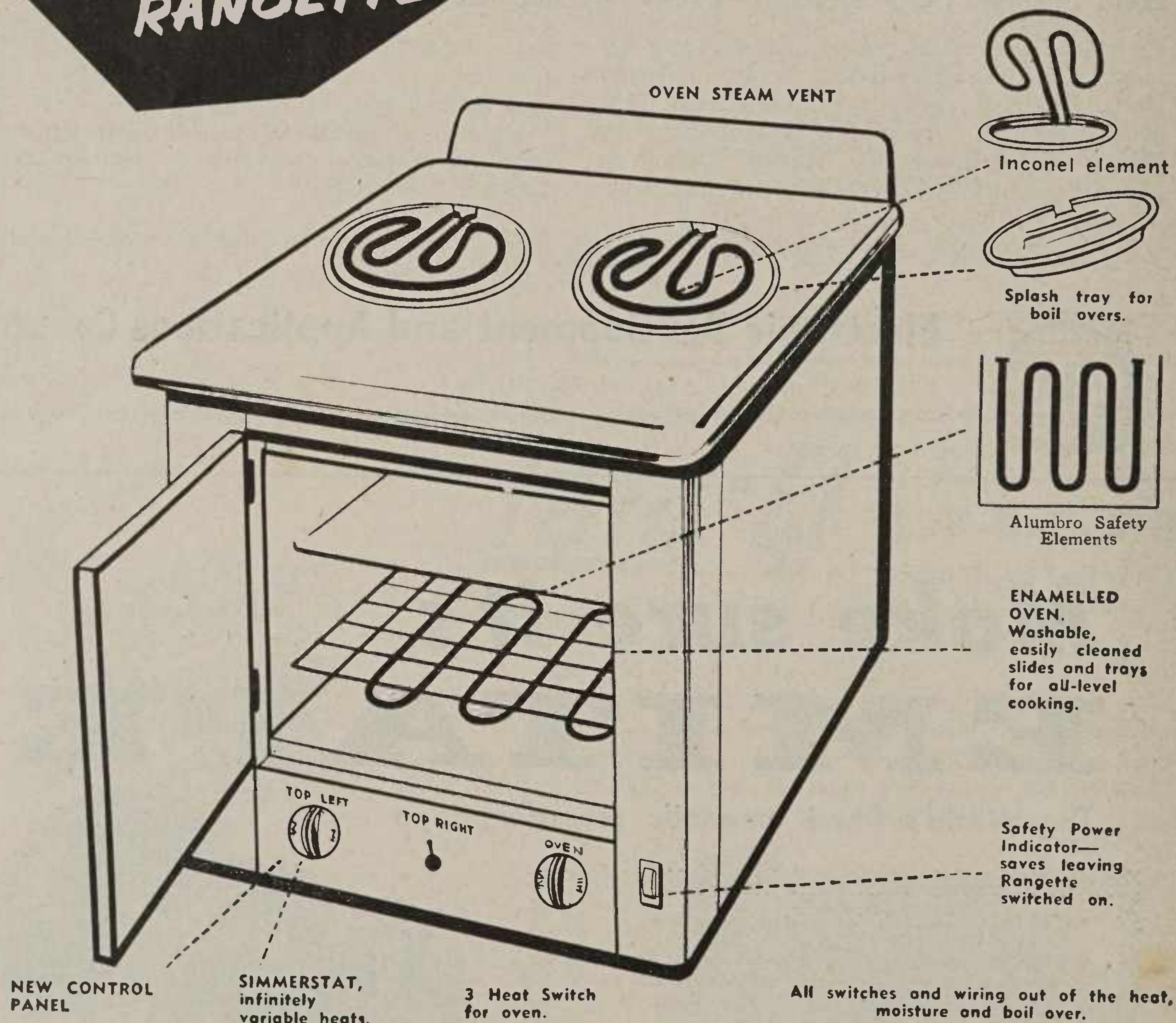
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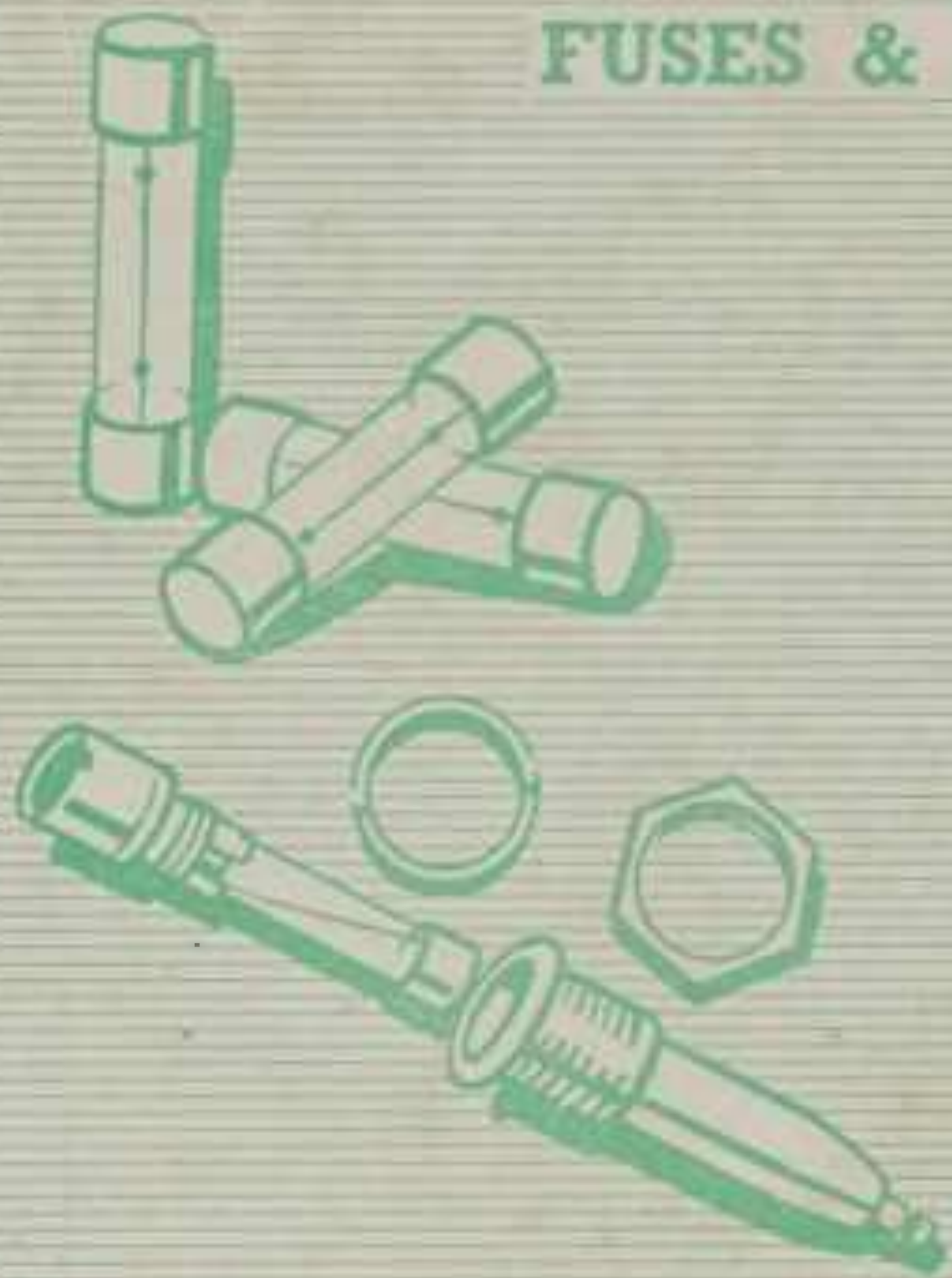
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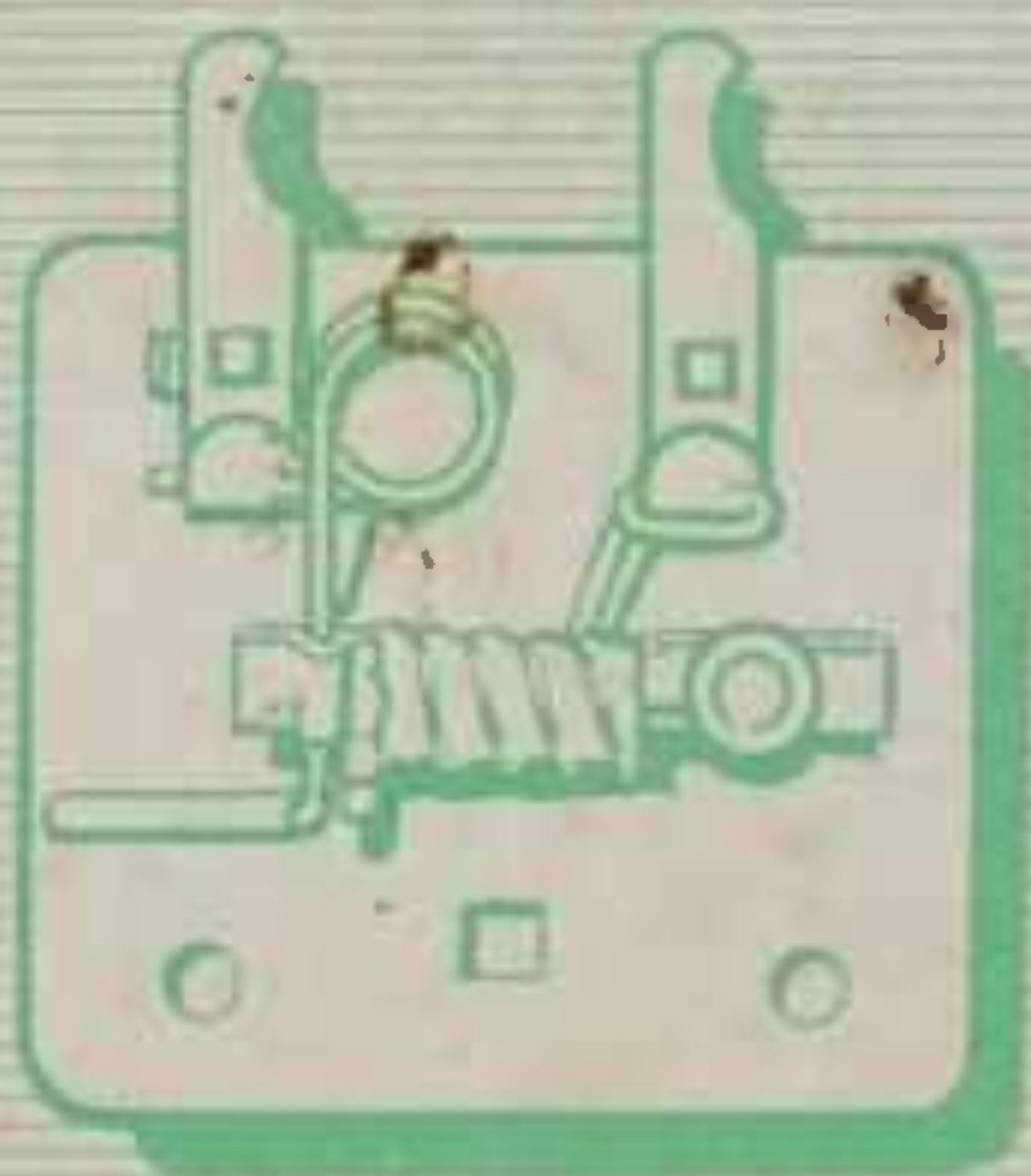
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